

Syllabus of Courses Focussing on Employability/Entrepreneurship /Skill Development



Banasthali Vidyapith
PO Banasthali Vidyapith 304022
(Rajasthan)

Entrepreneurship & Motivation

Exam Duration: 2 hrs Total Marks: 30

Contact Hrs: 2 hrs/week Cont. Assessment: 10

Annual Assessment: 20

Objective: The course aims at developing the required motivation and aptitude for Entrepreneurial career and gives various informational inputs.

Note: There will be 7 questions in all from the syllabus. Candidates will be required to attempt any four questions.

Course Content:

Manager, Entrepreneur, Entrepreneurship as an art, Enterprise, Concept of Entrepreneurship, Theories of Entrepreneurship, Classification and types of Entrepreneurship, Entrepreneurship and Economic Development.

Training, Developing Entrepreneurship through training, Motivation, Entrepreneurial Motivational training, Different Motivational theories, Creativity and Innovation, Entrepreneurial traits and competencies

BOOKS RECOMMENDED:

1. Dynamics of Entrepreneurial Development & Management: Vasant Desai; Himalaya Publishing House, Mumbai
2. Entrepreneurial Development: S. S. Khanka ; S. Chand & Company Ltd., New Delhi
3. Fundamental of Entrepreneurship: G. S. Sudha ; Ramesh Book Depot, Jaipur

EXPERIENTIAL LEARNING

1. COMPETENCIES TESTING & DEVELOPMENT
2. ASSIGNMENT: Different assignment may be given to the students on the following topics
 - a) A study of any Nationalized Bank
 - b) A study of any Industrial area.
 - c) A study of any sick unit
 - d) A study of any export unit
 - e) A study of any training place
3. GAMES : Different games on the entrepreneur's motivation will be taken up in the class like:
 - (a) Ring Toss game
 - (b) Making paper boats
 - (c) Tower building games etc

Dynamics of Entrepreneurship

Exam Duration: 2 hrs Total Marks: 30

Contact Hrs: 2 hrs/week Cont. Assessment: 10

Annual Assessment: 20

Objective: The course aims at developing the required dynamics and aptitude for entrepreneurial career and help in setting up of small – scale enterprises through project exposure.

Note: There will be 7 questions in all from the syllabus. Candidates will be required to attempt any four questions.

Course Content:

Small scale industries: Definition, role in India's economic development, regulation covering small scale industries and small medium enterprise, Source of information and non- financial support, Incentives and benefits available to small scale entrepreneurs, Market research and survey

Project launching and resourcing, evaluation of potential opportunities, SWOT analysis. Project selection / formulation, project appraisal, financial analysis, collaboration procedure for application for foreign procedural requirements for establishing new enterprise. Selecting type of business Organization, Registration and Licensing, Incentives and facilities available, for different Projects.

Business Crises. Ethical Entrepreneurship

BOOKS RECOMMENDED :

- Hand Book for New Entrepreneurs: Oxford University Press
- Fundamental of Entrepreneurship: G. S. Sudha; Ramesh Book Depot, Jaipur
- Entrepreneurship: New Venture Creation; David Holt, Prentice Hall, India

EXPERIENTIAL LEARNING

Project Proposal to set up an entrepreneurial venture will be formulated by the students and presented in the class

Computer Fundamentals and Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students will be able to:

- Describe the concepts of computer basics and programming.
- Explain the organization and operations of a computer system.
- Design the combinational and sequential circuits.
- Employ the logical thinking for analyzing problems, designing and implementing algorithmic solutions.
- Employ the skills for the use of the C programming language to implement the real world applications.

Section A

Brief introduction to computer organization, Block diagram, Hardware and software. Introduction to operating System, Concept of Data and Information, Representation of data, bits and bytes, Number System (binary, octal, decimal, hexadecimal), Representation of integers, real numbers, positive and negative numbers, Binary arithmetic, simple concepts and theorems of Boolean algebra. Representation of characters: BCD, ASCII, EBCDIC codes. Programming fundamentals: Program, Steps in program development, programming language, compilers, interpreters. Algorithms, flowcharts, Control statements sequencing, conditional and unconditional branching and looping.

Section B

Overview of C language- History, structure of a program data types, variables, constants, operators (arithmetic, logical, relational), expressions (arithmetic and logical), assignments, conditional statements, control statements, simple I/O. Single and multi-dimensional arrays, Searching (linear, binary), sorting (bubble, selection) and merging, matrix arithmetic.

Section C

Concept of pointers, pointer expression, pointer v/s arrays, functions, parameter passing (call by value, call by reference), recursion, structure, union and enumerated data types, concept of structured programming.

Suggested Books:

1. Sinha, P. K. (2003). *Computer fundamentals: concepts, systems & applications*. BPB publications.
2. Balagurusamy, E. (2012). *Programming in ANSI C*. Tata McGraw-Hill Education.
3. Kanetkar, Y. P. (2016). *Let us C*. BPB publications.
4. Rajaraman, V., & ADABALA, N. (2014). *Fundamentals of computers*. PHI Learning Pvt. Ltd.

Suggested E-Learning Material:

1. Introduction to Programming in C
<https://nptel.ac.in/courses/106104128/>
2. Introduction to Programming in C Specialization
<https://www.coursera.org/specializations/c-programming>
3. Sinha, P. K. (2003). *Computer fundamentals: concepts, systems & applications*. BPB publications.
<https://www.edutechlearners.com/computer-fundamentals-p-k-sinha-free-pdf/>

Computer Fundamentals and Programming Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course, students will be able to:

Perform internal and external DOS commands.

Implement problems based on expressions containing constants, variables and operators.

Implement problems based on conditional statements, switch and loops.

Implement problems based on array, pointers, functions, files and command line arguments.

Lab Exercise

- i. Explore DOS & WINDOWS Operating System
- ii. Implement Following programs in 'C'
 - i. Simple Programs
 - ii. Arithmetic Calculation
 - iii. Formula Based Calculation
 - iv. Conditional Statements
- iii. Check odd-even, positive-negative
 - i. Calculation of Division, Rank of student
 - ii. Menu Driven Programs
 - iii. Programs using if and switch statement
 - iv. Looping
- iv. Sum of digits of number, reverse of number, palindrome checking
 - i. Table Generation
 - ii. Prime number checking, generation
 - iii. Calculation of GCD, LCM
 - iv. Sum of various series, Fibonacci series, sin, cos, exp etc.
 - v. Pattern Drawing
- v. Programming with Arrays
 - i. Max, min & Average calculation
 - ii. Linear Search
 - iii. Binary Search
 - iv. Bubble Sort
 - v. Selection Sort
 - vi. Insertion Sort
 - vii. Merging
 - viii. Number System Conversion
 - ix. Matrix Manipulation- sum of row, column & diagonal element
 - x. Display and sum of upper triangular, lower triangular matrix elements
 - xi. Matrix Arithmetic (Addition, Subtraction, Multiplication)
 - xii. String Manipulation

- vi. Pointers and Functions
 - i. Use of Functions the previous programs
 - ii. Use of pointers and function in array and string processing
 - iii. Recursion-factorial, GCD, Fibonacci, Power, Tower of Hanoi etc.
- vii. Structures
 - i. Operations on Complex number
 - ii. Record storage, searching, sorting, generating reports
 - iii. Use of Union

Data Structures

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students will be able to:

- Develop knowledge of basic data structures for storage and retrieval of ordered or unordered data. Data structures include: arrays, linked lists, stacks, queues, binary trees, heaps.
- Develop knowledge of applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching, and sorting of each data structure.
- Analyze and compare algorithms for efficiency using Big-O notation.
- Describe the concept of dynamic memory management, data types, algorithms, Big O notation.
- Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.

Section A

Concept of data types, Abstract data type, Data structures, running time of a program, asymptotic notations: Big-Oh, Theta, Little-oh, Omega. Linear data structures: Static implementation of stack, queue, and their applications Searching and Sorting: Linear search and Binary Search, Bubble sort, Selection sort, Insertion sort, Quick sort, Radix sort.

Section B

Linked List: Linear, doubly or two way, circular, header and various operations; Representation of polynomial using linked list, addition and subtraction of polynomials. Dynamic implementation of stacks and queues. Dynamic memory management: fixed and variable block storage, storage techniques: first-fit, best-fit, worst-fit, next-fit; data compaction, and garbage collection.

Section C

Non linear data structures: Tree concepts, General Tree, binary tree and types, binary search tree, implementation of various operations on Binary Search Tree (tree traversal, searching, insertion and deletion, counting leaf and non-leaf nodes, height), Heap and heap sort, Balanced tree: concepts, rotations, insertion and deletion.

Suggested Books:

1. Langsam, Y., Augenstein, M., & Tenenbaum, A. M. (1996). *Data Structures using C and C++*. New Jersey: Prentice Hall.
2. Tremblay, J. P., & Sorenson, P. G. (1976). *An introduction to data structures with applications*. New York: McGraw-Hill.
3. Horowitz, E., Sahni, S., & Anderson-Freed, S. (2008). *Fundamentals of data structures in C*. Universities Press: Computer Science.
4. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (1983). *Data Structures and algorithms*. Addison Wesley Publishing Company.

Suggested E-Learning Material:

1. Programming and Data Structures
<https://swayam.gov.in/course/1407-programming-and-data-structures>
2. Data Structures and Program Methodology
<https://nptel.ac.in/courses/106103069/>

Data Structures Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course students will be able to

- Implement problems based on basic data structures like stack and queues.
- Implement problems on linked lists.
- Implement problems for performing different operations like insertion, deletion and searching on binary tree and binary search tree.

Lab Number Problems

L1-L4	Implementation of stack, Applications of stacks (parenthesis checker, postfix evaluation, infix to postfix), recursion
L5-L7	Implementation of linear, circular, circular queue, priority queue
L8-L12	Implementation of linear link list (creation, traversal, insertion, deletion, searching, sorting, merging, reverse)
L13-L14	Implementation of circular link list (creation, traversal, insertion, deletion, searching, sorting)
L15-L16	Implementation of doubly link list (creation, traversal, insertion, deletion, searching, sorting)
L17	Linked representation of stack and queue
L18	Polynomial arithmetic (Addition, Subtraction)
L19-L30	Implementation of binary search tree (creation, traversal, insertion, deletion, searching), Non recursive traversal (inorder, preorder, postorder)

Database Management System

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

- List and explain the fundamental concepts of a relational database system.
- Analyze database requirements and develop the logical design of the database using data modeling concepts such as entity-relationship diagrams and normalization.
- Create relational databases in Oracle and implement simple and moderately advanced database queries using Structured Query Language (SQL)
- Describe the concept of a database transaction and its desirable properties, concurrency control, locking protocols and deadlock handling.
- Explain the significance of data independence, integrity, security, recovery and performance with reference to a database system.

Section A

Database Management System- Introduction to Database Systems, Comparison between traditional file system and DBMS, Database Users, Role of DBA, Architecture of DBMS. Data models, schema, instances, three level architecture of DBMS, Data Independence, Data modeling using ER and EER diagrams, Reducing ER-diagrams to tables

Section B

Relational Database- Concepts, Constraints. Relational algebra: Selection, Projection, Union, Difference, Cartesian-product, Division. Database Design: Functional dependencies, Normal forms: First, Second, Third, BCNF, Multi-valued dependencies, Fourth normal forms, Join dependencies, and Fifth normal forms. SQL: DDL and DML commands.

Data Integrity, security and authentication in database. Query optimization

Section C

Transaction Processing: Transaction, ACID properties, Serializability, Concurrency control techniques, Lock types (exclusive, shared, update, Intent & Phase Locking), Deadlocks, Management of deadlock. Recovery Techniques.

Distributed Databases: Introduction, Network Topology, Architecture, Transparency, Data fragmentation, Transaction Management, Deadlocks, Homogeneous vs Heterogeneous system.

Suggested Books:

1. Elmasri, R., & Navathe, S. B. (2011). *Fundamentals of Database Systems*. Boston, MA: Pearson Education.
2. Bayross, I. (2000). *SQL, PL/SQL The Programming Language of Oracle*. BPB Publication.
3. Silberschatz, A., Korth, H. F., & Sudarshan, S. (1997). *Database system concepts*. New York: McGraw-Hill.
4. Leon, A. & Leon, M. *Database Management Systems*. McGraw-Hill.

Suggested E-Learning Material:

1. Data Base Management System
<https://nptel.ac.in/courses/106105175/>
2. Database Management Essentials
<https://www.coursera.org/learn/database-management>
3. Silberschatz, A., Korth, H. F., & Sudarshan, S. (1997). *Database system concepts*. New York: McGraw-Hill.
<https://kakeboksen.td.org.uit.no/Database%20System%20Concepts%206th%20edition.pdf>

Database Management System Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course students will be able to

Create and manipulate structure of tables in Oracle.

Perform basic operations like insertion, update, and deletion on tables of a database.

Write complex queries for retrieval of data from more than one table.

Implement problems in PL/SQL.

Lab Number Problems

L1-L3	Look and feel of DBMS (ORACLE/SQL Server)
L4-L5	DDL commands (Create, Alter, Drop)
L6-L9	DML Commands (Insert, Update, Delete)
L10-L15	SQL (basic constructs)
L16-L18	Operators (Arithmetic, Logical, Relational etc)
L19-L21	SQL (Aggregate functions, set membership functions, set operators)
L22-L30	Nested Sub queries, Assignment based on DDL, DML with conditions. Joins (Self join, inner join, outer join, equi join), Complex queries (Retrieval of data from more than one table)

Computer Organization and Architecture

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students will be able to:

- Use the concepts and design of all type of sequential and combinational circuits.
- Have knowledge to design and conduct experiments, as well as to analyze of the hardware of a computer system and its components such as control unit, arithmetic and logical (ALU) unit, input/output, and memory unit.
- Design techniques such as pipelining and microprogramming in the design of the central processing unit of a computer system.

Section A

Review of Number Systems, Binary arithmetic & codes. Logic Gates: Logic Gates and Simplification of Boolean Algebra functions by Map methods, minimal function and their properties, Combinational Circuits design. Adder, subtractor, decoder, demultiplexer, encoder, multiplexer, comparator, three state devices, exclusive-OR gates and parity circuits. Latches and flip flop, synchronous sequential circuits, clocked synchronous state machine analysis and design, asynchronous and synchronous counters, state reduction and assignment, design procedure and design of counter, shift register.

Section B

Instruction codes, Instruction formats, Instruction set, Instruction cycle. Micro programmed Control: Control memory, Address sequencing, Design of control unit.

Central Processing Unit: Stack organization, Addressing modes, data transfer and manipulations, program control CISC& RISC characteristics.

Pipeline and Vector Processing: Parallel processing, pipelining, Arithmetic pipelining, RISC pipeline.

Section C

Memory Organization: memory technology, memory device characteristics, serial access memory. Semiconductor memory - RAM, ROM. Memory hierarchy, Associative memory, cache memory - features, address mapping, cache performance, cache coherence, virtual memory.

Input - Output Organization, programmed I/O, DMA, Interrupts, I/O Processor. Multiprocessor: Characteristics, Interconnection Structures, Inter processor communication and synchronization.

Suggested Books:

1. Mano, M. M. (2017). *Digital logic and computer design*. Pearson Education India.
2. Mano, M. M. (2003). *Computer system architecture*. Prentice-Hall of India.
3. Hayes, J. P. (1988). *Computer Architecture and Organization*. McGraw Hill.
4. Short, K. L. (1987). *Microprocessors and programmed logic*. Prentice-Hall, Inc.
5. Hennessy, J. L., & Patterson, D. A. (2011). *Computer architecture: a quantitative approach*. Elsevier.
6. Stone, H. S. (1992). *High-performance computer architecture*. Addison-Wesley Longman Publishing Co., Inc.

Suggested E-Learning Material:

1. Stallings, W. (2003). *Computer organization and architecture: designing for performance*. Pearson Education India.
<http://williamstallings.com/ComputerOrganization/>
2. The Computing Technology Inside Your Smartphone
<https://www.edx.org/course/computing-technology-inside-smartphone-cornellx-engri1210x-0>
3. Computer Organizations and Architecture
<https://nptel.ac.in/courses/106103068/>

Design and Analysis of Algorithms

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

4 0 0 4

Learning Outcomes:

After successful completion of the course students will be able to

Analyze the performance of various algorithms in terms of time and space.

Solve recurrence relation using various methods

Describe the concept and design algorithm using data structures including threaded binary tree, B-Tree and hashing techniques.

Design numerous algorithm techniques including divide & conquer, greedy, dynamic programming, backtracking and branch & bound.

Section A

Analysis of an algorithm, Time and Space complexity, Asymptotic notation to represent complexity of an algorithm, Solving Recurrence relation by substitution method and master theorem

Advanced Data Structures: Threaded Tree, B-Tree, Union and Find operations on Disjoint Set, Hashing and collision resolution techniques,

Section B

Divide and Conquer: General Method, Max-Min, Merge Sort, Quick Sort, and Matrix Multiplication.

Graph: Representation, Breadth First and Depth First Traversals of Graphs, Connected Components.

Greedy Technique: General Method, Knapsack Problem, Job Sequencing with Deadlines, Optimal Merge Patterns, Minimum Cost Spanning Tree (Prim's and Kruskal's Method), Single Source Shortest Path.

Section C

Dynamic Programming: General Method, All Pair Shortest Paths, 0/1 Knapsack Problem, Traveling Salesman Problem.

Backtracking: General Method, N Queen Problem, Sum of Subsets Problem, Graph Coloring Problem, Hamiltonian Cycles, 0/1 Knapsack Problem.

Branch and Bound: General Method, 0/1 Knapsack Problem, Traveling Salesman Problem.

Suggested Books:

1. Horowitz, E., Sahni, S., & Rajsekan S. (2003). *Fundamentals of Computer Algorithms*. Orient Black Swan.
2. Aho, A. V., Hopcroft J. E., & Ullman J. D. (2016). *The Design and Analysis of Computer Algorithms*. Addison Wesley.
3. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). *Introduction to algorithms*. MIT press.
4. Berlioux, P., & Bizard, P. *Algorithms - The Construction, Proof and Analysis of Programs*. Wiley.
5. Mehlhorn, K. (2013). *Data structures and algorithms Vol. 1 & Vol. 2*. Springer Science & Business Media.

Suggested E-Learning Material:

1. Design and Analysis of Algorithms
<https://nptel.ac.in/courses/106101060/>
2. Algorithms Specialization
<https://www.coursera.org/specializations/algorithms>
3. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). *Introduction to algorithms*. MIT press.
<https://mcdtu.files.wordpress.com/2017/03/introduction-to-algorithms-3rd-edition-sep-2010.pdf>

Design and Analysis of Algorithms Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course students will be able to

Implement problems based on sorting techniques and max heap.

Perform various operations on threaded binary tree and B-Tree practically.

Implement graph based problems.

Implement problems based on deterministic algorithms.

Lab Number Problems

L-1 L5	Implementation of Max Heap (Creation, Insertion, Sorting), Operations on Sets (Creation, Union, Weighted Union, Find and Collapsing find)
L6-L8	Implementation of Threaded Binary Search Tree (Creation, Insertion, Traversal, Searching, Find successor and predecessor of a given node)
L9-L11	Implementation of Divide and Conquer Algorithms (Merge-Sort, Quick-Sort and Matrix Multiplications)
L12-L16	Implementation of Greedy Knapsack problem, Job sequencing with Deadline and Minimum spanning tree algorithms (Prim's and Kruskal)
L17-L20	Implementation of Single source shortest path Algorithms, DFS and BFS Algorithms.
L21-L25	Implementation of N-Queens, Sum of Subset, Graph Coloring, 0/1 Knapsack Problem and Hamiltonian Cycle

Object Oriented Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Describe the features of C++ supporting object oriented programming.

Explain the relative merits of C++ as an object oriented programming language.

Describe how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism.

Apply advanced features of C++ specifically stream I/O, templates and operator overloading

Apply other features of the C++ language including templates, forms of casting, conversions, and file handling.

Section A

Basic Concept of Object Oriented Programming: Need of OOP, advantage over other programming paradigms, Tokens, Keywords, Identifiers and Constants, Basic Data Types, Control Structures.

Functions: Call by Value, Call by Reference, Function Overloading.

Class & Objects: Concepts of Objects & Classes, declaring multiple objects, array of objects, Friend Functions.

Section B

Constructors and Destructors: Introduction, Default, Parameterized and Copy Constructor, Concept and use of destructors.

Operator Overloading: Overloading Unary Operators, Overloading Binary Operators.

Inheritance: Derived and Base Class, Public, Private, Protected, Multiple and Multilevel Inheritance, Function Overriding.

Pointers: Pointers to Objects, this Pointer, Virtual Functions, Polymorphism.

Section C

Console I/O: Concept of Streams, Hierarchy of Console stream Classes, Unformatted and formatted I/O Operations, Managing Output with Manipulators

Templates: Class and function templates, overloading of function templates

File Handling: Classes for file stream operations, open and close a file, EOF, file modes, file pointers and their manipulators, sequential I/O operations, updating a file-Random access, Error Handling During File Operation.

Suggested Books:

1. Balagurusamy, E. (2001). *Object Oriented Programming with C++*, 6e. Tata McGraw-Hill Education.
2. Schildt, H. (2003). *C++: The complete reference*. McGraw-Hill.
3. Lafore, R. (1997). *Object-oriented programming in C++*. Pearson Education.
4. Stroustrup, B. (2000). *The C++ programming language*. Pearson Education India.
5. Venugopal, K. R. (2013). *Mastering C++*. Tata McGraw-Hill Education.

Suggested E-Learning Material:

1. Stroustrup, B. (2000). *The C++ programming language*. Pearson Education India.
<http://www.stroustrup.com/C++.html>
2. Programming in C++
<https://nptel.ac.in/courses/106105151/>

Object Oriented Programming Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course students will be able to

Implement problems based on expressions, arrays and strings.

Carry out problems using functions, class, constructor and destructor.

Implement problems using pointers, operator overloading, inheritance, file handling and exception handling.

Lab Number Problems

1-8	Implementation of simple problems with the Objects and class. Understanding of private, public and protected access using problem, Implementation of static variable & static member function. Constructors & destructors. Problems using friend function.
9	Implementation of polymorphism.
10	Implementation of inheritance
11-16	Implementation of operator overloading to overload various operators: unary operators (+, -, *, % etc) and binary operators: +, *, [], >> and << operators on vectors
17-18	Problem related with dynamic binding. Problems using this pointer
19-20	Problems related with the templates function and template classes.

Systems Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Learn concepts of System Software, IBM 360/370 hardware programming.

Design, write, and test moderately complicated low-level programs using a systems programming language such as Assembler, Macro processor and loaders.

Enumerate and explain the function of the common operating system functions and types.

Learn Working of a compiler and text editor.

Illustrate MS dos, ROM BIOS and Interrupt system.

Section A

System Software: Components and Evolution. General Machine Structure: Memory, Instructions, Registers. Operating Systems: Types, basic functions, concept of process and lifecycle of process.

Assemblers: Elements of Assembly Language Programming, A Simple Assembly Scheme, Pass Structure of Assemblers, Design of 2 pass assembler.

Section B

Macros and macro processors: Macro Definition and Call, Macro Expansion, Nested Macro Calls, Design of a Macro Preprocessor. Loaders and linkers: Loader schemes (Compile and go loader, general loader scheme, absolute loader, subroutine linkage, relocating loader, direct linking loader, binders and overlays). Software Tools: Editors, Debug Monitors, Program generators, Translators, Interpreters.

Section C

Compiler: Brief description of different phases. ROM BIOS, DOS, keyboard, mouse and display services. Device Drivers: Types, structure and processing. Interrupt: Types, Organization, processing, IVT, interrupt handler.

Suggested Books:

1. Donovan, J. J. (1972). *Systems programming*. New York: McGraw -Hill.
2. Duncan, R. (1988). *Advanced MS-DOS Programming*. Redmond, WA: Microsoft Press.
3. Dhamdhere, D. M. (1986). *Introduction to system software*. Tata McGraw-Hill.
4. Bose, S. K. (1996). *Hardware and Software of Personal Computers*. New Age International.
5. Biggerstaff, T. J. *System Software Tools*. Prentice Hall.
6. Dhamdhere, D. M. (1999). *Systems Programming and Operating Systems*. Tata McGraw-Hill.
7. Norton, D. A. (1992). *Writing Windows device drivers*. Addison-Wesley.

Suggested E-Learning Material:

1. System Programming
<http://solomon.ipv6.club.tw/Course/SP.941/>

Data Communication and Networks

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Independently understand basic computer network technology and the Data Communications System and its components.

Describe the layers of the OSI model and TCP/IP and the function(s) of each layer.

Describe the importance of data communications and the Internet in supporting business communications and daily activity.

Analyze the features and working of IPV4, IPV6 and their transition with Connection less and Connection oriented Transport layer protocols (TCP/UDP).

Analyze the features and operations of various protocols such as Http, DNS, SMTP and many more application layer protocols.

Section A

Data Communication Model, tasks of a communication system, computer network, historical background of computer networks, analog and digital transmission, transmission media, signal encoding techniques: digital data digital signals, digital data analog signals (ASK, PSK, FSK), analog data digital signals (PCM, Delta modulation), analog data analog signals (AM, FM, PM), multiplexing (TDM, WDM, FDM).

Section B

Principles and Purpose of layered approach, OSI model, TCP/IP protocol suite, Data link control: framing & synchronization, Error detection & Error correction techniques, Flow control & Error Control protocols (stop and wait, sliding window, go-back-N, selective repeat), MAC layer (CSMA/CD, CSMA/CA), Network switching techniques, Internetworking: various internetworking devices, Routing (unicast routing).

Section C

Internet Protocols (IPv4, IPv6), IP addressing (classless, classful, IPv6). Transport protocols: TCP, UDP, SCTP; Application layer protocols: DNS, FTP, E-mail, HTTP; Network security: overview of cryptography, RSA algorithm, firewalls.

Suggested Books:

1. Tanenbaum, A. S. (2014). *Computer networks*. PHI
2. Stallings, W. (2007). *Data and computer communications*. Pearson Education India.
3. Gupta, P. C. (2013). *Data communications and computer networks*. PHI Learning Pvt. Ltd.
4. Kurose, J. F., & Ross, K. W. (2009). *Computer networking: a top-down approach*. Pearson Education
5. Forouzan, A. B. (2007). *Data communications & networking*. Tata McGraw-Hill Education.

Suggested E-Learning Material:

1. Computer Networking: A Top-Down Approach by James F. Kurose and Keith W. Ross
https://www.bau.edu.jo/UserPortal/UserProfile/PostsAttach/10617_1870_1.pdf
2. Data Communication by IIT Kharagpur
<https://nptel.ac.in/courses/106105082/>

Java Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Explain Object Oriented Programming & Java Programming Constructs.

Explain basic concepts of Java such as Operators, Classes, Objects, Interface, Inheritance, Packages, Enumeration and various keywords.

Apply the concepts of Exception Handling, Collections, Input/output operations, Socket Programming, Database Connectivity in their programs.

Design the applications of Java, Swing, Applet and JSP.

Analyze & Design the concept of Event Handling and Abstract Window Toolkit (AWT).

Section A

Java Introduction: Evolution, features, concepts of Java Virtual Machine (JVM) and its task, Java and Internet, Environment (JRE, JDK, JSDK, APIs), Application & Applet.

Java Programming: Structure of program, Data Types, Variables, Operators, Expressions, Control statements (sequencing, alteration, looping), Object oriented Concepts, Objects, Classes, Constructors, Method Overloading, Arrays, String handling, Wrapper classes, packages, Access Specifier, Inheritance, Method Overloading, Interfaces, Inner & Anonymous classes.

Section B

Exception handling, Streams and I/O programming, Serialization, Multithreading, Collection framework (Set, Map, List, Vector), Generic, Iterators, Utility Classes, Networking, Socket and Datagram programming, JDBC, ODBC-JDBC drivers Database Connectivity, JDBC statements, Resultset, Metadata.

Section C

GUI in Java using graphics classes , Features of AWT and Swing, Layout Managers, Event handling, Adapter classes, Applet, Frames, all components of AWT (button, textbox, checkbox, fonts etc).

Java Server Pages (JSP), Servlet, Introduction to J2EE & EJB, Deployment of applications:

Suggested Books:

1. Schildt, H. (2007). *Java: the complete reference*. McGraw-Hill.
2. Rajgopalan, S. *Java Server Programming Bible*. Wiley Publication
3. Balaguruswamy, E. (2014). *Programming with Java-A Primer*. McGraw-Hill Professionals.
4. Ganguli, M. *JSP: A Beginner's Guide*. Wiley Publication
5. Deitel, P. J., & Deitel, H. M. (2014). *Java: How to Program*. Pearson Education Limited.
6. Horstmann, C. S., & Cornell, G. (2002). *Core Java 2: Volume I & Volume II, Fundamentals*. Pearson Education.
7. Bayross, I. (2009). *Web Enabled Commercial Application Development Using HTL, DHTML, Javascript, Perl CGI*. BPB Publications.
8. Haecke, B. V. (1997). *JDBC: Java Database Connectivity*. IDG Books Worldwide, Inc.

Suggested E-Learning Material:

1. Java Lectures
https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. Object Oriented Programming in Java Specialization
<https://www.coursera.org/specializations/object-oriented-programming>

Java Programming Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Learning Outcomes:

After successful completion of the course students will be able to

Implement problems based on control statements, classes, inheritance and arrays.

Implement problems based on packages, interfaces, wrapper classes and exception handling.

Implement problems on threads, applets, graphics, event handling, swings, networking and Servlets.

Lab Number	Problems
L1 – L2	Simple Programs
L3 – L4	Programs based on Control Statements
L5 – L8	Programs based on Classes & Inheritance
L9 – L10	Programs based on Arrays
L11 – L12	Programs based on Packages & Interfaces
L13 – L14	Programs based on Wrapper Classes
L15 – L16	Programs based on Exception Handling
L17 – L18	Programs based on I/ O Classes
L19 – L20	Programs based on Strings
L21 – L23	Programs based on Threads
L24 – L26	Programs based on Applets
L27 – L28	Programs based on Graphics
L29 – L32	Programs based on Event Handling
L33 – L35	Programs based on Swings & GUI Components
L36 – L37	Programs based on Serialization
L38 – L39	Programs based on Networking
L40 – L41	Programs based on JDBC
L42 – L45	Programs based on JSP & Servlets

Systems Programming

SECTION A

Components of System Software, evolution of system Software. General Machine structure (Memory, Register, Data Instructions). Assemblers, Design of Two Pass Assembler. Macros and Macro Processors. Translators: Interpreters, Brief description of different phases of compiler.

SECTION B

Loaders: A Two Pass Loader Scheme, Relocating loader, subroutine linkage, Direct linking loader. Binders, Overlays. Types and basic functions of operating systems. Software Tools: Text Editors, Program Generator, Debug Monitors.

SECTION C

Access to system services: ROM BIOS, DOS , Mouse and EMS (Expanded memory specifications) Functions, Keyboard and Screen Management. Introduction to Terminal Emulator. DOS Device Drivers : Types , Structure and Processing. Interrupt Types, Organization, Interrupt Hardware , Program status register(PSR) , Interrupt Processing.

Text/Reference Books:

1. Roy Donovan J.J., Ellzay S. & Staff Bigger: **Systems programming:** Mc-Graw Hill, 1972.
2. Dhamdhere D.M.: **Introduction to system software:** Tata Mc-Graw Hill, 1986.
3. Peter D. L.: **An Introduction Real-Time Microcomputer System Design:** Mc-Graw Hill International Co.
4. BiggerStaf Ted J.: **System Software Tools:** Prentice Hall.
5. Ray Dunkan: **Advance MS-DOS programming:** BPB Publication.
6. Dhamdhere D. M.: **System Programming and Operating Systems:** Mc-Graw Hill.
7. Daniel A. Norton: **Writing DOS Device Drivers:** Addison Wisley.
8. Sanjay K. Bose: **Hardware and Software of Personal Computers:** Wiley Eastern Publications.

Operating Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Learn the fundamentals of Operating Systems.

Learn the mechanisms of OS to handle processes and threads and their communication.

Learn the mechanisms involved in memory management in contemporary OS.

Gain knowledge on Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.

Know the components and management aspects of concurrency management with case study of UNIX.

Section A

History of operating systems, OS Functions, OS Goals, OS classification: single user, multiuser, Batch Processing Operating System, Time Sharing, Real Time Operating System (RTOS), Multiprogramming Operating System, Multiprocessing System, Networking Operating System, Distributed Operating System, Operating Systems for Embedded Devices, Introduction to popular operating systems like UNIX, Windows, etc.

Process management: Process status, schedulers, scheduling algorithms, Threads

Inter process communication: Process Synchronization, Critical Section problem and its solutions, classical problems in concurrent programming.

Deadlock: Prevention, Avoidance, Detection and recovery.

Section B

Information Management: Management file supports, access methods, allocation methods, contiguous, linked and indexed allocation, directory system.

Memory management: swapping, paging and segmentation demand paging, virtual memory, page replacement algorithms, working set model.

Secondary storage: Disks, disk space management, Scheduling algorithms.

Input/output: device controllers and device drivers, I/O processor management: I/O scheduler.

Section C

Protection and Security - Accessibility and Capability Lists

Multiprocessor Systems: Bus-oriented System, Crossbar-connected System, Hypercube System, Multistage Switch-based System

Parallel processing and distributed processing: concept, differences, OS.

Case study: Unix (History, Design principles, interface, file system, process management, memory management, I/O management, vi editor, shell).

Suggested Books:

1. Godbole, A. S. (2005). *Operating systems*. Tata McGraw-Hill Education.
2. Silberschatz, A., Gagne, G., & Galvin, P. B. (2018). *Operating system concepts*. Wiley Publications.
3. Tanenbaum, A. S. (2009). *Modern operating system*. Pearson Education, Inc.
4. Kanetkar, Y. P. (1996). *UNIX shell programming*. BPB Pub.
5. Deitel, H. M., Deitel, P. J., & Choffnes, D. R. (2004). *Operating systems*. Delhi.: Pearson Education.

Suggested E-learning Material:

1. Operating Systems
<https://nptel.ac.in/courses/106108101/>
2. Linux for Developers
<https://www.coursera.org/learn/linux-for-developers>

Operating Systems Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes:

After successful completion of the course students will be able to

Perform various Linux commands.

Write shell scripts for the various problems using conditional statements and loops.

Write shell script for the problems based on positional parameters, expressions and basic commands.

Lab Problems:

- Introduction to Unix/Linux
- Working with VI editor
- Commands
 - o Man command
 - o Files and Directory management (ls, chmod, cat etc.),
 - o Zipping and Archiving (zip, gzip, tar etc.).
 - o Filter commands (head, tail, grep etc.).
 - o I/O redirection commands (>, >>, 2>, < etc.).
 - o Miscellaneous (bc, expr, echo, read etc.)
- Shell scripting
 - o Introduction to BASH shell.
 - o Problems based on conditional statements (if else, switch).
 - o Problems based on command line arguments.
 - o Problems based on loops (for, while).

Software Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Have foundation in mathematics, science, statistics and management skills.

Illustrate development cycle including feasibility study for planning, analysis, design, implementation and testing phases. Implementations are taught to make them realize the importance of this aspect as well.

Deal with existing software product and the new product developments. They understand the need for team work environment.

Apply basic software quality assurance practices to ensure that software designs, development, and maintenance meet or exceed applicable standards. Also, students will have good oral and written communications so that their professionalism will show a mark to the society.

Section A

Software engineering concepts, software evolution, software process models, software project planning: identifying software scope, resources, risk management, project scheduling, tracking, cost estimation: project metrics, cost factors, cost estimation techniques (decomposition, empirical, automated estimation, Delphi). Analysis concepts, structured vs object oriented analysis, object oriented analysis modelling.

Section B

System Design: design concepts and principles (modularization, abstraction, refinement, cohesion, and coupling), object oriented concepts: class and object definitions, encapsulation, polymorphism, inheritance, association, multiplicity, composition and aggregation, generalization, specialization. Object Oriented Modelling using Unified Modelling Language (UML): class diagrams, use case diagrams, sequence diagrams, activity, and state diagrams. Implementation: language classes, coding style, efficiency.

Section C

Software Quality Assurance: quality factors and criteria, SQA metrics, SQA techniques. Verification and Validation: software testing methods (WBT, BBT), software testing strategy (unit testing, integration testing, system, testing), Maintenance: types of maintenance, software maintenance process, maintainability, software reuse, re-engineering, reverse engineering, CASE.

Suggested Books:

1. Pressman, R. S. (2005). *Software engineering: a practitioner's approach*. Palgrave Macmillan.
2. Jalote, P. (2012). *An integrated approach to software engineering*. Springer Science & Business Media.
3. Godbole, N. S. (2004). *Software quality assurance: Principles and practice*. Narosa Publications.
4. Sommerville, I. (2011). *Software engineering*. Boston: Pearson.
5. Fairley, R. (1985). *Software engineering concepts*. McGraw-Hill, Inc.
6. Offutt, J., & Ammann, P. (2008). *Introduction to software testing*. Cambridge: Cambridge University Press.

Suggested E-Learning Material:

1. Software Engineering
<https://nptel.ac.in/courses/106101061/>
2. Pressman, R. S. (2005). *Software engineering: a practitioner's approach*. Palgrave Macmillan.
<http://qiau.ac.ir/teacher/files/911610/13-11-1387-17-31-03.pdf>

Theory of Computation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Model, compare and analyze different computational models using combinatorial methods.

Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.

Identify limitations of some computational models and possible methods of proving them.

Have an overview of how the theoretical study in this course is applicable to and engineering application like designing the compilers.

Section A

Mathematical Preliminaries, Alphabets, Strings, Languages, States, Transitions, Finite Automata and Regular Expressions, Applications e.g. Lexical Analyzers and Text Editors, Pumping Lemma, Closure Properties of Regular Sets, Decision Algorithms for Regular Sets.

Section B

Context Free Grammars, Chomsky Normal Forms And Greibach Normal Forms, Ambiguity, Pushdown Automata and the Equivalence of Context Free Languages to Sets Accepted by Non-Deterministic PDA, Pumping Lemma for CFL's, Closure Properties of CFL's and Decision Algorithms for CFL's.

Section C

Turing Machines: Introduction, Turing Computability, Non-deterministic, Multitape and other versions of Turing Machine, Church's Hypothesis, Primitive Recursive Function, Gödelization, Recursively Enumerable Languages, Undecidability: Universal Turing Machines and Unsolvability of the Halting Problem, Post's Correspondence Problem.

Suggested Books:

1. Hopcroft, J. E., Motwani, R., & Ullman, J. D. (2001). *Introduction to automata theory, languages, and computation*. Narosa Publishing House.
2. Wood, D., & Wood, D. (1987). *Theory of computation*. New York: Harper & Row Publishers.
3. Lewis, H. R., & Papadimitriou, C. H. (1997). *Elements of the Theory of Computation*. Prentice Hall PTR.
4. Martin, J. C. (1991). *Introduction to Languages and the Theory of Computation*. NY, USA: McGraw-Hill.
5. Srimani, P. K., & Nasir, S. F. B. (2007). *A Textbook on Automata Theory*. Cambridge India.

Suggested E-Learning Material:

1. Theory of Computation
<https://nptel.ac.in/courses/106104028/>
2. Linz, P. (2006). *An introduction to formal languages and automata*. Jones & Bartlett Learning.
<http://almuhammadi.com/sultan/books/Linz.5ed.pdf>

Client Server Computing and Applications

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

After successful completion of the course students will be able to
Understand real life application using client-server architecture.
Learn concepts of network and its usage in client-server model.
Design distributed database for various application.

Section A

Evolution of PC, Introduction to Local Area Network, PC LANS, Mainframe Computers, PC Connected to mainframes.

Section B

Distributed Systems and database. Client Server Computing model, Client-Server Hardware and software need, issues in Client Server Computing – shared access, connectivity, security advantages of client server computing. Examples UNIX & Windows NT.

Section C

Client Server Applications: Database Server Networks, Gateways, Video Conferencing and multimedia applications. Client – server architectures: segmentation, switched FDDI, Peer-to-Peer architecture.

Suggested Books:

1. Dewire, D. T. (1993). *Client/server computing*. McGraw-Hill, Inc.
2. Berson, A. (1992). *Client-server architecture*. McGraw-Hill.
3. Orfali, R., Harkey, D., & Edwards, J. (2007). *Client/server survival guide*. John Wiley & Sons.
4. Trivedi, M. & Khanna M. *Client Server Computing*. Book Publishing Co. Pvt. Ltd

Compiler Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Specify and analyze the lexical, syntactic and semantic structures of advanced language features.

Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation

Write a scanner, parser, and semantic analyzer without the aid of automatic generators

Describe techniques for intermediate code and machine code optimization

Design the structures and support required for compiling advanced language features.

Section A

Analysis of source programme, Different phases of a compiler, Symbol Table. **Lexical Analysis:** Different approaches to design a lexical analyzer, regular expression, finite automata (Deterministic & Non-deterministic). RE to NFA and NFA to DFA. Optimization of DFA states. Implementation of lexical analyzer (introduction). **Error Handling:** errors in different phases of compiler. Introduction to Compiler Construction Tools.

Section B

Syntax analysis: context free grammar, Parsing techniques (Top-down, Bottom-up, Operator-precedence, SLR, LALR). Intermediate code generation: Intermediate language, syntax directed translation, assignment statement, Boolean statements and back patching, array references, procedure calls and record structure.

Section C

Code optimization: Principal sources of optimization, Local & Loop optimization, loop invariant computations, induction variable elimination. Code generation: Design of code generation, a machine model, a simple code generator, register allocation & assignment, code generation from DAG's.

Suggested Books:

1. Aho, A. V., & Ullman, J. D. (1977). *Principles of Compiler Design*. Addison-Wesley Longman Publishing Co., Inc.
2. Jeffrey, A. V., Ullman, J. D. & Sethi R. (1986). *Compilers, Principles, Techniques, and Tools*. Wesley.
3. Barrett, W. A., & Couch, J. D. (1988). *Compiler construction: theory and practice*. Galgotia.
4. Tremblay, J. P., & Sorenson, P. G. (1985). *Theory and Practice of Compiler Writing*. McGraw-Hill, Inc.
5. Gries, D. (1987). *Compiler construction for digital computers*. New York: Wiley.

Suggested E-Learning Material:

1. Principles of Compiler Design
<https://nptel.ac.in/courses/106108113/>
2. Compilers
<https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/>

Compiler Design Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes:

After successful completion of the course students will be able to

Develop understanding for implementing programs for lex code.

Implement program for Yacc tool to develop a scanner and parser.

Apply the knowledge of patterns, tokens & regular expressions in programming for solving problems.

List of Experiments:

1. Revision of Basic Linux Commands like: Is, mkdir, rmdir, cd, cat, cp, rm, mv, vi, head, tail, cut, grep etc. (2 Labs)
2. Revision of C programs using gcc compiler like (Adding numbers, finding greater or lesser, generation of series, adding series, Using functions) (3 Labs)
3. Write a Lex code to check given string is keyword or identifier
4. Write a Lex code to match a given string
5. Write a Lex code to count vowel and consonant from input
6. Write a Lex code to count number of printf and scanf from C file
7. Write a Lex code to count number of identifiers from C file
8. Write a Lex code to count word, characters, blank spaces and lines
9. Write a Lex code to count number of comment lines
10. Write a Lex code to check the validity of arithmetic statement
11. Write a Lex code to find the number of constants
12. Write a Lex code to count number of keywords from C file
13. Write a Lex code to check statement is compound or simple
14. Write a Lex code to check number is integer or floating point
15. Write a Lex code which return type of relational operator like >, <, <=, >=, ==
16. Write a Lex code to count escape sequences from C file
17. Write a Lex program to count the type of numbers
18. Write a Lex code to find longest word from the file
19. Write a Yacc code to check expressions are valid or not
20. Write a Yacc code to check given string is Keyword
21. Write a Yacc code to check variable declaration is correct or not like type varname
22. Write a Yacc code for checking parenthesis
23. Write a Yacc code to check compound statements are valid or not
24. Write a Lex and Yacc code for a simple desk calculator
25. Write a Lex and Yacc code for arithmetic operations on float variables
26. Write a Lex and Yacc code for checking if else statement from C file (2 Labs)
27. Write a Lex and Yacc code for evaluating postfix expressions (2 Labs)

Computer Graphics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Apply knowledge of mathematics, science, and engineering to implement basic transformation and scan conversion.

Apply the knowledge of co-ordinate system that is necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Apply aesthetic judgments and critical thinking skills to art and graphics related issues.

Recognize and evaluate critical and aesthetic issues within computer graphics and the mixed media.

Section A

Components of Graphics Systems: Display devices - Refresh CRTs, Random scan and Raster scan monitors, color CRT monitors, DVST, Plasma-panel displays, Hard copy devices-printers, plotters. Display processors-Random scan systems, Raster scan systems. Interactive Input devices: keyboards, touch panels, light pens, tablets, joysticks, trackball, mouse. Logical classification - Locator, Stroke, String, Valuator, Choice, Pick devices. Interactive picture construction techniques - positioning methods, constraints, grids, gravity field, rubber band methods, sketching, dragging.

Section B

Output primitives: Points and lines, DDA and Bresenham's line drawing algorithm, Antialiasing lines. Bresenham's circle drawing algorithm. Character generation. Area filling: Scan line, Boundary-fill, Flood-fill algorithm. 2-D Transformations: Basic Transformations, General Transformation equations, Reflection, Shear. Windowing and clipping: Windowing concepts, Line, Area, Text clipping algorithms, Window to View port Transformation. Segmentation: Concepts, Segment files, segment attributes.

Section C

3D Transformation: 3D co-ordinates. Basic 3D transformations. Rotation about arbitrary axis. Reflection, shear, viewing transformation. Curved lines and Surfaces: Polygon surface, Bezier Curves and surfaces, spline curves and surfaces. Fractals Geometry Methods: Introduction. Hidden surface and hidden line removal: Classification of algorithms, Back-face removal, Depth buffer method, Scan line method, Depth sorting method, Area subdivision method. Comparison. Shading: Constant intensity, Gouraud shading, Phong shading, Ray-tracing algorithms.

Suggested Books:

1. Hearn, D., & Baker, M. P. (1996). *Computer Graphics*. Person Education Inc.
2. Newman, W. M., & Sproull, R. F. (1979). *Principles of interactive computer graphics*. McGraw-Hill, Inc.
3. Harrington, S. (1987). *Computer Graphics: A Programming Approach*. Mc-Graw Hill.
4. Foley, J. D., & Van Dam, A. (1982). *Fundamentals of interactive computer graphics*. Reading, MA: Addison-Wesley.
5. Giloi, W. K. (1978). *Interactive computer graphics: data structures, algorithms, languages*.
6. Roy, A. P., & Kalley, G. (1987). *Theory and Problems of Computer Graphics*. Schaum's outline series in Computers.Mc-Graw Hill.

Suggested E-Learning Material:

1. Computer Graphics
<https://nptel.ac.in/courses/106106090/>
2. Computer Graphics
<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/>

Computer Graphics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course students will be able to

Implement various line drawing and circle drawing algorithms.

Implement algorithms for polygon drawing.

Implement boundary fill algorithm and flood-fill Algorithm to fill convex regions.

Implement problems based on object translations, scaling, rotations and projections.

Implement algorithms based on line clipping, anti-aliasing and curve fitting.

Lab No. Program

LI & L2	Implementation of in-built functions of C-language in Graphics.
L 3	Implementation of Vector Generation Technique and DDA Line Drawing Algorithm.
L 4	Implementation Bresenham's Line Drawing Algorithms.
L 5	Implementation of Simple Circle drawing Algorithm and using Trigonometric method.
L 6	Implementation of the Bresenham's Circle Drawing Algorithm, and Ellipse drawing by modifying Bresenham's Circle drawing algorithm.
L 7	Implementation of the Mid-point Circle Drawing Algorithm.
L 8	Implementation of Line and Point method of polygon drawing.
L 9	Implementation of Inside/Outside test of pixels in respect to a polygon.
L 10	Implementation of the Boundary Fill Algorithm and Flood-Fill Algorithm to fill convex regions.
L I 1	Implementation of Scan Line Conversion Algorithm for Polygon Filling (concave region).
L 12	Problems based on object translations using equations.
L I 3	Problems based on object scaling using equations.
L 14	Problems based on object rotations using equations.
L 15	Problems based on object translations using homogeneous matrices.
L 16	Problems based on object scaling using homogeneous matrices.
L 17	Problems based on object rotations using homogeneous matrices.
L18-L19	Problems based on object reflections using homogeneous matrices.
L 20	Problems based on object shear using homogeneous matrices.
L21-L22	Problems based on composite 2D transformations on any object using homogeneous matrices.
L 23	Implementation of Gupta-Sproull Anti-Aliasing method.
L 24	Problems based on Point Clipping.
L 25	Problems based on Cohen Sutherland Line Clipping Algorithm.
L 26	Problems based on Liang Barsky Line Clipping Algorithm.
L 27	Problems based on Sutherland Hodgeman Polygon Clipping Algorithm.
L 28	Implementation of Hilbert Curve and Koch curve.
L 29	Problems based on Segments.
L 30	Problems based on Character Generation using raster approach.
L 31	Problems based on Simple Parallel Projection.
L 32	Problems based on Simple Perspective Projection

Modeling and Simulation

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Describe the components of system and its principles.

Illustrate conceptualization of model in system analysis, design and postulation.

Describe the role of creating a model for any system in simulating it.

Describe the applications of various simulation techniques in various real life scenarios.

Learn the different statistical techniques used in simulation process and describe the characteristics of different simulation languages and their use.

Section A

Modeling: Definition of a SYSTEM, System concepts, types of system, continuous & discrete systems, modeling process, verification & validation. **Simulation:** Introduction, classification of simulation models, advantages and disadvantages of simulation, discrete system simulation: Monte Carlo method, Random Number Generation.

Section B

Queuing Theory: Introduction, Notation and assumption, Queuing model with poison input, exponential service and arbitrary service times, Simulation of queuing system, Simulation of a single-server queue, Simulation of two-server queue. Inventory Control: Elements of inventory theory, more complex inventory models, finite and infinite delivery rate model with and without back ordering, Simulation of inventory systems.

Section C

Evaluation of simulation, length of simulation runs, variance reduction techniques. Project management: PERT/CPM techniques, simulation of PERT networks, Model as components of information systems, modeling for decision support, Virtual reality: The ultimate interactive model.

Suggested Books:

1. Gordon, G. (1969). System simulation. Prentice Hall of India.
2. Payne, J. A. (1982). *Introduction to Simulation: Programming Techniques and Methods Analysis*. McGraw-Hill, Inc.
3. Deo, N. (1983). *System simulation with digital computer*. Englewood Cliffs (NJ): Prentice-Hall.

Suggested E-Learning Material:

1. Modelling and Simulation of Discrete Event System
<https://nptel.ac.in/courses/112107220/>
2. Simulation and modeling of natural processes
<https://www.coursera.org/lecture/modeling-simulation-natural-processes/modeling-and-simulation-F7vas>

Pattern Recognition & Image Processing

SECTION A

Image processing : introduction, linear systems, the Fourier transform, matrix theory results. Image perception, image sampling, Quantization : the optimal mean square(Lloyd-max quantizer), visual quantization. Image transforms : two dimensional orthogonal and unitary transforms, properties, one dimensional discrete Fourier transform(DFT), two dimensional DFT, cosine transform, sine transform.

SECTION B

Image enhancement : point operation, histogram modeling, spatial operations, transform operations, multispectral image enhancement, false color and pseudocolor, color image enhancement. Image filtering : image observation models, inverse and Wiener filtering, finite impulse response(FIR) wiener filtering, other Fourier domain filters.

SECTION C

Image Analysis: Feature extraction, Edge detection, Scene segmentation and labelling. Pattern recognition: Introduction, Recognition process, Statistical decision making (Bayes' theorem), Nonparametric decision making (Nearest neighborhood classification tech), clustering.

References :

1. A.K. Jain: Fundamentals of digital image processing: PHI Publications.
2. E. Charniak,D: Introduction to Artificial Intelligence: Mcdermott.
3. M.A.Sid-Ahmed: Image processing: Mcgrawhill International publication Lecture Schedule
4. Earl Gose, Richard Johnsonbaugh, steve Jost: Pattern Recognition and Image Analysis: PHI Publications.

Distributed Computing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Study software components of distributed computing systems. Know about the communication and interconnection architecture of multiple computer systems.

Give the hardware and software concepts of distributed operating systems, various design issues like transparency, flexibility etc., and communication and synchronization in distributed operating systems.

Apply scheduling in distributed operating systems, fault tolerance, real-time distributed systems, and designing of distributed file systems.

Develop various synchronous and asynchronous algorithms: Leader election, shortest path problem, minimal spanning tree, randomized co-ordinate attack problem, consensus problems and construction of the breadth first tree, spanning tree, and maximal independent set.

Have in-depth knowledge of asynchronous shared memory model including various classical algorithms of mutual exclusion and resource allocation.

Section A

Distributed Operating System: Distributed Computing system models, Issues in design of distributed operating system, message passing, Remote Procedure Calls, synchronization, process management, resource management, distributed file systems. Introduction to distributed data-bases.

Section B

Distributed Algorithms: Introduction to distributed algorithms, synchronous and partial synchronous models, Algorithms in general synchronous leader election, Breadth first search, shortest path, randomized algorithms. Distributed consensus with link and process failures. Asynchronous system model, I/O automata, operation of automata, complexity measures, randomizations,

Section C

Asynchronous shared memory model, mutual exclusion, resource allocation, consensus, Asynchronous network model, basic asynchronous network algorithms, shared memory Vs Networks. Introduction to parallel distributed processing: general framework, methods of learning.

Suggested Books:

1. Sinha, P. K. (1998). *Distributed operating systems: concepts and design*. PHI Learning Pvt. Ltd.
2. Tanenbaum, A. S. (2009). *Modern operating system*. Pearson Education, Inc.
3. Lynch, N. A. (1996). *Distributed algorithms*. Elsevier.
4. Rumelhart, D. E., McClelland, J. L., & PDP Research Group. (1987). *Parallel distributed processing* (Vol. 1 & Vol. 2). Cambridge, MA: MIT press.
5. Haykin, S. (1994). *Neural networks: a comprehensive foundation*. Prentice Hall PTR.

Suggested E-Learning Material:

1. Distributed Systems
<https://nptel.ac.in/courses/106106168/>
2. Tanenbaum, A. S., & Van Steen, M. (2007). *Distributed systems: principles and paradigms*. Prentice-Hall.
<https://www.distributed-systems.net/index.php/books/distributed-systems-3rd-edition-2017/>

Departmental Electives

Artificial Intelligence

SECTION A

Introduction to Artificial Intelligence, General problem solving, state space and graph model techniques, Heuristic designs, Aim-oriented heuristic algorithms versus solution guaranteed algorithms, Game playing strategies.

Knowledge representation: Knowledge representation tools, First order predicate calculus. The language PROLOG - sementic nets, partitioned nets, Minsky's frames, case grammer theory, production rules, knowledge base, the inference system, forward and backward deduction.

SECTION B

Understanding Natural Language, Parsing techniques, context free and transformational grammer, transition net, augmented transition nets, Fillmore's grammer, Shanks conceptual dependency. Grammer free analysers, Sentence generation, Translation.

Expert systems: Structure, development tools, uncertainty considerations, domain exploration, meta knowledge, expertize transfer, existing systems (DENDRAL, MYCIN), self explaining systems.

SECTION C

Pattern recognition: Structured description, symbolic description; machine perception: Vision & Speech; techniques used in solving preceptual problems, analysing visual clues (edge detection); speech recognition: Problems in speech recognition, analyzing speech, Introduction to machine learning.

Text/Reference Books:

1. Elaine Rich & Kevin Knight: **Artificial Intelligence:** Mc-Graw Hill, International edition, 1991.
2. N.J. Nilsson: **Principles of Artificial Intelligence:** Narosa Publishing, 1991.
3. Peter Jackson: **Introduction to Expert Systems:** Addison Wesley.
4. E. Charniak & D. McDermott: **Introduction to Artificial Intelligence:** Addison Wesley, 1985.
5. Avron Barr & Edward A. Feigenbauen: **The Handbook of Artificial Intelligence:** Addison-Wesley Pub., 1982. Vol I, Vol II, Vol III
6. James Allen: **Natural Language Processing:**
7. Tau & Genzaes: **Pattern Recognition Principles:** Addison-Wesley, 1974.

Real Time Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Present the mathematical model of the system.

Develop real-time algorithm for task scheduling.

Illustrate the working of real-time operating systems and real-time database.

Work on design and development of protocols related to real-time communication.

Section A

Introduction to Real-time computing: Characterizing Real-time system & tasks; Performance measures of real time systems, estimation of program run time, Real-time system design: Hardware requirement, system-development cycle, data transfer techniques, synchronous & asynchronous data communication, standard interfaces.

Section B

Task Assignment and Scheduling: Priority scheduling, scheduling with fixed priority dynamic priority scheduling, Real-time programming languages & Tool: desired language characteristics, data typing, control structure, run time error handling, overloading & generics, run time support, Real-time databases.

Section C

Real time communication algorithms, Fault tolerance techniques: Causes of failure, fault types, fault detection, redundancy, integrated failure handling Reliability Evaluation techniques: Parameter values, reliability model for hardware redundancy, software error model, Clock synchronization.

Suggested Books:

1. Krishna, C. M. (2001). *Real Time Systems*. Wiley Encyclopedia of Electrical and Electronics Engineering.
2. Mathai, J. (1996). *Real-time systems: specification, verification and analysis*. Prentice Hall International series in Computer Science.
3. Lawrence, P. D., & Mauch, K. (1987). *Real-time microcomputer system design: an introduction*. McGraw-Hill, Inc.
4. Bennett, S. (1994). *Real-time computer control: an introduction*. Englewood Cliffs: Prentice Hall.
5. Young, S. J. (1982). *Real time languages*. Horwood.

Suggested E-Learning Material:

1. Real-Time Systems
http://www.cse.chalmers.se/edu/year/2015/course/EDA222_Real_Time_Systems/Documents/Slides/
2. Fault Tolerance
<https://www.coursera.org/lecture/big-data-essentials/fault-tolerance-rcwk5>

Soft Computing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Apply the theory and concepts of neural networks, neuro-modeling, several neural network architectures and their applications.

Describe the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.

Describe evolutionary computation like genetic algorithms and its power to optimize the problem in hand.

Section A

Neural Network (NN) Paradigms: Introduction, Neuron model, Neural network architectures, Learning Rules (Hebbian, Competitive, Boltzmann, Supervised, unsupervised) Types of neural networks: Perceptron, MLP, radial basis function network, recurrent network, self organizing Feature maps, Boltzmann m/c, Applications of NN.

Section B

Fuzzy Logic: Introduction, Fuzzy sets, Basic operations on fuzzy sets, relations, rule based models and linguistic variables, fuzzy control, interpolation in fuzzy rule base, Applications of Fuzzy logic.

Section C

Evolutionary Computations: Introduction, Genetic Algorithm (GA), Evolutionary programming, Classifier systems, genetic programming parse trees, Mathematical foundation of GA variants of GA (hybrid GA, Fuzzy GA Enhancements of genetic programming, application).

Suggested Books:

1. Zimmermann, H. J. (1996). *Fuzzy Set Theory—and Its Applications*. Springer, Dordrecht.
2. Haykin, S. (1994). *Neural networks: a comprehensive foundation*. Prentice Hall PTR.
3. Li, H., Li, H. H., & Gupta, M. M. (1995). *Fuzzy logic and intelligent systems*. Springer Science & Business Media.
4. Jain, L. C., & Kacprzyk, J. (1997). *Soft computing techniques in knowledge-based intelligent engineering systems: approaches and applications*. Physica-Verlag.
5. Geyer-Schulz, A. (1997). *Fuzzy rule-based expert systems and genetic machine learning*. Physica Verlag.
6. Yegnanarayana, B. (2009). *Artificial neural networks*. PHI Learning Pvt. Ltd..
7. Valluru, B. R. & Hayagriva, V. R. (1995). *C++ neural networks and fuzzy logic*. MIS Press; New York, USA.
8. Ruan, D. (Ed.). (2013). *Fuzzy systems and soft computing in nuclear engineering*. Physica.
9. Anderson, J. A. (1995). *An introduction to neural networks*. MIT press.
10. Kosko, B. (1992). *Neural networks and fuzzy systems: a dynamical systems approach to machine intelligence*. Prentice hall.

Suggested E-Learning Material:

1. Neuro-Fuzzy and Soft Computing
<http://www.cs.nthu.edu.tw/~jang/nfsc.htm>
2. Introduction to Soft Computing
<https://nptel.ac.in/courses/106105173/>
3. Neural Networks and Deep Learning
<https://www.coursera.org/courses?query=neural%20networks>

Data Mining and Warehousing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Describe the basic concepts of data mining and data warehousing.

Apply skills for different data mining techniques in the analysis of data.

Describe the schema and organization of data in data warehouse.

Apply data mining techniques in wide variety of data like spatial, time series, text, multimedia and World Wide Web.

Get experience and encouragement of exploring data mining techniques in real world and doing research.

Section A

Introduction to data mining - Definition, why data mining, on what kind of data, knowledge discovery in databases (KDD), appropriateness of data mining, expert systems vs. data mining systems, data mining functionalities, classification of data mining systems, data mining techniques, major issues. **Data Preprocessing** - data cleaning, integration and transformation, data reduction, data discretization and concept hierarchy generation.

Section B

Association rules - Market Basket Analysis, Apriori algorithm for generating association rules, FP-growth algorithm. **Classification and prediction** - decision tree induction, other methods for classification (introduction only), Prediction - linear and non linear regression, Evaluating the accuracy of a classifier or predictor.

Clustering - Categorization of Major cluster methods, the K-means algorithm, hierarchical clustering (agglomerative and division method).

Section C

Data Warehouse - difference between operational database and warehouse, data warehouse design, three tier architecture, online analytical processing (OLAP), data warehouse implementation. Trends in data mining – system products and research prototypes. Social impacts of data mining. Applications of data mining. Brief overview of mining time series databases, spatial databases and World Wide Web mining.

Suggested Books:

1. Han, J., Pei, J., & Kamber, M. (2011). *Data mining: concepts and techniques*. Elsevier.
2. Roiger, R. J. (2017). *Data mining: a tutorial-based primer*. Chapman and Hall/CRC.
3. Berry, M. J., & Linoff, G. S. (2009). *Data mining techniques*. John Wiley & Sons.
4. Adriaans, P., & Zantinge, D. (2000). *Data Mining*. Addison Wesley.

Suggested E-Learning Material:

1. Data Mining
<https://nptel.ac.in/courses/106105174/>
2. Data Mining: Concepts and Techniques
https://hanj.cs.illinois.edu/bk3/bk3_slidesindex.htm

Digital Signal Processing

Section-A

Introduction of Signals, Systems and Signal Processing, Classification of Signals and Systems, Advantages of Digital over Analog Signal processing, Signal Models - Continuous Time versus Discrete time signals, Periodic and Periodic Signals, Phasor Signals and Spectra, Energy and Power Signals, System Modeling Concepts, The superposition integral for Fixed and Linear Systems, Impulse Response of a Fixed and Linear System - Fourier Series - Trigonometric Series- Exponential Fourier Series-Symmetry Properties of the Fourier Coefficients. Fourier Integral, Energy Spectral Density, Fourier Transforms in the Limit, Fourier Transform Theorems and Pairs, System Analysis with Fourier Transform, Laplace Transform Theorems, Network Analysis using the Laplace Transform.

Section-B

Discrete Time Signals and Systems - Review of Sampled Data Systems, Time Domain Representations of Discrete Time Signals, Frequency Domain Representation of Discrete Time Signals, Discrete Time Signals obtained by sampling, Discrete Fourier Transform. Z-Transform - Definition and Examples, Inverse Z-Transform, Properties of the Z-Transform, Introduction to Realization of Digital Systems - Block Diagrams and Signal Flow Graphs. Introduction to Realization of an IIR and FIR systems, Discrete Fourier Transforms (DFT) and Fast Fourier Transform (FFT)

Section-C

Design of Digital Filters: Introduction to Filters, A comparison of IIR and FIR Digital Filters. Design of IIR Digital Filters -Impulse Invariant Transformation, Bilinear Transformation, Design of Digital Butterworth and Chebyshev Filters. Design of FIR Digital Filters - Windowing and Rectangular Window, Filter Designs using Windows, Frequency Sampling Technique. DSP tools and DSP techniques in various applications.

Text Books:

1. Johnson Johnny R., "Introduction to Signal Processing," Prentice-Hall of India, 1998.
2. Oppenheim V. Alan, "Signal & Systems", Prentice-Hall of India, 1995.
3. Proakis G. John, "Digital Signal Processing," Prentice-Hall of India, 3rd edition, 2002.

Information Systems and Securities

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Appreciate the value of information to the modern organization.

Describe the key encryption techniques of cryptography.

Appreciate the difficulties that arise when valuable information needs to be shared.

Learn Confidentiality, Integrity and Availability.

Apply protocols to implement secure message exchanges.

Section A

Foundations of Cryptography and Security, Ciphers and Secret Messages, Security Attacks and Services, Mathematical Tools for Cryptography, Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Conventional Symmetric Encryption Algorithms, Theory of Block Cipher Design, DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB), Strength of DES, Modern Symmetric Encryption Algorithms, RC5 Stream Ciphers, One Time Pad, Cryptanalysis.

Section B

Public Key Cryptography, Prime Numbers and Primality testing, Factoring Large Numbers, RSA, attacks on RSA, Diffie-Hellman, Algorithm, Public-Key Cryptography Standards, Hashes and Message Digests, Message Authentication, MD5, SHA, Digital Signatures, Certificates, Digital Signature Standard (DSS and DSA),

Section C

Authentication of Systems, Kerberos (V4 and V5) and VeriSign, Electronic Mail Security (Pretty Good Privacy, S/MIME), IPSec and Web Security, Intrusion detection systems, Secure Sockets and Transport Layer (SSL and TLS), Electronic Commerce Security, Secure Electronic Transaction (SET), E-Cash (DigiCash), Digital Watermarking and Steganography.

Suggested Books:

1. William, S. (1999). *Cryptography and network security: principles and practice*. Prentice-Hall, Inc.
2. Schneier, B. (2007). *Applied cryptography: protocols, algorithms, and source code in C*. John Wiley & sons.
3. Schneier, B. (2011). *Secrets and lies: digital security in a networked world*. John Wiley & Sons.

Suggested E-Learning Material:

1. Introduction to Computer Security
<https://www.cs.northwestern.edu/~ychen/classes/cs350-w07/lectures.html>
2. Cryptography and Network Security
<https://nptel.ac.in/courses/106105031/>

Internet and Web Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course students will be able to

Describe the working of Internet & World Wide Web.

Develop a dynamic webpage by the use of java script, HTML & CSS.

Write a server side java application called Servlet to catch

Write a server side java application called JSP to catch form data sent from client, process it and store it on database.

Develop web application using JSP with database connectivity.

Section A

Introduction: Introduction to Internet, History & Evolution of Internet, Architecture of Internet, Working of Internet, Various services of Internet, Introduction to World Wide Web, Architecture of WWW, Web Browser architecture, working & Features of web browser, Web Documents, type of web documents

HTML: Introduction to HTML, structure of HTML document, Elements (Headings ,Paragraphs ,Formatting , Lists ,Quotations ,Links, Images, Tables , Forms, Audio, Video, Blocks, Layouts etc.) & Attributes

Section B

CSS: Introduction, Syntax of CSS rule, Internal, External and Embedded CSS, CSS properties (Text, Fonts, Tables, Border, Box, background), Class Selector, ID Selector, Element Selector, Pseudo classes.

JavaScript(JS): Introduction to JavaScript, JavaScript basics (statements, syntax, comments, variables, operators, data types, control structures, loops), JS objects, JS functions, JS form API, JS HTML DOM, JS Browser BOM, regular expressions, data validations using JS

XML: Introduction to XML, XML document rules, XML type definition, XML Schemas, XML schema documents, XML programming interfaces

Section C

JSON: Introduction to JSON, JSON syntax, uses of JSON, parsing and generating JSON.

AJAX: Introduction to AJAX, Creating Ajax requests and responses, Monitoring Ajax request state and events, Responding to Ajax requests with HTML and JSON

Server-side Technologies: Historical background of server side technologies, Web Server architecture, accessing web server, working & features of web server, Basics of JSP, JSP implicit objects, JSP Session Tracking, JSP Cookies handling, JSP page redirecting, database connectivity in JSP

Web2.0: Introduction to Rich Internet Application, Introduction to Service oriented Architecture, Introduction to Web Services

Suggested Books:

1. Deitel, P., & Deitel, H. (2007). *Internet & world wide web: how to program*. Prentice Hall Press.
2. Greenlaw, R., & Hepp, E. (2001). *Inline/online: fundamentals of the internet and the world wide web*. McGraw-Hill Higher Education.
3. Pekowsky, L. (2017). *Java Server Pages*. Addison Wesley.
4. Fain, B. *Responsive Web Design with HTML5 and CSS3*. Packt Publishing Limited

Suggested E-Learning Material:

1. W3Schools website

<https://www.w3schools.com/xml/>

2. HTML, CSS, and Javascript for Web Developers <https://www.coursera.org/learn/html-css-javascript-for-web-developers>
3. Internet Technology
<https://nptel.ac.in/courses/106105084/>

Internet and Web Technology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course students will be able to

Design web pages containing tables, images and links using HTML and CSS.

Design web pages using DIV, Class and ID selector.

Design dynamic web pages using Java Script and PHP

Develop a server side java application called JSP to catch form data sent from client, process it and store it on database.

Lab No.	Topic
Lab 1	Introduction to HTML and Web Browsers
Lab 2	Formatting Web Pages
Lab 5-Lab 6	Anchor tag, Image tag, List and Table formation
Lab 10-Lab 11	Color Schemes and Other Miscellaneous Tags
Lab 13-Lab 14	CSS (cascade style sheets), dynamically changing text and style
Lab 18-Lab 19	Dynamically Changing Content of using Placement, Filters and Transitions
Lab 25-Lab 26	Introduction to Scripting, Implications of using Script Tags in Various HTML Tags
Lab 30-Lab 31	Variable Declaration, Operators, Condition and Control Statements
Lab 35-Lab 36	Basic input/output functions of Java Script
Lab 40-Lab 41	Object Model, Simple Animation creation using Java Script and DHTML
Lab 44	Creation of XML File
Lab 45	DTD in XML

Data Mining and Warehousing Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course students will be able to

Implement programs for data preprocessing and data analysis.

Use association rule mining in programs for mining of different kinds of data.

Implement classification and clustering algorithms for data mining.

Lab No	Problems
L 1-L5	Introduction to the exploratory data analysis
L6-L10	Performing data preprocessing for data mining
L11-L13	Performing Association rule analysis
L14-L6	Performing Classification
L17-L18	Performing Clustering
L19-L20	Performing Regression

Multimedia Systems

SECTION - A

Multimedia Basics: : Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in Business and Work, Convergence of Computer, Communication and Entertainment Products, Multimedia Hardware, Memory & Storage Devices, Communication Devices, Multimedia Software's Presentation Tools, Tools for Object Generations, Stages of Multimedia Design: planning, content analysis, instructional design, preparation of media elements, integration of media elements, authoring, evolution.

Image: types of graphics-vector and raster, attributes of image-resolution, images, pixel depth, color, color palates, compression of images and its affects to quality and storage size, Various Files Formats: BMP, DIB, EPS, CIF, PEX, PIC, TGA and TIF Formats, the windows meta files formats, Compression Techniques: REL Compression, LZW Compression, JPEG fractal compression, Processing Tools: techniques of capturing image and converting image, software tools for processing images techniques of special text, effects using various software.

Article VI.

Article VII.

SECTION - B

Sound: Sound and its effects in multimedia, quality and storage size estimation of a sound file, transmission of digital sound, psychoacoustics -frequency and amplitude, sensitivity of hearing music and noise, stereo effects, masking, frequency domain compression of analog sound signal, digitization of audio signal - sampling of sound, frequency, sound depth, channels in sound; digital audio signal processing; elementary concepts of music, pitch and voice, electronic music and synthesizer, MIDI interface, protocol and data format.

Animation: Animation and its Basic – principals of animation and its use in multimedia, computer system configuration and peripherals requirements, software for animation, effects of resolution, pixel depth, image size and quality, types of animation, step for creating and generating animation.

SECTION - C

Basic of Video: analog and digital video, type of video computer, system configuration and peripherals required , digitization of analog video, type of video problems due to interlacing or non interlacing, Video Standard: NTSC, Pal, Secma, HDTV, Video capturing media/instruments, videodisk, compression techniques, file formats - AVI, MPEG, Move Real Video, video editing and movie making tools Quick Time Video for Window, web multimedia, various plug-ins for web, multimedia designing tips, text and image, web planning and distribution of a multimedia project, Virtual Reality Terminology: Head Mounts Display (HMD), Boom, Cave, Input Devices and Sensual Technology, Characteristic of Impressive VR, Shared Virtual Environments, Non Impressive VR, VRML, VR - related technology application

Text Books:

1. Multimedia: Making It Work (5th Edition), Vaughan, Tata McGraw Hill
2. Multimedia In Action, James E Shuman, Vikas Publishing
3. Multimedia Systems, John F. Buford, Pearson Education

Reference Books:

1. Multimedia On The PC, Norman Desmarasis, Tata McGraw Hill
2. Multimedia Fundamentals – Volume I, Ralf & Klara, Pearson Education
3. Multimedia Systems Design, Andleigh, Prabhat K. & Thakrar, K., Prentice-Hall

Engineering Drawing and Graphics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Learning Outcomes:

After successful completion of the course, students will be able to:

- Apply the concepts of engineering drawing in their respective field of interest.
- Implement various BIS and ISO concepts of drawing.
- Draw the sectional views of various engineering objects.
- Use engineering curves in tracing the paths of simple machine components.
- Draw various views related to real objects.
- Draw and read plan of industrial standards.
- Visualize the design ideas using software.

Indian Standard –Drawing Instruments, Lines & Lines symbols; Sheet Layout of rules of printing; Line sections & Conventions, Lettering, Scales, Curved used in Engineering Practice, Projection of Points, Projection of Lines, Projection of Planes, Projection of Solids, Orthographic Projections, Sectional Views, Rivets & Riveting Joints, Threads, Foundation Bolts & Nuts.

Computer Aided Drawing using Auto CAD /MICRO STATION.

Text Books:

1. Gill, P. S. (2010). *Engineering Drawing*. Kataria Publication,.
2. Bhatt, N. D. & Panchal, V.M. (2011). *Geometrical and Machine Drawing* (19th ed.). Charotar Publication.

e-Resources:-

1. <https://nptel.ac.in/courses/112103019/>
2. <http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html>
3. https://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/
4. <https://nptel.ac.in/courses/112104172/>

LIST OF EXPERIMENTS

1. Drawing sheet related to lettering.
2. Drawing sheet related to scale.
3. Drawing sheets related to conic sections.
4. Drawing sheets related to Engineering Curves.
5. Drawing sheet related to Projection of points.
6. Drawing sheet related to Projection of lines.
7. Drawing sheet related to orthographic projection by 1st angle.
8. Drawing sheet related to orthographic projection by 3rd angle.

Measurement Techniques Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Learning Outcomes:

After successful completion of the course, students should be able to:

- Demonstrate an understanding of different adulteration and qualitative analysis of biomolecules.
- Develop understanding working with microscope.
- Learn a basic concept of plant identification and vegetational analysis.
- Gain hand on training to check purity of biomolecules.

Biology

1. To test for adulteration in turmeric, wheat flour, ghee and milk.
2. Qualitative analysis of nitrate, carbonate and replaceable base deficiency in soil samples.
3. Determination of soil pH.
4. Biochemical test for sugar, albumin and ketone bodies in urine samples.
5. Biochemical tests for lipids and cholesterol.
6. Detection of Vitamin A in the given sample.
7. Study of typical prokaryotic and eukaryotic cells with the help of a microscope.
8. Gram staining to identify gram positive and gram negative bacteria
9. Description of plant identification (Neem, Babool, Peeli Kaner, Tulsi & Chandani, Aak/ Madar).
10. Vegetational analysis by Quadrat method.
11. Determination of concentration and purity of DNA.
12. Determination of concentration and purity of RNA.
13. Preparation of stained temporary mount of onion peel.

Suggested Books:

- Biradar, V.K., & Samshe, A. (2016). *Practical Biochemistry*. New Delhi: APH Publishing Corporation.
- Sharma, S., & Sharma, R. (2016). *Practical Manual of Biochemistry* (2nd ed.). New Delhi: Medtech.
- Vats, S. (2015). *A laboratory Text book of Biochemistry, Molecular Biology and Microbiology*. Germany: GRIN Verlag.

Yadav, V.K., & Yadav, N. (2018). *Biochemistry & Biotechnology: A Laboratory Manual*. Jaipur: Pointer Publisher

EC/EI Electromagnetic Field Theory

SECTION- A

Elements of Vector calculus: Cartesian coordinate system, Circular-Cylindrical coordinate system, Spherical coordinate system (dot product, cross product, divergence & curl). Electrostatics: Electric Flux Density, Coulomb's law, Gauss's law and their applications, Energy in electrostatic fields, capacitance of parallel plate and coaxial cable, Fields in dielectrics, Boundary conditions, dipole, Laplace's and Poisson's equations and their applications.

SECTION – B

Magnetostatics: Ampere's law, Biot-Savart's law and their applications, Stokes's theorem, Energy in magnetic field, Boundary conditions. Maxwell's Equation:- Maxwell's equations in integral & differential form (Gauss's law in electric and magnetic field, Ampere's circuital law, Faraday's law), Maxwell's equations for time varying field.

SECTION – C

Uniform Plane Waves: Wave equation and its solutions, Poynting vector, propagation through various media-free space, conductor & dielectric, Reflection and Refraction in conductors & Dielectrics with normal and oblique incidence, Phase & Group velocity, Skin depth. Transmission Lines: General equation, input impedance, characteristic impedance, Reflection and reflection coefficient, Standing wave ratio, resonant and resonant line impedance matching, Smith chart and its applications, practical problems in transmission lines.

Text Book: -

1. William H. Hayt: **Engineering Electromagnetic**: Tata Mc Graw Hill.

Reference Books:-

1. Jordan and Balmain: **Electromagnetic waves and Radiating Systems**: PHI.
2. J.D. Kraus and Fleisch: **Electromagnetic with Applications**: Mc Graw Hill.

Electrical and Electronics Measurements

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- Student will analyze the performance of industrial measurement systems.
- Student will identify different type of transducers used in various real-time processes.
- Measurement of various electrical quantities can be carried out by students.
- Student will be able to design the bridge circuits used in measurement task.
- Systems will have ability to operate different waveform analyzers and Cathode ray oscilloscope employed for measurement of electrical qualities.

Section A

Measurements: Elements of Measurements, Performance characteristics, Error in measurements, True value, Static error, Static correction, Scale range, Scale span, Reproducibility, Drift, Repeatability, Accuracy and Precision, Indication of Precision, Significant figures, Range of doubt, Static sensitivity, Linearity, Hysteresis, Threshold, Dead Time, Dead zone, Resolution and Discrimination.

Measurement error: Types and analysis, Loading error due to series and shunt connected instruments, Standards and Calibration, Curve fitting, Dynamic characteristics of measurement systems, Mathematical models of measurement system (Mechanical and Electrical System).

Transducers: Classification and characteristics, Resistive, Capacitive, Inductive, Hall Effect. **Measurement of Displacement:** LVDT and RVDT, Strain Gauges and its types.

Measurement of Temperature: RTD, Thermistor and Thermocouples.

Section B

D'Arsonval Galvanometer- Construction, Torque Equation and Dynamic behavior of galvanometers, PMMC Instrument- Construction, Torque equation, Ammeter shunts, Voltmeter multipliers, Ohmmeter- Series and Shunt type, Moving Iron Instruments, Electrodynamometer Instrument. AC Bridges- Measurement of self-inductance (Maxwell's Bridge, Hay's Bridge, Owen's Bridge, Anderson's Bridge), capacitance (De Sauty's and Schering Bridge) and frequency (Wien's Bridge).

Section C

Measurement of low, medium and high resistance. Multimeter- Analog and Digital, Function generator, Wave Analyzer, Spectrum Analyzer, Q-meter and its applications, CRO- CRT, Time base generator, Measurement of Phase and Frequency (Lissajous Patterns), types of CRO (Dual Trace, Dual Beam, Sampling type and Storage CRO).

Text Books:

1. Sawhney, A. K. (2015). *A Course in Electrical and Electronic Measurements and Instrumentation*. Dhanpat Rai Publication.
2. Jain, R.K. (2015). *Mechanical and Industrial Measurements*. Khanna Publishers.
3. Nakra, B.C. & Choudhary, K.K. (2016). *Instrumentation, Measurement and Analysis* (4th ed.). Tata McGraw Hill.

Reference Books:

1. Doebelin, E. O. (1990). *Measurement Systems: Application and Design* (4th ed.). McGraw Hill International.
2. Eckmann, D. P. (2006). *Industrial Instrumentation*. CBS Publishers and Distributors.

3. Kalsi, H.S. (2017). *Electronic Instrumentation* (3rd ed.). McGraw Hill Education.
4. Singh, S.K. (2017). *Industrial Instrumentation and Control* (3rd ed.). McGraw Hill Education.
5. Rangan, C., Sharma, G. & Mani, V.S.V. (2017). *Instrumentation: Devices and systems* (3rd ed.). McGraw Hill Education.

e-Resources:-

1. <https://nptel.ac.in/courses/108106070/>
2. <https://swayam.gov.in/course/3764-industrial-instrumentation>
3. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/download-course-materials/>
4. http://www.bput.ac.in/lecture-notes/download.php?file=lecture_note_212311150212320.pdf

Network Analysis & Synthesis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Analyze circuits using circuit laws.
- Develop the understanding of the circuit theorems in network reduction.
- Understand the behavior of various circuit elements in transient conditions and evaluate the responses
- Analyze the different types of network functions by identifying poles and zeros
- Characterization of a two port network

Section A

Circuit fundamentals and analyzing tools: Review of basics of DC network, Graph theory, tree, Loop and Nodal Analysis, tie set matrix, incidence matrix.

AC Network Theorems: Thevenin's, Norton's, Superposition, Reciprocity, Tellegen's, Millman's and Maximum power transfer theorem, Duality, method of obtaining dual network.

Section B

Transient behavior and initial condition: LTI System, complex frequency, behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL, RC and RLC circuit for AC and DC excitation.

Applications of Laplace Transform for electrical circuit: Review of Laplace transforms, solution of circuits, response of networks to step, ramp, impulse, exponential and sinusoidal inputs. Waveform Synthesis.

Section C

Two Port Networks: Network parameters-Z, Y, ABCD and h-parameter, properties of driving point transfer functions, interconnection and cascading of two port networks, ladder and lattice networks, T and π representation.

Network Synthesis: Realization of RL, RC and RLC, significance of poles and zeros, physical realization, Hurwitz criterion, Foster and Cauer realization, ladder development.

Text Books

1. Valkenburg, M.E.V. (2006). *Network Analysis*. Prentice Hall.
2. Malley, J.O. (2011). *Schaum's outline of Basic Circuit Analysis*. Mcgraw Hill.

Reference Books

1. Chakrabarti, A.K. (2018). *Circuit Theory* (7th ed.). Dhanpat Rai and Co.
2. Alexander, C. & Sadiku, M. N. O. (2003). *Fundamentals of Electrical circuits*. Oxford University Press.
3. Choudhary, D. R. (2013). *Networks and Systems*. Wiley Eastern Ltd.
4. Wadhwa, C.L. (2007). *Network Analysis and Synthesis*, New Age international Publishers.
5. Scott, D. E. (1987). *An Introduction to Circuit Analysis: a system approach*. Mcgraw hill.

E-Resources:-

1. <https://nptel.ac.in/courses/108102042/>
2. <https://www.edx.org/course/circuits-electronics-1-basic-circuit-mitx-6-002-1x-0>
3. <https://www.coursera.org/learn/linear-circuits-ac-analysis>
4. <https://swayam.gov.in/course/3868-networks-and-systems>

5. https://www.researchgate.net/publication/307984500_Circuits_and_Networks_Analysis_Design_and_Synthesis_2e
6. <http://www.covasa.cl/network-analysis-and-synthesis-by-franklin-f-kuo-solutions-free.pdf>
<http://www.nptelvideos.in/2012/11/circuit-theory.html>

Electrical Machines-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Understand the principle of electro-mechanical energy conversion
- Analyse the construction, classification and circuit model of DC machines
- Analyse the characteristics of DC machines and obtain their performance parameters
- Conduct various tests on the single phase transformer
- Apply various connection of three phase transformers for multiple applications

Section-A

Principles of Electro-mechanical Energy Conversion: Introduction, flow of Energy in electromechanical devices, energy in magnetic systems (defining energy & Co-energy), **Singly Excited Systems:** Determination of mechanical force, mechanical energy, torque equation, **Doubly excited Systems:** Energy stored in magnetic field, electromagnetic torque, Generated EMF in machines, torque in machines with cylindrical air gap.

Section-B

D.C. Machines: Construction of DC Machines, armature winding, EMF and torque equation, armature reaction, commutation, interpoles and compensating windings, performance characteristics of D.C. generators, performance characteristics of D.C. motors, **Starting of D.C. motors:** 3 point and 4 point starters, **Speed control of D.C. motors:** field control, armature control and voltage control (Ward Leonard method), **Efficiency and Testing of D.C. machines:** Hopkinson's and Swinburn's Test.

Section-C

Single Phase Transformer: Phasor diagram, efficiency and voltage regulation, all day efficiency, **Testing of Transformers:** O.C. and S.C. tests, Sumpner's test, polarity test.

Auto Transformer: Single phase Auto-transformer, volt-amp relation, efficiency, Conversion of a two-winding Transformer to an Auto transformer, saving in conductor material, advantages, disadvantages and applications of autotransformers.

Three Phase Transformers: Construction, three-phase unit transformer and bank of three single phase transformers with their advantages, three-phase transformer groups (phasor groups) and their connections, Y- Δ connection, open delta connection, three-phase/two-phase Scott connection and its application, Sumpner's test, all day efficiency, polarity test excitation phenomenon in Transformers, harmonics in Single phase and 3-phase transformers, parallel operation and load sharing of single phase and three phase transformers, three winding transformers, tertiary winding.

Text Books:

1. Nagrath, I. J. & Kothari, D. P. (2017), "*Electrical Machines*" (3rd Edn.), Tata McGraw Hill.
2. Ashfaq, H. (2016), "*Electrical Machines*" (5th Edn.), Dhanpat Rai & Sons.
3. Fitzgerald, A. E., Kingsley Jr., C. and Umans (2009), "*Electric Machinery*" (6th Edn), McGraw Hill, International Student Edition.
4. Gupta, B. R. & Singhal, V. (2005) "*Fundamentals of Electrical Machines*" (3rd Edn.), New Age International.

Reference Books:

1. Kosow, I. L. (2009). *Electric Machine and Transformers* (2nd Edn.). Prentice Hall of India.

2. Say, M. G. (2005). *The Performance and Design of AC machines* (4thEdn.), Pit man & Sons.
3. Guru, B. S. and Hiziroglu, H. R. (2001). *Electric Machinery and Transformers* (3rdEdn.). Oxford University Press.

E-Resources:

1. https://eleccompengineering.files.wordpress.com/2014/08/stephen_chapman_electric_machinery_fundamentals_bookfi-org-1.pdf
2. <http://solidviews.com/OaOY>
<https://kahrbjy.files.wordpress.com/2012/08/principles-of-electric-machines-solution-manual.pdf>

Power Electronics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Analyze functioning of switching devices for various applications
- Operate the switches in series and parallel, protect the switches and apply commutation techniques for different circuits
- Analyze and design phase controlled rectifiers and their performance
- Implement of voltage regulators and cyclo-converters
- Design of inverter circuits

Section A

Need of power electronics, introduction to power electronics devices (static and dynamic characteristics) power diodes, power transistor, power MOSFETS, IGBT, MCT, GTOs and TRIAC. **Thyristor (SCR):** Operational characteristics turn on methods, switching characteristics, protection, over voltage protection, over current protection, gate protection, Snubber circuit firing circuits, heating, series and parallel combination of Thyristors.

Section B

Commutation Techniques: Load commutation, resonant- pulse commutation complementary commutation, impulse commutation, line commutation, **Phase controlled rectifier:** Principle of phase control, single and three phase converters, effect of source impedance on the performance of converters dual converter (ideal and practical) **DC choppers:** Principle, control strategies, step-up and step-down choppers.

Section C

Inverters: Single-phase voltage source inverters 180 and 120 mode operation, Fourier analysis of single-phase inverter output voltage, pulse width modulated inverters, reduction of harmonics in the inverter output, single phase current source inverters with ideal switch. **Cyclo-converters:** Step-up and step-down cyclo-converter, Single phase to single-phase cyclo-converters three-phase half wave cyclo-converters.

Text Books

1. Rashid, M. H. (2017). *Power Electronics Circuits Devices and Applications* (4th ed.). PHI Publication
2. Bimbhra, P.S. (2012). *Power Electronics* (5th ed.). Khanna Publication.
3. Singh, M. D. & Khanchandani, K. B (2013). *Power Electronics* (2nd ed.). McGraw Hill.

Reference Books:

1. Moorthy, R. (1991). *An Introduction To Thyristors And Their Application* (2nd ed.). Affiliated East-West Press.
2. Sen, P.C. (2005). *Modern Power Electronics* (2nd ed.). S.Chand Publisher.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ee03/preview
2. <https://www.coursera.org/specializations/power-electronics>
3. <https://swayam.gov.in/courses/5440-jan-2019-fundamental-of-power-electronics>
4. <https://swayam.gov.in/courses/5435-jan-2019-advance-power-electronics-and-control>
5. <http://minitorn.tlu.ee/~jaagup/kool/java/kursused/15/robootika/elektriopik.pdf>
6. [http://down.elechu.com/Power%20Electronics/PEmohan\(2nd\).pdf](http://down.elechu.com/Power%20Electronics/PEmohan(2nd).pdf)

7. <http://down.elechu.com/Power%20Electronics/PE3rdmohan.pdf>
8. <http://u.dianyuan.com/bbs/u/51/1173964035.pdf>
9. <http://dl.offdownload.ir/ali/Power%20Electronics,Daniel%20W.%20Hart.pdf>
10. https://edisciplinas.usp.br/pluginfile.php/2587319/mod_resource/content/2/Introduction_to_Solid_State_Power_Electronics_Powerex.pdf
11. <https://onedrive.live.com/?cid=7BCEF2CD3680B4A0&id=7BCEF2CD3680B4A0%21212&parId=7BCEF2CD3680B4A0%21124&o=OneUp>
12. <https://nptel.ac.in/courses/108105017/>

Analog Integrated Circuit

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Student will be able to understand the design and working of transistor amplifiers.
- Observe the effect of negative feedback on different parameters of an amplifier and different types of topologies.
- Will have the potential to build and troubleshoot analog circuits.
- Understand the fundamentals and areas of applications of integrated circuits.
- Demonstrate the ability to design practical circuits that perform the desired operations.

SECTION A

Feedback Amplifiers: Classification of amplifiers, General feedback structure, Properties of negative feedback, Feedback topologies, Transfer gain with feedback, General characteristics of negative feedback amplifiers, input resistance, output resistance, Methods of analysis: Voltage series and current series feedback, current shunt and voltage shunt feedback.

Power Amplifiers: Classification, Operation, Analysis and design of Class A, Class B, Class AB, Class C, Power dissipation and efficiency calculations, Amplifier distortion.

SECTION B

High Frequency Amplifiers: Hybrid- π CE transistor model, Hybrid π conductance, Hybrid π capacitances, CE short circuit current gain, Current gain with resistive load, Single stage CE transistor amplifier response, Gain bandwidth product.

Multistage Amplifier: Frequency response, Effect of cascading on bandwidth, RC coupled amplifier, Low frequency response of an RC coupled stage, Effect of emitter bypass capacitor, High frequency response of two cascaded CE transistor stages, Multistage CE amplifier cascaded at high frequencies.

SECTION C

Operational Amplifier and its applications: BJT differential amplifier: DC and AC analysis, Transfer characteristics, Differential and Common mode gain. Ideal Op-amp, inverting and non inverting amplifier, offset voltage, offset current, bias current, slew rate, CMRR, design of integrator and differentiator, summing amplifier, differential and instrumentation amplifier, Active filter, Op-amp RC oscillator circuits : Wien bridge, Phase shift. Precision rectifier, comparator, Schmitt trigger and 555 IC Timer.

Text Books:

1. Millman, J., Halkias, C. & Parikh, C. (2017). *Integrated Electronics* (2nd ed.). McGraw Hill Education.
2. Boylestad & Nashelsky, (2015). *Electronic Devices and Circuit Theory* (11th ed.). Pearson Education India.
3. Gayakwad R. A. (2010). *OP-AMP and linear integrated circuits* (4th ed.). New Delhi: Prentice Hall.

Reference Books:

1. Sedra, A. & Smith, K. (2009). *Microelectronic Circuits: Theory and Applications* (5th ed.). Oxford University Press.

e-Resources:

1. <https://nptel.ac.in/courses/117106030/>
2. <https://nptel.ac.in/courses/117106030/nptel-aic/analogicdesign-intro.pdf>

3. <https://www.analog.com/en/education/education-library/tutorials/analog-electronics.html>
4. <https://nptel.ac.in/courses/117106030/nptel-aic/analogicdesign-intro.pdf>
5. https://onlinecourses.nptel.ac.in/noc18_ec05/preview
6. <https://nptel.ac.in/syllabus/117106030/>
7. <https://www.electronics-tutorial.net/analog-integrated-circuits/>
<https://www.allaboutcircuits.com/textbook/experiments/chpt-6/introduction-analog-integrated-circuits/>

Analog Integrated Circuit Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Develop the skill to build, and troubleshoot Analog circuits.
- Student will be able to choose the appropriate integrated circuit modules to build a given application.
- Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.
- Examine the appropriate integrated circuit modules to build a given application

LIST OF EXPERIMENTS

1. To design the AstableMultivibrator using 555.
2. To design the MonostableMultivibrator using 555.
3. To design summer using 741 IC.
4. To design Integrator using 741 IC.
5. To design Schmitt Trigger using 741 IC.
6. To design Differentiator using 741 IC.
7. To design peak detector using 741 IC.
8. To design scalar using 741 IC.
9. To study Active Filters: LPF,HPF,BPF.
10. To design Voltage to frequency converter
11. To design phase locked loop.
12. To study frequency shift keying using PLL 565.

Linear Control System

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Design and implement feedback control scheme for any industrial process.
- Identify and utilize the various components employed in control systems.
- Design and apply the control scheme for controlling any plant under consideration.
- Utilize various types of frequency domain approaches in the development of a control scheme for complex dynamic process.
- Apply the compensation techniques and modern control approaches in design and analysis of control systems.

Section A

Introduction to control system, differential equation and LTI transfer function, Mathematical Modeling, Block diagram reduction techniques, signal flow graph, servomechanism: synchros, AC and DC servomotors.

Time Domain Analysis: Standard test signals, Time Response Analysis of First Order and Second Order System. Transient response analysis, steady state errors and error constants.

Section B

Introduction to controllers: P, PI, PD and PID controllers, effect of feedback, Stability concept, relative stability, Routh stability criterion.

Root Loci Technique: Concept of root locus, construction of root locus and closed loop stability.

Frequency Domain Analysis: Correlation between time & frequency response, Polar plots, Stability in frequency domain (GM & PM), Nyquist plots and Nyquist stability criterion, Constant M and N circles.

Section C

Bode plot, Performance specifications in frequency-domain. Compensation: cascade and feedback compensation, time & frequency domain design using lag, lead and lag-lead compensation,

State Space Analysis:

Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

Text Books:

1. Ogata, K. (1996). *Modern Control Engineering*. USA, Upper Saddle River, NJ: Prentice-Hall
2. Kuo, B.C. & Golnaraghi, F. (2003). *Automatic controlsystem* (8th ed.). Asia: John Wiley and Sons.
3. Gopal, M. (2002). *Control System: Principles and Design* (3rd ed.). TMH.

e-Resources:

1. <https://swayam.gov.in/courses/4776-july-2018-control-systems>
2. <https://www.udemy.com/control-systems/>
3. <https://nptel.ac.in/courses/108101037/>
4. <https://studentshubblog.files.wordpress.com/2014/12/modern-control-engineering-3rd-ed-ogataprentice-hall.pdf>
5. <https://pdfstores.files.wordpress.com/2017/01/kuo-automaticcontrolsyste.ms.pdf>

6. https://onlinecourses.nptel.ac.in/noc18_ee41
7. <https://nptel.ac.in/courses/108106098/>
8. <https://nptel.ac.in/downloads/108103008/>
9. <http://www.mediafire.com/file/aqkq47e1el3hri7/Control+System+Engineering-+Norman+S.+Nise.+6th+Edition.pdf>
10. <https://drive.google.com/file/d/0B2KoaKB1FMGjUHNXdIZvSFhUMmM/edit>

Linear Control System Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Able to use and design the control schemes for various industrial processes.
- Capable to identify and employ various filters and compensators utilized in control system design.
- Apply many built-in functions in MATLAB to solve numerical problems
- Develop code for solving problems involving different types of mathematical models and equations.

LIST OF EXPERIMENTS

1. Operation and error calculation of the transmitter-receiver pair as a simple open loop position control system.
2. To obtain open and closed loop response of various process configurations.
3. To attain open loop and closed loop speed control of DC motor.
4. Step response studies for various values of forward gain during position control of DC motor.
5. To perform time domain analysis of first and second order systems using linear system simulator.
6. To study potentiometer as an error detector.
7. Identification of the oven parameters and study of P, PI, and PID based temperature control of oven.
8. To study high pass, low pass, band pass & band stop filter.
9. To study lead lag compensator.

MATLAB based experiments:

10. To obtain transfer function of a system defined in pole-zero form.
11. To find overall transfer function of a system comprise of series and parallel combinations of plants.
12. To find closed loop transfer function from the given block diagram and draw its pole-zero plot.
13. To plot step and impulse response of first and second order control system.
14. To obtain root locus, Nyquist plot and bode plot for the given transfer function.

Power System-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Understand generation of electric power and calculate transmission line parameters
- Analyze the performance of short, medium and long transmission lines
- Identify pin, post and suspension insulators
- Estimation of string efficiency and mechanical design of overhead transmission lines
- Understand corona effect, electromagnetic interference with communication lines and travelling waves
- Implementation of insulated cables, distribution system, and voltage and frequency control methods.

Section A

Introduction to power system. Generation of electrical energy- thermal, hydro and nuclear power plants. Load curves and factors, Electricity tariffs.

Transmission: types of conductor, resistance of line, skin effect, Proximity effect, Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, Representation and performance of short, medium and long transmission lines, Ferranti effect. Surge impedance loading.

Types of insulators, Voltage distribution across an insulator string, string efficiency, grading and methods of improving string efficiency.

Section B

Mechanical Design of Overhead Transmission Lines- Catenary Curve, Calculation of Sag and Tension, Effects of wind and ice loading, sag template, Vibration dampers.

Corona and Interference- Phenomena of Corona, Corona formulation, Calculation of Potential Gradient, Corona loss, Factors affecting Corona, Methods of reducing Corona and Interference, Electrostatic and Electromagnetic Interference with Communication lines.

Traveling Waves- Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipments and line against traveling waves.

Section C

Insulated cables: Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of Cables.

Distribution Systems: Primary and secondary distribution systems, feeder, distributor and service mains. Radial and ring- main distribution systems, Kelvin's law.

Voltage and Load Frequency Control: Introduction to control of active and reactive power flow, control of voltage, Introduction to Load Frequency Control and Automatic generation control.

Text Books:

1. Stevenson, W. D. (2002), "Element of Power System Analysis"(2ndEdn.) McGraw Hill, USA.
2. Wadhwa, C. L. (2016), "Electrical Power Systems"(7thEdn.) New age international Ltd. Third Edition.
3. Deshpande, M. V. (2011), "Electrical Power System Design" (1stEdn.), PHI.

Reference Books:

1. Soni, Gupta & Bhatnagar (2009), "*A Course in Electrical Power*", (1stEdn.) Dhanpat Rai & Sons, India
2. Uppal, S. L (1987), "*Electric Power*", (15thEdn.) Khanna Publishers, India
3. Singh, S. N., (2011) "*Electric Power Generation, Transmission & distribution*" (2ndEdn.), PHI

e-Resources:

1. <https://drive.google.com/file/d/0B15qSPkgb-zRY216X1NPd1dWUU/view>
2. http://jfgieras.com/Grigsby_Chapter_34_LEM.pdf
3. <http://down.elechu.com/stability/Book.pdf>
4. <https://nemasumit.files.wordpress.com/2017/08/electrical-power-engineers-handbook.pdf>
5. <https://nemasumit.files.wordpress.com/2017/08/electrical-machines-drives-and-power-systems-5e.pdf>
6. <https://docs.google.com/file/d/0B5vXY4-Kg5GeN19FVjNvVXZlTjg/edit>
7. https://pdfstores.files.wordpress.com/2016/04/modern-power-system-analysis_d-p-kothari-and-i-j-nagrath.pdf
8. <https://nptel.ac.in/courses/108105017/>

Power System-I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Perform various arithmetic and matrix operations in MATLAB
- Implement MATLAB commands, control operators
- Calculation of various problems using MATLAB programming
- Design electrical circuits using MATLAB simulink
- Estimate power system parameters using MATLAB programming

LIST OF EXPERIMENTS

1. Acquaintance with MATLAB.
2. Various matrix operations, logical operations and loop statements using MATLAB.
3. Study of various plot commands in MATLAB.
4. Transient analysis of series RL and RC circuit.
5. Generation of basic signals (Impulse, Step, Ramp *etc.*) using Simulink
6. Calculate the inductance and capacitance of different type of transmission line configuration
7. Calculation of V_s , V_r , line losses and power factor of short transmission line.
8. Calculation of V_s , V_r , line losses and power factor of medium transmission line.

Communication Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- Use different modulation and demodulation techniques used in analog communication
- Identify and solve basic communication problems
- Analyze transmitter and receiver circuits
- Compare and contrast design issues, advantages, disadvantages and limitations of analog communication systems
- Understand various spreading techniques and determine bit error performance of various digital communication systems.
- Differentiate between different pulse modulation and demodulation techniques and signal multiplexing for various applications.

Section A

Amplitude Modulation: Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, superhetrodyne receiver, IF amplifiers, AGC circuits Frequency Division multiplexing

Angle Modulation: Basic definitions Narrow band and wideband frequency modulation, transmission bandwidth of FM Signals, Generation and detection of frequency modulation .

Section B

Sampling process. Analog Pulse Modulation Systems-Pulse Amplitude Modulation, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation, Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, methods of generation of coherent and non-coherent, ASK,FSK and PSK, comparison of above digital techniques.

Section C

Time Division Multiplexing: Fundamentals, Electronic Commulator, Bit/byte interleaving, Tl carrier system, synchronization and signaling of Tl, TDM and PCM hierarchy, synchronization techniques

Introduction to Information Theory: Measure of information, Entropy & Information rate, channel capacity, Hartley Shannan law, Huffman coding, shannanFano coding.

Text Books:

1. Haykin, S. (2006). *Communication Systems* (4th ed.). John Wiley & Sons.
2. Kennedy, G. & Davis, B. (2017). *Electronic Communication systems*(4th Ed.). Tata McGraw Hill.
3. Haykin, S. (2013). *Digital Communications*. John Wiley & Sons.

e-Resources:

1. <https://nptel.ac.in/courses/117102059/>
2. https://onlinecourses.nptel.ac.in/noc18_ee03/preview
3. <https://swayamprabha.gov.in/index.php/program/current/14>
4. <https://nptel.ac.in/courses/108104098/>
5. <https://nptel.ac.in/syllabus/117102059/>
<https://nptel.ac.in/courses/117106090/3>

Electrical Machines-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Develop various types of models used for synchronous machines like, hydro, steam turbine, governors & excitation systems
- Understand the construction, connections, principle of operation of three-phase & single phase induction motor
- Understand equivalent circuits representation of three phase & single phase induction motor
- Understand calculation of the performance characteristics (current/speed and torque/speed) of the three-phase & single phase induction motor
- Understand the starting and speed control methods of three-phase induction motor
- Understand the construction, connections, principle of operation of single-phase induction and special purpose motors
- Perform tests on synchronous and induction machines

Section-A

Synchronous Machine I: Constructional features, Armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage Regulation using Synchronous Impedance Method, MMF Method, Potier's Triangle Method, Parallel Operation of synchronous generators, operation on infinite bus, synchronizing power and torque co-efficient **Synchronous Machine II:** Two Reaction Theory, Power flow equations of cylindrical and salient pole machines, operating characteristics **Synchronous Motor:** Starting methods, Effect of varying field current at different loads, V- Curves, Hunting & damping, synchronous condenser

Section-B

Three phase Induction Machine – I: Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Induction generator & its applications. **Three phase Induction Machine- II:** Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed Control (with and without emf injection in rotor circuit.)

Section-C

Single phase Induction Motor: Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, repulsion motor **AC Commutator Motors:** Universal motor, Single phase AC series compensated motor, stepper motors

Text Books:

1. Nagrath, I. J. & Kothari, D. P. (2017), “*Electrical Machines*” (3rd Edn.), Tata McGraw Hill.
2. Ashfaq, H. (2016), “*Electrical Machines*” (5th Edn.), Dhanpat Rai & Sons.
3. Fitzgerald, A. E., Kingsley Jr., C. and Umans (2009), “*Electric Machinery*” (6th Edn), McGraw Hill, International Student Edition.
4. Gupta, B. R. & Singhal, V. (2005) “*Fundamentals of Electrical Machines*” (3rd Edn.), New Age International.

Reference Books:

1. Kosow, I. L. (2009), “*Electric Machine and Transformers*” (2nd Edn.), Prentice Hall of India.
2. Say, M. G. (2005), “*The Performance and Design of AC machines*” (4th Edn.), Pitman & Sons.

3. Guru, B. S. and Hiziroglu, H. R. (2001) “*Electric Machinery and Transformers*” (3rdEdn.), Oxford University Press.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ee01
2. <https://nptel.ac.in/courses/108106071/>
3. <https://nptel.ac.in/courses/108105017/>
4. https://eleccompengineering.files.wordpress.com/2014/08/stephen_chapman_electric_machinery_fundamentals_bookfi-org-1.pdf
5. <http://solidviews.com/OaOY>
6. <https://kahrbjy.files.wordpress.com/2012/08/principles-of-electric-machines-solution-manual.pdf>

Electrical Machines-II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Understand calculation of the performance characteristics (current/speed and torque/speed) of the three-phase & single phase induction motor
- Understand the starting and speed control methods of DC motor
- Understand the construction, connections, principle of operation of transformer
- Perform tests on DC and induction machines

LIST OF EXPERIMENTS

1. Perform no load test in a single phase induction motor.
2. Obtain the losses and efficiency of DC shunt machine by Hopkinson's test.
3. Obtain the efficiency and losses of DC machine by Swinburne's test.
4. Perform load test of single phase IM.
5. To perform Sumpner's test of single phase transformer.
6. Study of cut section model of single and three phase Induction motor.
7. Speed control of compound DC motor.
8. To study compound motor-generator set.

Power System-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- Model various power system components (synchronous machine, transformer, transmission line) and representation of 3 phase system using per unit system & symmetrical components
- Calculate and analyze the symmetrical and unsymmetrical faults in power system
- Solve load flow/power flow problems on transmission line with various analysis methods and interpret the result
- Analyse transient and steady state stability for power system
- Determine the economic schedule of thermal generators

Section A

Representation of Power System Components: Synchronous machines, Transformers, Transmission lines, One line diagram, Impedance and reactance diagram, per unit System.

Symmetrical components and fault analysis: Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks. Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions.

Section B

Unsymmetrical faults: Analysis of single line to ground fault, line to line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance. Formation of Z bus using singular transformation and algorithm, computer method for short circuit calculations.

Load Flows: Introduction, bus classifications, nodal admittance matrix (Y BUS), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method.

Section C

Power System Stability: Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.

Economic Operation of Power Systems: Introduction, Input output, heat rate and incremental rate curves of thermal generating units, Distribution of loads between units within a plant, Transmission loss equation, Classical Economic dispatch with losses.

Text Books:

1. Stevenson, W. D. (2002). *Element of Power System Analysis*(2ndEdn.).McGraw Hill, USA.
2. Wadhwa, C. L. (2016). *Electrical Power Systems*(7thEdn.) New age international Ltd. Third Edition.
3. Deshpande, M. V. (2011). *Electrical Power System Design* (1stEdn.). PHI.

Reference Books:

1. Soni, Gupta & Bhatnagar (2009). *A Course in Electrical Power* (1stEdn.).Dhanpat Rai & Sons, India
2. Uppal, S. L (1987). *Electric Power*(15thEdn.).Khanna Publishers, India
3. Singh, S. N., (2011) “*Electric Power Generation, Transmission & distribution*” (2ndEdn.), PHI

E-Resources:

1. <https://nptel.ac.in/courses/108105067/>
2. <https://nptel.ac.in/courses/108102047/>
3. <https://nptel.ac.in/courses/108105104/>
4. https://onlinecourses.nptel.ac.in/noc19_ee02
5. <https://drive.google.com/file/d/0B15qSPkgb-zRY216X1NPa1dlWUU/view>
6. http://jfgieras.com/Grigsby_Chapter_34_LEM.pdf
7. <http://down.elechu.com/stability/Book.pdf>
8. <https://nemasumit.files.wordpress.com/2017/08/electrical-machines-drives-and-power-systems-5e.pdf>
9. https://pdfstores.files.wordpress.com/2016/04/modern-power-system-analysis_d-p-kothari-and-i-j-nagrath.pdf

Power System-II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Model various power system components (synchronous machine, transformer, transmission line) and representation of 3 phase system using per unit system & symmetrical components
- Calculate and analyze the symmetrical and unsymmetrical faults in power system
- Solve load flow/power flow problems on transmission line with various analysis methods and interpret the result
- Analyse transient and steady state stability for power system
- Determine the economic schedule of thermal generators

LIST OF EXPERIMENTS

1. To plot the instantaneous current, active and reactive power for a given load with power factor over the interval 0 to 2π .
2. To formulate bus admittance (Y-BUS) matrix using node equation method.
3. To formulate bus admittance (Y-BUS) matrix using singular transformation.
4. To solve non-linear equation using Gauss-Seidel and Newton Raphson method.
5. To solve load flow problem using Gauss-Seidel.
6. To solve load flow problem Newton Raphson method.
7. To obtain short-circuit parameters for symmetrical faults.
8. To perform unsymmetrical fault analysis
9. To perform transient stability analysis of single machine connected to infinite bus system.
10. To obtain numerical solution of Swing equation using step-by-step method.
11. Software will used: MATLAB, PSS®E, PSCAD, Dig SILENT Power Factory and GAMS.

Electrical Drives and Control

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- To understand definition, scope, objectives, and limitation of electric drives, power transistor and SCR.
- To analyze the construction and characteristics and application of D.C. motor.
- To analyze the construction and characteristics and application of three phase induction motor .
- To analyze the speed control methods of A.C. and D.C. motor
- To analyze the construction and characteristics and application of sensor, transducer and switches.
- To analyze the industrial applications of electric drives.

Section A

Fundamentals of Electric Drive: Construction, advantages and classification, speed-torque conventions and multi-quadrant operations, constant torque and constant power operation.

Types of load torque: Components, nature and classification, load equalization.

Dynamics of electric Drive: Dynamics of motor-load combination, steady-state and transient stability of electric Drive.

Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty.

Section B

Electric Braking: Purpose and types, braking of DC motor, three phase induction and synchronous motors.

Dynamics during Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting, energy relations during braking, dynamics during braking.

Power Electronic Control of DC Drives: Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor, supply harmonics, power factor and ripples in motor current, chopper control of separately excited dc motor and dc series motor.

Section C

Power Electronic Control of AC Drives: Three phase induction motor drive, static voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo-converter based) static rotor resistance and slip power recovery control schemes.

Three Phase Synchronous motor: Self-controlled scheme.

Special Drives: Switched reluctance motor, brushless dc motor, selection of motor for particular applications.

Text Books:

1. Dubey, G.K. (2002). *Fundamentals of Electric Drives (2nd ed.)*. Narosa Publishing House.
2. Pillai, S.K. (2012). *A First Course on Electric Drives (3rd ed.)*. New Age International.
3. Bose, B. K. (2006). *Power Electronics and Motor Drives (1st ed.)*. Academic Press.

Reference Books:

1. Chilkin, M. (2012). *Electric Drives*. Mir Publishers, Moscow.
2. Mohammed A. E. (2008). *Fundamentals of Electric Drives*. Thomson Asia, Pvt. Ltd. Singapore.

3. De N.K. and Prashant (2007) K.S. *Electric Drives*. Prentice Hall of India Ltd.
4. Subrahmanyam, V. (2005) *Electric Drives: Concepts and Applications*. Tata McGraw Hill.

E- Resources:

1. <https://nptel.ac.in/courses/108102046/>
2. <https://nptel.ac.in/courses/108104011/>
3. http://www.vssut.ac.in/lecture_notes/lecture1424084684.pdf
4. <https://nptel.ac.in/courses/108108077/>

Electrical Drives and Control Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- To understand definition, scope, objectives, and limitation of electric drives, power transistor and SCR.
- To analyze the construction and characteristics and application of D.C. motor.
- To analyze the construction and characteristics and application of three phase induction motor.
- To analyze the speed control methods of A.C. and D.C. motor
- To analyze the construction and characteristics and application of sensor, transducer and switches.
- To analyze the industrial applications of electric drives.

LIST OF EXPERIMENTS

1. Modeling and simulation of armature voltage control of DC drive.
2. Modeling and simulation of speed control of chopper fed DC drive.
3. Modeling and simulation of speed control of fully controlled rectifier fed DC drive.
4. To obtain four quadrants operation of dual converter fed DC drive.
5. To control speed of DC drive through microcontroller.
6. To control speed of three phase Induction motor drive through microcontroller.
7. To control speed of SRM drive through microcontroller.
8. To control speed of PMSM drive through microcontroller.

Digital Signal Processing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes

The Students will be able to:

- Demonstrate the analytical representation of discrete time signals.
- Apply techniques in time and frequency domain to the analysis and design of discrete time systems.
- Analyze discrete time systems in both time and frequency domain.
- Design and analysis of the frequency response of discrete-time signals and systems.
- Design, Analyze and Implement Digital IIR and FIR filters.

Section A

Introduction of Signals, Systems and Signal Processing, Classification of Signals and Systems, Advantages of digital over analog Signal processing, Signal Models - Continuous Time versus Discrete time signals, Periodic and aperiodic Signals, Phasor Signals and Spectra, Energy and Power Signals, System Modeling Concepts, The superposition integral for Fixed and Linear Systems, Impulse Response of a Fixed and Linear System - Fourier Series - Trigonometric Series- Exponential Fourier Series-Symmetry Properties of the Fourier Coefficients. Fourier Integral, Energy Spectral Density, Fourier Transforms in the Limit, Fourier Transform Theorems and Pairs, System Analysis with Fourier Transform, Laplace Transform Theorems, Network Analysis using the Laplace Transform.

Section B

Discrete Time Signals and Systems- Review of Sampled Data Systems, Time Domain Representations of Discrete Time Signals, Frequency Domain Representation of Discrete Time Signals, Discrete Time Signals obtained by sampling, Discrete Fourier Transform. Z-Transform - Definition and Examples, Inverse Z-Transform, Properties of the Z-Transform, Introduction to Realization of Digital Systems - Block Diagrams and Signal Flow Graphs. Introduction to Realization of an IIR and FIR systems, Discrete Fourier Transforms (DFT) and Fast Fourier Transform (FFT).

Section C

Design of Digital Filters: Introduction to Filters, A comparison of IIR and FIR Digital Filters. Design of IIR Digital Filters –Impulse Invariant Transformation, Bilinear Transformation, Design of Digital Butterworth and Chebyshev Filters. Design of FIR Digital Filters - Windowing and Rectangular Window, Filter Designs using Windows, Frequency Sampling Technique. DSP tools and DSP techniques in various applications.

Text Books:

1. Johnson J. R. (1998). *Introduction to Digital Signal Processing*. India: Prentice-Hall
2. Oppenheim, A. V., Willsky, A. S. & Nawab, H.S. (1996). *Signal & Systems*. India: Prentice-Hall.
3. Proakis J. G. & Manolakis, D. G. (2007). *Digital Signal Processing: Principles, Algorithms, and Applications* (4th ed.). India: Prentice-Hall

e-Resources:

1. <https://swayam.gov.in/course/3674-discrete-time-signal-processing>
2. <https://nptel.ac.in/courses/117102060/1>

3. <https://swayam.gov.in/courses/5452-jan-2019-principles-of-signals-and-systems>
4. <https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/>
5. <https://nptel.ac.in/courses/117104070/>
6. <http://www.nptelvideos.in/2012/11/digital-signal-processing.html>
7. [http://jpkc.gnnu.cn/jpkc/Signal/ziliaoxiazai/Oppenheim%20%20Signals%20And%20Systems%20\(Complete\).pdf](http://jpkc.gnnu.cn/jpkc/Signal/ziliaoxiazai/Oppenheim%20%20Signals%20And%20Systems%20(Complete).pdf)

Digital Signal Processing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Able to generate elementary signals/ waveforms and perform arithmetic operations on signals.
- Able to plot frequency response of a given system and verify the properties of LTI system
- Able to carry out simulation of DSP systems.
- Able to demonstrate the applications of FFT to DSP.

LIST OF EXPERIMENTS

1. Write a program in MATLAB to generate the following functions: Unit Impulse, Unit Step, Unit Ramp, Sinusoidal, Exponential, Random signal.
2. Write a program in MATLAB to study the basic operations on the discrete time signals: Amplitude Scaling, Time Shifting, Time Scaling, Folding, addition and multiplication of two signals.
3. Write a program in MATLAB to check for linearity, causality and stability of discrete time system.
4. Write a program in MATLAB to perform Linear Convolution.
5. Write a program in MATLAB to perform Circular Convolution.
6. Write a program in MATLAB to perform the Discrete Fourier transform for the given sequences.
7. Write a program in MATLAB to perform Inverse Discrete Fourier transform for the given sequences.
8. Write a program in MATLAB to design analog Butterworth filter for the given specifications.
9. Write a program in MATLAB to design analog Chebyshev filter for the given specifications.
10. Write a program in MATLAB to find frequency domain response (magnitude and phase response) for the given IIR and FIR systems.

Switchgear and Protection

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- Design the feasible protection systems needed for each main part of a power system
- Understand different applications of the relays, circuit breakers, grounding for different elements of power system
- Understand characteristics of different type of relays
- Design the ratings for fuses according to the requirement
- Elucidate various protection schemes of various power system components like alternators, transformers and bus-bars
- Understand various methods of over voltage protection in power systems

Section A

Introduction to Protection System: Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays: Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relay.

Relay Application and Characteristics: Amplitude and phase comparators, duality, over current relays, directional relays, distance relays, differential relay.

Section B

Static Relays: Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.

Protection Of Transmission Line: Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus, auto reclosing.

Section C

Circuit Breaker: Properties of arc, arc extinction theories, re-striking voltage transient, current chopping, resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings.

Testing Of Circuit Breaker: Classification, testing station and equipments, testing procedure, direct and indirect testing, Operating modes, selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF₆, Vacuum and DC circuit breakers.

Text Books:

1. Ram, B. & Vishwakarma, D. N. (2017). *Power System Protection and Switchgear* (2nd ed.). Tata Mc. Graw Hill.
2. Ravindranath, B. & Chander, M. (2018). *Power system Protection and Switchgear*. (2nd ed.). New Age International Publishers
3. Rao, S. S. (2008). *Switchgear and Protection*. Khanna Publishers.

Reference Books:

1. Paithankar, Y. G. & Bhide, S. R. (2013) *Fundamentals of Power System Protection*. (2nd ed.). India, Prentice Hall.
2. Rao, T. S. M. (2017). *Power System Protection: Static Relays with Microprocessor Applications*. (2nd ed.). Tata Macgraw Hill”.
3. Warringtaon, A.R. V. C. (2014). *Protective Relays- Their Theory and Practice*, Vol. I & II. Springer.

e-Resources:

1. <https://nptel.ac.in/downloads/108101039/>
2. <https://nptel.ac.in/courses/108101039/3>
3. http://www.vssut.ac.in/lecture_notes/lecture1425873259.pdf
4. <https://electrical-engineering-portal.com/transformer-feeder-protection>

Switchgear and Protection Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

Learning Outcomes

The Students will be able to:

- Assemble & de-assemble air circuit breaker
- Understand interconnection of contractor & MCCB
- Apply accurate protection scheme through ETU
- Implement soft starting for 3-phase induction motor
- Apply star-delta starting for 3-phase induction motor

LIST OF EXPERIMENTS

1. Study of 3WL air circuit breaker.
2. Study of 3WT air circuit breaker.
3. Study of molded case circuit breaker (MCCB).
4. Study of electronic trip unit (ETU).
5. Soft starting of 3-phase induction motor.
6. Study of Type-II coordination for contactors.
7. Study and operation of timer & relay.
8. Study and operation of star-delta starter.

L	T	P	C
0	0	2	1

Pneumatic Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- The students will be able to explain the detailed functioning of Pneumatics Engineering.
- Students will be able to explain the properties of control elements based upon physical principles, and the roles they play within the system.
- By understanding and performing measurements on the pneumatic and control circuits, students will learn and apply troubleshooting strategies.
- To impart the knowledge of electro-pneumatics-systems.
- To impart the knowledge of Concepts, Design and Applications of Pneumatics Engineering.

Section-A

Introduction to Pneumatic energy, Gas laws (Boyle's law, Charles' law, Gay-Lussac's law), Generalized gas equation, Preparation of compressed air, Compressor and its type (Piston, Screw, Reciprocating, Rotary and Axial), Air Storage System, Dryers, Maintenance and troubleshooting of Pneumatic system.

Section-B

Elements of pneumatic system: Filter, Regulator and Lubricator (FRL) unit, Direction Control Valves (DCV), Flow Control Valves (FCV), Pressure Control Valves (PCV), Time delay, Quick Exhaust, Twin pressure and Shuttle valves, Non-Return Valves (NRV), Pilot-operated check valves

Pneumatic Actuator: Linear, Rotary and Limited angle actuators

Classification and types of Cylinders, Cushioning, Seals, ISO symbols

Section-C

Electro-pneumatic circuits: solenoid valves, switches (push button, detent and limit), relays, reed & proximity switches, Switch Mode Power Supply (SMPS).

Direct and Indirect actuation, Development of single and multi actuator circuits, speed control of cylinders, supply air throttling and Exhaust air throttling.

Signal Processing Elements: Use of logic gates (OR and AND) in pneumatic applications. Introduction to Vacuum Technology & its application.

Text Books:

1. Jagadeesha, T. (2015). *Pneumatics: Concepts, Design and Applications*. Universities Press (India) Private Limited,
2. Sundaram, K.S. (2006). *Hydraulic and Pneumatic Controls: Understanding made Easy*. S. Chand Limited.
3. Majumdar, S.R. (1996). *Pneumatic Systems: Principle and Maintenance*. Tata McGraw-Hill Education.

e-Resources:-

1. <https://nptel.ac.in/courses/112105046/>
2. <https://www.hydraulicspneumatics.com/>
3. <https://www.coursera.org/lecture/fluid-power/hydraulics-and-pneumatics-SD8dv>
4. <http://www.180skills.com/manufacturing-skills-courses/pneumatics-skills-courses/>

Pneumatic Engineering Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Explore fundamentals of pneumatics and identify the different types of pneumatic system and circuit.
- Student will be able to assemble pumps and motors to rectify problems.
- Introduce efficient design of pneumatic system.
- Use software to simulate the pneumatic circuits.
- Build, Test and Troubleshoot pneumatic system.

LIST OF EXPERIMENTS

- 1) Direct control of single and double acting cylinders.
- 2) Controlling double acting cylinder with impulse valve.
- 3) Logical (AND & OR) control with shuttle & twin pressure valve.
- 4) Operation of single and double acting cylinder using pilot operated directional control valve.
- 5) Operation of double acting cylinder using relay and solenoid valve.
- 6) Apply AND, OR logic using solenoid valve and two manual controls for forward stroke of a double acting cylinder.
- 7) Continuous operation of a double acting cylinder using double solenoid valve.
- 8) Simulation for condition monitoring of double acting cylinder.
- 9) Simulation of PID Controller in Feed Forward mode.
- 10) Operation of Double Acting Cylinder using PLC.
- 11) Study of vacuum technology.

Industrial Instrumentation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- Explain and identify various kinds of sensors and transducers employed in different types of industrial environments.
- Select and apply a suitable sensor for a given strain and pressure measurement application.
- Define the principle of working of various sensors used for temperature, level and flow rate measurement.
- Signify the importance of velocity and vibration measurement in standard industrial testing procedures.
- Understand and analyze a virtual instrument employed for a particular application.

Section A

Role of transducers in instrumentation- classification of transducer and its characteristics. Signal Conditioning of Strain Gauge circuits, temperature compensation for Strain gauge, Piezoelectric Transducers and its Frequency response. Optical Transducers: Photo emissive cell, Photo voltaic cell, Photo Conductive cell.

Pressure Measurement: Manometers, Elastic pressure elements, Electromechanical Pressure Transducers, Vacuum Measurement: Knudsen gauge, Pirani Gauge, Ionization gauge, McLeod Gauge.

Noise: Electrical noise, Static noise, Magnetic noise, Crosstalk and its remedies.

Section B

Temperature Measurement: Thermometers: Liquid in glass and Bimetallic type, Radiation Pyrometers and Optical Pyrometers.

Level Measurement: Sight Glass, Hydrostatic, Purge type level sensor, differential pressure method for level measurement, Buoyancy methods, Nucleonic level gauge, Ultrasonic level meter, and capacitive type level sensor.

Flow measurement: Venturimeter, Orifice plate, Pitot tubes, Rotameter, Turbine Flowmeter, Electromagnetic Flowmeter, Hot wire anemometer, Ultrasonic Flowmeter, Laser Doppler anemometer.

Section C

Measurement of Velocity: DC and AC Tacho-generators, Seismic Transducer for vibration measurement, Accelerometers.

Miscellaneous Measurement: pH Sensor, hygrometer, measurement of thermal conductivity and thickness, Hydrometer.

Virtual Instrumentation: Architecture of a virtual Instrumentation, graphical system design, Data-flow techniques, graphical programming in data flow and comparison with conventional programming.

Text Books:

1. Sawhney, A. K. (2015). *A Course in Electrical and Electronic Measurements and Instrumentation*. Dhanpat Rai Publication.
2. Jain, R.K. (2015). *Mechanical and Industrial Measurements*. Khanna Publishers.
3. Nakra, B.C. & Chaudhry, K.K. (2016). *Instrumentation, Measurement and Analysis* (4th ed.). Tata McGraw Hill.

Reference Books:

1. Doebelin, E. O. (1990). *Measurement Systems: Application and Design* (4th ed.). McGraw Hill International.
2. Eckmann, D. P. (2006). *Industrial Instrumentation*. CBS Publishers and Distributors.
3. Kalsi, H.S. (2017). *Electronic Instrumentation* (3rd ed.). McGraw Hill Education.
4. Singh, S.K. (2017). *Industrial Instrumentation and Control* (3rd ed.). McGraw Hill Education.
5. Rangan, C., Sharma, G. & Mani, V.S.V. (2017). *Instrumentation: Devices and systems* (3rd ed.). McGraw Hill Education.

e-Resources:

1. <https://nptel.ac.in/courses/112103174/3>
2. <https://swayam.gov.in/course/3764-industrial-instrumentation>
3. <https://online.stanford.edu/courses/me220-introduction-sensors>

Industrial Instrumentation Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- Employ built-in functions in LabVIEW to solve various numerical problems.
- Develop Vis for solving problems involving different types of mathematical models and equations.
- Solve many simulation problems encountered in theory courses of the semester.
- Perform simulations using LabVIEW and develop optimization toolkits for various electrical and electronics engineering problems.
- Design and simulate projects for electrical and electronics engineering problems.

LIST OF EXPERIMENTS

1. Introduction to LabVIEW environment.
2. Application of arithmetic, logical and Boolean operations in LabVIEW.
3. Implement a virtual instrument (VI) for conversion of temperature from Celsius to Fahrenheit.
4. Develop a VI in LabVIEW to solve an equation using Formula Node.
5. Create a VI to compute full adder logic using half adder logic as sub VI.
6. Application of 'For' and 'While' loop using LabVIEW.
7. Create a VI to find the factorial of the given number using 'For' Loop and Shift Registers.
8. Create a VI to display any information using case structure.
9. Introduction of array and cluster.
10. Introduction to NI ELVIS and its application to component testing.
11. Implementation of clipper and potential divider circuit using ELVIS.
12. Implement a RC circuit on NI ELVIS and acquire the data for charging and discharging period.
13. Implement an event counter using photo interrupter (1A57HR) on NI ELVIS and also implement a VI to display the counting.
14. Interface LDR using NI ELVIS and implement a VI to glow an LED when LDR senses the change in light intensity.

Thermodynamics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning outcomes:

The students will be able to:

- Carryout thermodynamic analysis of real systems.
- Carryout thermodynamic analysis multiphase systems with chemical changes.
- Understand thermodynamic functions and their relationships

Section A

Definition, significance and limitations, Classical versus statistical 1 in closed systems, zeroth law of thermodynamics and the absolute temperature scale.

Section B

Thermochemistry: Heat of reaction at constant pressure and at constant volume, Hess's law of heat summation and its application, temperature dependence of enthalpy (Kirchhoff's equation), bond dissociation energy and its calculation from thermo-chemical data,

Second law of Thermodynamics: need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem, Heat Engine, Efficiencies, thermodynamic scale of temperature.

Concept of Entropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium, entropy change in ideal gases and mixing of gases.

Section C

Thermodynamic Relations: Maxwell's equations, TdS equations, difference in heat capacities, ratio of heat capacities, energy equations, Joule-Kelvin effect, Clausius-Clapeyron equation.

Third law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibb's and Helmholtz functions: Gibbs-Helmholtz equation, Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, variation of G and A with P, V and T.

Recommended Books:

1. Atkins, P. W., & De, P. J. (2006). Atkins' physical chemistry. Oxford: Oxford University Press.
2. Puri, S., Sharma, R. L., & Pathania M. S. (2004). Principles of physical chemistry. Vishal Publishing Co.
3. Sharma, K. K., & Sharma, L. K. (1977). A textbook of physical chemistry. Vikas Publishing House.
4. P. K. Nag (2009). Basic & applied thermodynamics. Tata McGraw Hill.
5. Van Ness, H. C. (1983). Understanding thermodynamics. Courier Corporation.
6. Van Wylen, G. J., & Sonntag, R. E. (1985). Fundamentals of classical thermodynamics. New York: Wiley.

E-resource(s): <https://nptel.ac.in>

Chemical Process Calculations

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Make material balances on unit operations and processes
- Perform simultaneous material and energy balances
- Understanding the degrees of freedom analysis and its significance
- Understand the concept of humidity and usage of psychrometric chart

Section A

Introduction to chemical engineering, units and dimensions, conversion of units, dimensional consistency in equations and mole unit, definitions of density, specific gravity, mole and mass fractions, basis, different units of temperature and pressure, limiting and excess reactants, percentage conversion, selectivity & yield, definition and characteristics of a system, difference between open and close systems.

Section B

Material balance: strategy for analyzing material balance problems; solving material balance problems without chemical reactions, solving material balance with chemical reactions, material balances involving multiple subsystem, material balances with recycle and bypass, calculation procedures for ideal gas system; vapor pressure and saturation, calculation of dew point, definition of relative saturation, molal saturation, absolute saturation.

Section C

Energy balance: calculations of enthalpy changes using heat capacity equations and enthalpy tables; use of steam tables; enthalpy balances with chemical reactions, humidity chart and its use in determining the properties of moist air, simultaneous material and energy balances.

Recommended Books:

1. Himmelblau, D. M., & Riggs, J. B. (2009). Basic principles and calculations in chemical engineering. Prentice Hall.
2. Bhatt, B. I., & Vora, S. M. (2004). Stoichiometry. New Delhi: Tata McGraw Hill.
3. Hougen, O. A., Watson, K. M., & Ragatz R.A. (2004). Chemical process principles Part I. CBS Publishers & Distributors Pvt. Ltd.

E-resource(s): <https://nptel.ac.in>

Heat Transfer

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Understand and solve conduction, convection and radiation problems
- Design and analyze the performance of heat exchangers, condensers, boilers and evaporators
- Design and analyze reactor heating and cooling system

Section A

Introduction: Modes of heat transfer: conduction, convection, radiation.

Steady-State Conduction in One Dimension: Fourier's Law, thermal conductivity, steady-state conduction of heat through a composite solid, cylinder and sphere; Steady-state heat conduction in bodies with heat sources: plane wall, cylinder and sphere.

Heat Transfer Coefficient: Convective heat transfer and the concept of heat transfer coefficient, overall heat transfer coefficient, heat transfer from extended surfaces, thermal contact resistance, critical insulation thickness, optimum insulation thickness.

Forced Convection: Flow over a flat plate, thermal boundary layer, flow across a cylinder; Dimensional analysis: Buckingham Pi theorem, Dimensional groups in heat transfer; Correlations for the heat transfer coefficient, heat transfer coefficient in a packed and fluidized bed.

Free Convection: Introduction, heat transfer correlations for free convection in flat surface, cylinder, sphere.

Section B

Boiling and Condensation: Boiling phenomenon, nucleate boiling, Correlations for pool boiling heat transfer, critical heat flux, stable film boiling; Forced convection boiling, condensation phenomena, film condensation on a vertical surface, turbulent film condensation, condensation outside a horizontal tube and tube bank; Condensation inside a horizontal tube, effect of non-condensable gases. Drop-wise condensation.

Radiation Heat Transfer: Basic concept, black body radiation, Planck's Law, Wien's Displacement Law, Stefan-Boltzmann Law, Kirchoff's Law, Gray body; Radiation intensity of a black body, spectral emissive power of a black body over a hemisphere. Radiation heat exchange between surfaces- the view factor. Radiation exchange between black bodies and between diffuse gray surfaces.

Section C

Heat Exchangers: Construction of a shell-and-tube heat exchanger, fouling of a heat exchanger, LMTD, temperature distribution in multi-pass heat exchangers, individual heat transfer coefficients; Types of shell-and-tube heat exchanger.

Evaporators: Types, Natural-circulation evaporators, forced-circulation evaporators, falling film evaporators, climbing-film evaporators, agitated thin-film evaporators and plate evaporators; Principles of evaporation and evaporators; Single and multiple effect evaporators, Capacity and economy, Boiling point rise, heat transfer coefficient enthalpy of a solution; Calculations of a single effect evaporator.

Recommended Books:

1. Kern, D. Q. (2019). Process heat transfer. S.I.: Echo Point Books & Media.
2. Holeman, J. P., & Bhattacharyya, S. (2017). Heat transfer. Chennai: McGraw Hill Education (India) Private Limited.
3. Chapman, A. J. (1984). Heat transfer. Maxwell Macmillan.
4. Dutta, B. K. (2001). Heat transfer: principles and applications. New Delhi: PHI Learning Pvt. Ltd.

E-resource(s): <https://nptel.ac.in>

Chemical Engineering Thermodynamics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Apply fundamental concepts of thermodynamics to engineering applications.
- Estimate thermodynamic properties of substances in gas and liquid states.
- Determine thermodynamic efficiency of various energy related processes.
- Solve problems related to the solution thermodynamics.

Section-A

Thermodynamics properties of pure fluids: PVT behavior of pure substances, Virial equation of state, the ideal gas, applications of the virial equations, cubic equation of state, generalized correlation for gases and liquids.

Thermodynamics properties of fluids: property relations for homogeneous phases, residual property, residual properties by equations of state, two-phase system, thermodynamic diagram, tables of thermodynamic properties, generalized property correlations for gases, Clapeyron's equation, Kirchoff's equation.

Section-B

Heat effects: sensible heat effects, heat of reaction, formation and combustion, effect of temperature on the standard heat of reaction.

Multi-component systems: fundamental property relation, chemical potential & phase equilibrium, partial properties, ideal-gas mixture, fugacity and fugacity coefficient for pure species & species in solution, generalized correlations for the fugacity coefficient, ideal solution, excess properties: excess Gibbs' energy, activity coefficient.

Phase equilibrium at low to moderate pressures: nature of equilibrium, phase behavior for vapor liquid systems, models for vapor liquid equilibrium: Margules equation, Van Laar equation, NRTL equation, Raoult's Law, Dew point, bubble point and flash point calculations.

Section C

Solution thermodynamics: liquid phase properties from VLE data, models for the excess Gibbs energy, property changes of mixing, heat effects of mixing processes, partially miscible systems.

Chemical reaction equilibrium: reaction coordinates, equilibrium criteria to chemical reactions, standard Gibbs' energy change and the equilibrium constant, effect of temperature on the equilibrium constant, evaluation of equilibrium constants, relations between equilibrium constants and compositions: gas-phase reactions, liquid-phase reactions, calculation of equilibrium compositions for single-phase reactions, multi-component equilibrium.

Recommended Books:

1. Smith, J. M., Van Ness, H. C., & Abbott, M. M. (2005). Introduction to chemical engineering thermodynamics. New York: McGraw-Hill.
2. Rao, Y. V. C. (1997). Chemical engineering thermodynamics. Universities Press.
3. Koretsky, M. D. (2004). Engineering and chemical thermodynamics. New York: Wiley.

E-resource(s): <https://nptel.ac.in>

Fluid Mechanics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Understand the basic principles of fluid mechanics
- Analyze fluid flow problems with the application of the momentum and energy equations
- Analyze pipe flows as well as fluid machinery

Section A

Introduction: unit systems, dimensional consistency, dimensionless groups; hydrostatic forces on submerged objects, buoyancy; continuum hypothesis, definition of a fluid.

Fluid properties: properties of fluids and their classification, Newtonian and Non-Newtonian fluids, types of fluid flow, nature of turbulence, eddy viscosity, flow in boundary layer.

Basic equations of fluid flow: derivation and applications of Navier stokes equation, Bernoulli's equation and Hagen-Poiseuille equation.

Section B

Incompressible flow: Flow in pipes and channels: shear stress and skin friction, friction from changes in velocity or direction, application of Bernoulli's equation for fluid friction; flow in thin layers.

Flow past immersed objects: normal forces in fluids, forces on submerged bodies, motion of single particle through fluid, hindered settling; Flow through bed of solids: packed bed, minimum fluidization velocity.

Section C

Flow measurement: Flow measuring devices for chemical plants: orifice meter, nozzle, venturi meter, rotameter, pitot tube, notches, Hook's experiment.

Flow machinery: classification of pumps; Centrifugal pump: cavitation, net positive suction head, characteristic curves, pump scale-up; application of Bernoulli's equation for pump work; Gas moving machinery: fans, blowers and compressors; work done in isothermal & adiabatic compression.

Agitation of liquids: need; Impellers: propellers, paddles and turbines.

Recommended Books:

McCabe, W. L., Smith, J. C., & Harriott, P. (2005). Unit operations of chemical engineering. Boston: McGraw-Hill.

E-resource(s): <https://nptel.ac.in>

Chemical Reaction Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Analyze chemical reactors and reaction systems
- Solve open-ended reaction engineering problems in teams
- Calculate operating parameters for isothermal and non-isothermal operation of ideal well-mixed batch and continuous reactors, and for ideal plug-flow reactors
- Formulate a set of consistent material and energy balance equations to describe operation of batch, semi-continuous and continuous reactor systems with single or multiple reactions, operating with and without heat exchange
- Choose an appropriate reactor type and operating conditions to achieve a desired output such as reactant conversion, selectivity and yield

Section-A

Introduction: Definition of reaction rates, variables affecting reaction rates, classification of reactions, order, molecularity. Kinetics of Homogenous Reactions: Concentration & temperature dependent term of a rate equation.

interpretation of batch reactor data & reactor design: Constant volume batch reactor, variable volume batch reactor, temperature and reaction rate; Reactor Design: Ideal batch reactor, steady state Mixed Flow Reactor, steady state PFR, Holding time and space time for flow systems.

Section-B

Design for single reactions: Size comparison, multiple reactor systems, recycle reactor, auto catalytic reactions.

Design for parallel reactions: Irreversible first order reactions in series, first order followed by zero order & zero order followed by first order reactions, reversible reaction, irreversible series-parallel reactions.

Non-isothermal reactor design: Design for adiabatic batch and flow reactors, Non-adiabatic maxed flow reactor, Multiple steady-states in a mixed flow reactor; Single reactions and multiple reactions & selection of reactors.

Section-C

Non-Ideal Flow: Residence time distribution of fluids, General characteristics, Measurement of RTD, RTD in Ideal Reactor, Dispersion Model, Tanks-in Series Model, Chemical Reaction and conversion using RTD data directly as well as using dispersion and tanks-in-series models.

Recommended Books:

1. Levenspiel, O. (1999). Chemical reaction engineering. Singapore: John Wiley & Sons.
2. Scott Fogler, H. (2015). Elements of chemical reaction engineering. Delhi: Prentice Hall.
3. Smith, J. M. (1981). Chemical engineering kinetics. McGraw-Hill.

E-resource(s): <https://nptel.ac.in>

Computational Methods in Engineering

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Linear Algebraic Equations: Introduction, Gauss-Elimination, Gauss-Siedel and LU Decomposition methods. Thomas algorithm.

Eigen Values and Eigen Vectors of Matrices: Introduction, Fadeev-Leverrier's method, Power method, Householder's and Givens method.

Nonlinear Algebraic Equations: Single variable and multivariable successive substitution method, Single variable and multivariable Newton-Raphson technique and **Polynomial root finding methods :** Lin's and Lin - Bairstow's method.

Section-B

Function Approximation: Least square curve fit, Newton's interpolation formulae, Lagrangian interpolation, Pade approximation and Finite difference approximation.

Integration formulae: Trapezoidal rule, Simpson's 1/3 & 3/8 rule.

Ordinary Differential Equations: Initial Value Problems: Explicit Adams-Bashforth technique, Implicit Adams-Moulton technique and Runge-Kutta methods.

Section-C

Ordinary Differential Equations: Boundary Value Problems : Finite difference technique, Shooting Technique, Orthogonal Collocation Legendre Polynomials.

Partial Differential Equations: Classification of PDE Solution of Heat equation using Finite difference technique (Method of lines).

Text Book :

1. Gupta, S. K., "Numerical Methods for Engineers," New Age International Ltd., New Delhi, 1995.

Reference Books :

1. Hanna, O.T. and Sandall, O.C., "Computational Methods in Chemical Engineering," Prentice-Hall, 1975.
2. Sastry, S.S. "Introductory Methods of Numerical Analysis : PHI 4th Edition

Environmental and Fuel Lab

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

Environmental Pollution Control

1. P^H and TDS measurement for water samples
2. Available chlorine
3. COD measurement
4. BOD measurement
5. DO measurement through aeration unit
6. Air pollution measurement
7. Noise pollution measurement

Fuel Analysis

8. Coal sample analysis
9. Bomb calorimeter
10. Carbon residue
11. Smoke point analysis
12. Flash point measurement
13. Orsat gas analysis
14. Reid vapor pressure

Note : Minimum five experiments from each subject are compulsory.

Environmental Pollution Control

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Introduction: Legislation, standards for water and air. Effects of air pollutants on human health, vegetation and materials. Wastewater Treatment: Characterization of Industrial wastewater, primary, secondary and tertiary treatment, segregation, screening, equalization, coagulation, flocculation, precipitation, flotation, sedimentation, aerobic treatment, anaerobic treatment, absorption, ion exchange, membrane filtration, electro-dialysis, sludge dewatering and disposal methods.

Section-B

Air Pollution Control: Sources and classification of air pollutants, nature and characteristics of gaseous and particulate pollutants, pollutants from automobiles. Air pollution meteorology, plume and its behavior and atmospheric dispersion, control of particulate emissions by gravity settling chamber, cyclones, wet scrubbers, bag filters and electrostatic precipitators.

Section-C

Control of gaseous emissions by absorption, adsorption, chemical transformation and combustion. Solid Waste Management: Hazardous and non-hazardous waste, methods of treatment and disposal, land filling, leachate treatment and incineration of solid wastes.

Text Books:

1. Peavy, H. S., Rowe, D. R., Tchobanoglous, G., "Environmental Engineering" ; McGraw Hill, 1995.
2. Modi, P. N., "Sewage Treatment and Disposal and Waste Water Engineering," Vol. II, Standard Book House, Delhi, 2001.

Reference Book:

1. Metcalf & Eddy, Inc., "Wastewater Engineering: Treatment and Reuse", 4th ed., Tata McGraw Hill, New Delhi, 2003.

Mass Transfer

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Section-A

Diffusion : Fick's law of diffusion, molecular and eddy diffusion, calculation of diffusivities in gas and liquid, application to diffusion in fluid and solid systems (stagnant film, equimolar, counter, unsteady state).

Convective mass transfer: Mass Transfer coefficients, Laminar and turbulent flow situations and correlations.

Inter-phase mass transfer : film theory, two film theory, penetration and surface renewal theories.

Section-B

Gas Absorption : tray and packed columns, choice of solvent and packing arrangements, counter current isothermal, HETP design equation. (L/G) min, NTU, HTU calculation of NTU, nonisothermal absorption co-current operation.

Adsorption : types of adsorption, nature of adsorbents, Adsorption equilibria; adsorption isotherms and hysteresis; stage wise and continuous contact operations. fixed and moving bed absorbers, adsorption equipments, ion exchange.

Section-C

Humidification : vapor-liquid equilibrium, enthalpy for pure substances, Vapour-gas mixture; absolute humidity, dry bulb temperature, relative and % saturation, dew point, humid volume, humid heat, adiabatic saturation curves, wet bulb temperature; adiabatic gas-liquid contact operation, classification of cooling towers, dehumidification operation.

Drying : Solid-gas equilibria, different modes of drying operations, definition of moisture, mechanism and rate of batch and continuous drying, batch and continuous driers.

Text Book :

1. Treybl, R.E., "Mass transfer operations", 3rd ed. McGraw Hill, New York, 1980.

Reference Books :

1. King, C.J., "Separation Process", McGraw Hill, NY.
2. Smith, B.D., "Design of Equilibrium Stage-Process", McGraw-Hill, NY.
3. McCabe, W.I., Smith J.C. and Harriot, P., "Unit operation of chemical Engineering" 7th ed. McGraw Hill, NY.
4. Coulson, J.M. and Richardson, J.f., "Chemical Engineering" Vol. I & II, 4th ed. Asion Book, Pvt Ltd., New Delhi.

Chemical Process Control

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Measurement: Introduction; Classification of Methods of Measurements, Fundamental Methods of Measurement, Factors in Selection of Measuring Instruments.

Measurement System: Purpose and performance of measurement systems, Function of the measurement system, Structure of measurement systems.

Performance characteristics: Static characteristics; Systematic Characteristics; Accuracy, Error, Reproducibility, Range, Span, Ideal Straight line, Non-linearity, Sensitivity, Environmental effects, Hysteresis, Resolution etc. Generalized model of a system element and Statistical characteristics.

Dynamic characteristics: Dynamic Response of First and Second order type Instruments with four different types of forcing input functions.

Fundamentals of: Signals acquisition, Conditioning and Processing.
Measurement of Temperature, Pressure, Flow, Force and Torque etc.

Section-B

Modeling for Process Dynamics : Concept of Modeling and Simulation, Modeling for Process Dynamics. Mathematical model of physical systems in transfer function.

Linear Open and Closed loop System: Response of First Second and Higher order system, transportation lag, the control system, Closed loop Transfer function, Transient Response of Simple Control System, Stability Analysis, Concept of Root locus.

Frequency Response: Substitution rule, Bode Diagrams Bode stability criteria, Gain & Phase Margin.

Section-C

Controllers: P, PI, PD, PID. Advance Control Strategies : Cascade and Feedforward Control.

Controller Tuning : Ziegler-Nicholes and Cohen and Coon Rules. Controllers using Digital Computer, Introduction to Discrete time Systems, Signals acquisition, Conditioning and Processing.

Control Components : Actuators; valves and servo Amplifier.

Text Books:

1. Coughanowr, D. R., "Process Systems Analysis and Control", 2nd ed. McGraw Hill, 1991.
2. Jain, R.K., "Mechanical & Industrial measurements", Khanna Publishers, New Delhi. 1999.

Reference Books:

1. Stephanopoulos, G., "Chemical Process Control", PHI, 1984.
2. Luyben, W. L., "Process Modeling, Simulation and Control for Chemical Engineers," McGraw Hill, 1973.

Process Simulation Lab - I

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

1. PFD
2. ASPN

Fluid Mechanics and Mechanical Operations Lab

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

Fluid Mechanics

1. Pressure drop due to various kind of fittings
2. Drag coefficient measurement
3. Bernoulli's theorem
4. Flow measurement through pressure drop
5. Fluidized bed
6. Centrifugal pump test rig (constant speed)
7. Centrifugal pump test rig (variable speed)

Mechanical Operations

8. Gyratory sieve shaker with test sieves
9. Ball mill (constant speed)
10. Ball mill (variable speed)
11. Roll crusher
12. Jaw crusher
13. Cyclone separator
14. Mineral Jig

Note : Minimum five experiments from each subject are compulsory.

Mechanical Operations

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Section-A

Particle technology : particle size, sphericity, shape factor, different ways of expressing particle size, particle size distribution, measurement of average particle diameter; Laws of crushing and grinding; energy required for size reduction, work index; Crushing & grinding equipments; jaw crusher, roll crusher; gyratory crusher, ball mill, hammer mill, fluid energy mill, closed and open circuit grindings; Screens: ideal and actual screens, types of screens, mesh number and size distribution, particle size analysis, effectiveness of screen (screen efficiency); Industrial screening equipments; grizzly, gyratory screen, vibrating screen, trammel; Size enlargement; agglomeration.

Section-B

Solid-Liquid separation : Filtration; principle of cake filtration, equations for compressible and incompressible cakes, constant pressure filtration & constant rate filtration, filter aid, filter medium, characteristics of filter media; Filtration equipments; filter press, rotary drum and vacuum filter, centrifuges-principles and applications; Gravity based separation sedimentation, clarifier, classifier, thickener, mineral jig, tabling, flotation, hydro-cyclone.

Section-C

Solid Gas separation : principle and application of cyclone separator and electrostatic precipitator. Storage & conveying of solids : bulk storage, bin storage, hoppers, silos; Conveyors; belt conveyor, chain conveyor, apron conveyor, bucket conveyor, bucket elevator, screw conveyor.

Mixing of solids : application : Types of mixers; muller mixers, ribbon blender, internal screw mixer, tumbling mixer, kneader, Banbury mixer, pug mill.

Text Books :

1. McCabe, W.L., Smith, J.C., and Harriott, P., "Unit Operations of Chemical Engineering". 7th ed., McGraw Hill, 2005.
2. Chemical Engineers Hand Book by R.H. Perry and C.H. Chilton.

Reference Books :

1. Chemical Engineering Vol.-I : Coulson & Richardson, Pergamon Press, 1979.
2. Momentum transfer operation : S.K. Gupta, 1979.

Advanced Chemical Reaction Engineering

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Catalysts: Description, methods of preparation and manufacture; catalyst characterization BET surface area, pore volume pore size distribution. catalyst Reaction Kinetic Models : Physical and chemical adsorption; Determination of rate expressions using adsorption, surface reaction and desorption as rate-controlling steps.

Determination of Global Rate of Reaction : Heterogeneous laboratory reactors; Determination of rate expressions from experimental data. Effect of Intrapellet Diffusion on Reaction Rates in Isothermal Pellets: concept of effectiveness factor, Thiele modulus, experimental determination of effectiveness factor-Weisz-Prater criteria, Non-isothermal effectiveness factor.

Section-B

Packed bed catalytic reactors: suspended solid reactors, bubbling fluidized bed and circulating fluidized bed reactors.

Deactivating Catalyst: mechanism of deactivation, rate & performance equations.

Gas-Liquid Reactions on solid catalyst: trickle bed, slurry reactors, three-phase fluidized beds, general rate equations & performance equations

Section-C

Non-catalytic systems: rate equations for fluid-fluid reactions, reactor design;

Fluid particle reaction kinetics: selection of a model, shrinking core model for spherical particle of unchanging size, rate equation and determination of the rate controlling step. Fluid-particle reactors design.

Text Book:

1. Levenspiel, O., "Chemical Reaction Engineering," 3rd ed., John Wiley & Sons, Singapore, 1999.

Reference Books:

1. Scot Fogler, H., "Elements of Chemical Reaction Engg.," 4th ed., Prentice-Hall of India, Delhi, 2007.
2. Smith, J. M., "Chemical Engineering Kinetics," 3rd ed., McGraw-Hill, 1981.

Chemical Technology

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Industrial Gases: Hydrogen, oxygen, nitrogen, producer gas and water gas.

Fertilizer Industries: Nitrogen, potassium and phosphorus based fertilizers.

Agrochemicals: Important pesticides, BHC, DDT.

Cement Industries: Types and manufacture of Portland cement.

Coal Chemicals: Coal tar distillation and recovery of chemicals.

Section-B

Petrochemical Precursors: Formaldehyde, acetaldehyde, acetic acid, acetic anhydride, maleic anhydride, nitrobenzene, ethylene oxide, ethylene glycol, acrylonitrile, styrene, butadiene.

Oils and Fats: Refining of edible oils and fats, fatty acids, hydrogenation of oils.

Pulp & Paper Manufacturing: kraft process, production & engineering problems, paper products, soaps and detergents.

Section-C

Alcohol Industries: Fermentation of industrial alcohol, absolute alcohol, ethyl alcohol, beers, wines and liquors.

Polymer Based Industries and Their Characteristics: Plastics: Production of thermoplastic and thermosetting resins such as polyethylene, polypropylene, phenolic resins and epoxy resins; polymers and their applications in engineering practice.

Text Book:

1. Rao M.G. and M. Sittig, "Dryden's Outlines of Chemical Technology", Affiliated East West Press, 1997.

Reference Books:

1. Shreve N., "Chemical Process Industries" 5th Edn. McGraw Hill, New York, 1984.
2. Faith W.L., Keyes D.B. and Clark R.L., "Industrial Chemicals", 4th Ed., John Wiley.

Optimizations of Chemical Processes

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Introduction to process optimization: Formulation of various process optimization problems, Basic concepts of optimization: convex and concave functions, necessary and sufficient conditions for stationary points.

Unconstrained single variable optimization: Newton, Quasi-Newton methods, Polynomial approximation methods. **Unconstrained multivariable optimization:** Direct search methods, conjugate search method, steepest descent method, conjugate gradient method, Newton's method.

Section-B

Linear Programming with constraints: Formulation of LP problem, graphical solution of LP problem, simplex method, duality in linear Programming, Two-phase method.

Section-C

Non-linear programming with constraints: Necessary and sufficient conditions for a local extremum, Penalty & Barrier methods, Quadratic Programming, successive quadratic programming, Generalized reduced gradient (GRG) method.

Text Book:

1. Edgar, T.F., Himmelblau, D. M., Lasdon, L. S., "Optimization of Chemical Process", 2nd ed., McGraw-Hill, 2001.

Reference Book:

2. Rao, S.S., "Optimisation Techniques", Wiley Eastern, New Delhi, 1985.

Plant Design and Economics
CE 6.5

L T P C
3 1 0 4

Max. Marks : 60
(CA : 20 + ESA : 40)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

The Design Process : Design Opportunities. Steps in Process Design, Environmental Protection, Safety Considerations.

Process Creation : Preliminary Database Creation, Experiments, Preliminary Process Synthesis, Development of the Base Case Design.

Simulation to Assist in Process Creation : Principles of Steady-State Flowsheet Simulation, Principles of Batch Flowsheet Simulation.

Heuristics for Process Synthesis : Introduction, Raw Materials and Chemical Reactions, Distribution of Chemicals, Separations, Heat Removal from and Addition to Reactors, Heat Exchangers and Furnaces, Pumping, Compression, Pressure Reduction Vacuum and Conveying of Solids, Changing the Particle Size of Solids, Removal of Particles from Gases and Liquids.

Section-B

Energy Integration : Introduction, Minimum Utility Targets, Networks for maximum Energy Recovery, Minimum Number of heat Exchangers, Threshold Approach Temperature, Optimum Approach Temperature, Superstructures for minimization of annual costs, Multiple Utilities, Distillation Trains, Heat Engines and Head Pumps.

Scheduling of Batch Processes : Design of single and multiple product processing sequences.

Section-C

Cost Accounting and Capital Cost Estimation : Accounting, Cost Indexes and Capital Investment for Commodity Chemicals, Capital Investment Costs, Estimation of the Total Capital Investment, Purchase Costs of the Most Widely Used Process Equipment.

Annual Costs, Earnings and Profitability Analysis : Introduction, Annual Sales Revenues, Production Costs and The Cost Sheet, Working Capital and Total Capital Investment, Approximate Profitability Measures, Time Value of Money, Cash Flow and Depreciation, Rigorous Profitability Measures.

Text Book:

1. Seider, W.D., Seader, J.D. and Lewin, D.R., "Product & Process Design Principles", 2nd edition, Wiley Student Edition, Wiley India, Reprint 2012.

Reference Books:

1. R. Smith, "Chemical Process Design", McGraw Hill, New York, 1995.
2. R.K.Sinnot, "An Introduction to Chemical Engineering Design", Pergamon Press, Oxford, 1989.

Process Simulation Lab - II

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

1. MATLAB
2. PROSIM
3. UNISIM

Advanced Mass Transfer

L T P C

3 1 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Section-A

Distillation: Vapor-liquid equilibria: pressure-temperature-concentration phase diagram, enthalpy-concentration diagram; ideal and non-ideal solutions, Raoult's law and its application, relative volatility, maximum and minimum boiling mixtures.

Single stage binary distillation: flash vaporization, partial condensation, differential (Rayleigh) distillation, differential condensation, constant relative volatility, lever rule, steam distillation.

Section-B

Continuous distillation of binary mixtures: ideal and non-ideal stages, definition of a point, stage and column efficiency; Ponchon Savarit method: adiabatic & non-adiabatic; McCabe Thiele method: plate calculations, feed plate location; use of open steam, tray efficiency, tray type (bubble cap, sieve & valve), flooding, tray layout, delta P, tray hydraulics, determination of column height and diameter; packed column.

Liquid-liquid extraction: principle, usefulness, ternary liquid equilibria, triangular coordinates, mixer rule, choice of solvent; Extractors: mixer settlers, spray & packed column, rotating disk contactor, sieve tray column.

Section-C

Leaching: solid liquid equilibrium; Batch and continuous operations: single and multistage cross current and counter current operations, number of equilibrium stages; Equipments: percolation tank, agitated vessel, thickeners, classifiers, continuous counter current decantation.

Crystallization: nucleation & crystal growth rate, controlled growth of crystals, equilibrium yield of crystallization, heat and mass transfer rates in crystallization, classification of industrial crystallizers.

Text Book :

1. Treybl, R.E., "Mass transfer operations", 3rd ed. McGraw Hill, New York, 1980.

Reference Books :

1. King, C.J., "Separation Process", McGraw Hill, NY.
2. Smith, B.D., "Design of Equilibrium Stage-Process", McGraw-Hill, NY.
3. McCabe, W.I., Smith J.C. and Harriot, P., "Unit operation of chemical Engineering" 7th ed. McGraw Hill, NY.
4. Coulson, J.M. and Richardson, J.f., "Chemical Engineering" Vol. I & II, 4th ed. Asion Book, Pvt Ltd., New Delhi.

Heat and Mass Transfer Lab

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

Heat Transfer

1. Fin tube heat exchanger
2. Shell and Tube heat exchanger
3. Vertical and horizontal condenser
4. Heat transfer in agitated vessel
5. Heat Transfer through composite wall
6. Natural convection heat transfer
7. Forced Convection heat transfer

Mass Transfer

8. Steam distillation
9. Continuous packed bed distillation
10. Forced draft tray dryer
11. Solid-gas diffusion
12. Adsorption in packed bed
13. Vapor-liquid equilibria
14. Liquid-liquid extraction

Note: Minimum five experiments from each subject are compulsory.

Reaction Engineering and Process Control Lab

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

Reaction Engineering

1. Study of rate law parameters
2. Reactors in series
3. Isothermal batch reactor
4. Continuous stirred tank reactor
5. RTD studies in plug flow reactor
6. Plug flow reactor (coil type)
7. Plug flow reactor (straight tube)

Process Control

8. Interacting and non-interacting systems
9. Time constant of thermocouple and thermometer
10. Time constant of manometer
11. Trainer for temperature control
12. Trainer for pressure control
13. Trainer for level control
14. Trainer for flow control

Note: Minimum five experiments from each subject are compulsory.

Computer Aided Process Plant Design

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

The students will be able to:

- Create hierarchy of process design
- Develop models for preliminary systems
- Create CAD model for fluid, heat and mass transfer equipment

Section-A

Introduction and properties evaluation - spread sheeting, hierarchy of process design and the onion model - flow sheeting, typical unit of cad system - process synthesis - physical properties evaluation - Transport properties and thermodynamic properties of gases and binary mixtures.

Basic model development for preliminary systems , methods of calculating vapor liquid equilibrium data for ideal and non-ideal mixtures, bubble point and dew point, flash and distillation calculations, equipment design, development of software programs for the following systems, piping system - Single phase and two phases.

Section-B

Fluid Moving Machinery: Cad Model for fluid moving machinery and storage design – Separator system - Two phase and three phase - Storage system - Atmospheric, pressurized cryogenics.

Heat Transfer Equipment: CAD model for heat transfer equipment design - Double Pipe, Shell and tube heat exchanger - PHE - Air cooler - Heat integration of evaporators.

Section-C

Mass Transfer Equipment: Cad Model for mass transfer equipment and safety devices design - Binary mixtures - Pseudo binary, multistage distillation system – Heat integration of distillation columns - Absorber and strippers – Liquid Liquid extractor - Safety devices-pressure safety valve and flare system.

Recommended Books:

1. Bhattacharyya, B.C & Narayanan, C.M., (2012). Computer aided design of chemical process equipment. New Delhi: New Central Book Agency (P) LTD.
2. Smith, R., & Smith, R. (1995). Chemical process design. New York: McGraw-Hill.
3. Husain, A. (1986). Chemical process simulation. New Delhi: Wiley Eastern Limited.
4. Coker, A. K. (1995). FORTRAN programs for chemical process design, Analysis, and Simulation. Gulf Publishing Company.
5. Bhattacharyya, B.C, Narayanan, C.M., (1992). Computer aided design of chemical process equipment. New Delhi: New Central Book Agency (P) Ltd.

Corrosion Engineering

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

The students will be able to:

- Understand the electrochemical and metallurgical behavior of corroding systems.
- Apply the electrochemical and metallurgical aspects of combating eight forms of corrosion.
- Select or choose the testing procedures for corroding systems.
- Evaluate the polarization behavior of corroding systems.
- Design of suitable materials, methods to combat corrosion.
- Predict the function of corrosion inhibitor

Section-A

Corrosion - Definition, classification, forms of corrosion, expressions for corrosion rate, emf and galvanic series, merits and demerits, Electrochemical, Environmental Metallurgical and other aspects. Eight forms of corrosion; Galvanic corrosion, Crevice corrosion, Pitting, Intergranular corrosion, Selective leaching, Erosion corrosion, Stress corrosion and Hydrogen damage; Causes and remedial measures.

Section-B

Purpose of corrosion testing, classification, susceptibility, Surface preparation and aeration. Tests for Galvanic corrosion, Inter-granular corrosion, Stress corrosion, Pitting, Crevice and Erosion corrosion. Tests for Stainless steels and metals. NACE test methods. instrumentation.

Corrosion prevention; Materials selection, Alteration of environment, Design, Cathodic and anodic protection and Coatings.

Section-C

Theory of corrosion; Principles and applications. Thermodynamics and electrode kinetics. Activation, concentration and combined polarization. Passivity and mechanism of growth and breakdown of passive films. Predicting corrosion behavior, anodic protection, noble metal alloying. Tafel extrapolation, linear polarization. High-temperature corrosion; Pilling Bedworth ratio Electrochemical and morphological aspects of oxidation, Oxidation Kinetics, High temperature materials.

Recommended Books:

1. Fontana, M. G. (2005). Corrosion engineering. Tata McGraw-Hill Education.
2. Narayan, R. (1983). An introduction to metallic corrosion and its prevention. Mohan Pramlani for Oxford & IBH Publishing Company.
3. Budinski, K. G. (1988). Surface engineering for wear resistance. (Retroactive Coverage). Prentice-Hall, Inc.
4. Uhlig, H.H. (1985). Corrosion and corrosion control. New York: John Wiley and Sons.

E-resource(s): <https://nptel.ac.in>

Enzyme Engineering

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

The students will be able to:

- Recognize the factors affecting enzyme activity and its kinetics
- Understand the role enzyme as a catalyst in chemical industries
- Understand how enzyme kinetics affects reactor design for large scale production

Section-A

Introduction to biochemistry - Function and applications, nature and function of enzyme. coenzyme/ cofactor - Classification of enzymes - Assay methods and units - Applications of enzymes in industry, analytical techniques, medicine and pharmaceuticals Kinetics and mechanism of enzyme catalysis, Enzyme catalysis and controlling factors - Kinetics of enzyme catalyzed reactions in solution - Immobilized enzyme reaction kinetics - Effect of mass transfer resistance

Section-B

Enzyme production on large scale technology, isolation and purification of enzyme, protein, protein fractionalization methods

Immobilization technology and development, immobilization technique for enzymes - Characteristics and uses for immobilized enzyme systems.

Section-C

Industrial bioreactors utilizing isolated enzymes and biosensors development and applications - Reactor design and analysis for immobilized enzyme reactors - Applications in biosensors – Some modern developments for enzyme in organic synthesis.

Recommended Books:

1. Bailey, J. E., & Ollis, D. F. (1986). Biochemical engineering fundamentals. New York: McGraw Hill Publishing Company.
2. Wiseman, A. (1985). Handbook of enzyme biotechnology. E. Horwood.
3. Schomburg, D., Stephan, D., & Gesellschaft für Biotechnologische Forschung (Braunschweig, Germany). (1996). Enzyme handbook: 12. Berlin: Springer.
4. Pye, E. K., & Wingard, L. B. (1974). Enzyme engineering: 2. New York: Plenum Press.
5. Palmer, T., & Bonner, P. L. (2007). Enzymes: biochemistry, biotechnology, clinical chemistry. Elsevier.

E-resource(s): <https://nptel.ac.in>

Membrane Separation Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	0	2

Learning Outcomes:

The students will be able to:

- Understand the principles and materials properties for different membrane separation processes
- Identify the best membrane modules and manufacturing process for different applications
- Identify and design the suitable membrane separation technique for intended problem

Section-A

Introduction to membrane separation processes: History, their classification, material & material properties and applications.

General transport theories: driving forces, transport through porous (knudsen flow & friction model) and nonporous membranes.

Module and process design: plate & frame module, spiral wound module, tubular module, Hollow fiber module, comparative study of module configuration.

Section-B

Synthetic Membrane preparation techniques: Phase inversion membranes, preparation of composite membranes, Characterization of porous (Microfiltration, bubble point method, gas adsorption-desorption & permeability method), ionic and nonporous (permeability, physical & density measurement methods) membranes.

Section-C

Design and analysis and industrial application of various membrane processes such as reverse osmosis, ultra-filtration, electro-dialysis, dialysis, liquid membrane separation, gas permeation and pervaporation.

Concentration polarization and membrane fouling: causes of fouling, pressure drop, temperature polarization, gel layer & osmotic pressure model, Methods to reduce fouling.

Recommended Books:

1. Mulder, M. (1996). Basic principles of membrane technology. Second. Kluwer Academic Pub.
2. Baker, R. W. (2012). Membrane technology and applications. John Wiley & Sons.
3. Noble, R. D., & Stern, S. A. (Eds.). (1995). Membrane separations technology: Principles and applications. (Vol. 2). Elsevier.
4. Strathmann, H. (2004). Ion-exchange membrane separation processes. (Vol. 9). Elsevier.

E-resource(s): <https://nptel.ac.in>

Renewable Energy Resources

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

The students will be able to:

- Recognize the types of renewable energy resources
- Recognize the advantages of renewable energy resources on environment
- Do cost benefit analysis
- Efficiency of renewable energy systems as compared to conventional energy system

Section –A

Energy and Power, conventional energy sources.

Renewable energy sources, solar energy alternatives, optimal tilt for solar equipments.

Solar photovoltaic technologies, solar photovoltaic systems and their components.

Wind energy, wind flow, power in the wind, types of wind turbines, wind turbine sizing and systems design.

Section –B

Biomass energy, introduction, types of biomass and their applications, energy content of biomass, biomass as a source of energy, biomass-based fuels, structure of a biogas plant, design of a biogas plant, costing and payback period.

Chemical energy sources, hydrogen energy-technology, production storage transportation alternate fuel for motor vehicles, safety and management.

Section –C

Magneto hydro dynamic power, thermo electric power, thermionic generation, thermonuclear fusion energy, Energy storage and distribution

Energy conservation concept, principles technologies involved. Co-generation, waste heat utilization heat recuperators, regenerators, heat pipes & pumps.

Renewable energy sources and devices and their instrumentation and control

Recommended Books:

1. Rai, G. D. (2013). Non-conventional sources of energy. Khanna Publishers.
2. Singal, R. K. (2009). Non-conventional energy resources. S K Kataria and Sons.
3. Chiogioji, M. H. (1979). Industrial energy conservation. New York: McGraw Hill.
4. Solanki, C. S. (2009). Renewable energy technologies: A practical guide for beginners. PHI Learning Pvt. Ltd.

E-resource(s): <https://nptel.ac.in>

Process Plant Safety and Hazard Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Students will be provided the guidance to key techniques and methods used in industry for identifying and documenting safety and health hazards and their controls.
- It also contains examples that explain how to identify hazards, analyze hazards and controls, document the results of an analysis, and manage residual risk

Section-A

Introduction: Safety program, engineering ethics, accidents & loss statistics, acceptable risk, public perception, three significant disasters: case studies.

Toxicology: Toxic materials and their properties, effect of dose and exposure time, relationship and predictive models for response, threshold limit value and its definitions, industrial hygiene evaluation.

Section-B

Fire & Explosion: The fire triangle, distinction between fires and explosions, definitions, flammability characteristics of liquids and vapors, minimum O₂ concentration & inerting, ignition energy, autoignition, autooxidation, ignition sources, explosions.

Introduction to Reliefs: relief concepts, definitions, location, types, relief scenarios, relief systems.

Section-C

Hazard Identification: process hazard checklist, surveys, hazard & operability studies (HAZOP).

Risk Assessment: probability and failure, plant reliability, risk analysis, event trees & fault trees.

Accident Investigations: learning from accidents, layered investigation, aids for diagnosis, aids for recommendations.

Recommended books:

1. Crowl, D. A., & Louvar, J. F. (2001). *Chemical process safety: Fundamentals with applications*. Pearson Education.
2. Wentz, C. A. (1998). *Safety, health, and environmental protection*. McGraw-Hill Companies.
3. Smith, B. D. (1963). *Design of equilibrium stage processes*. McGraw-Hill Companies.

E-resource(s): <https://nptel.ac.in>

Biochemical Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Kinetics of enzymatic reactions
- Understand about metabolic stoichiometry and energetic
- Design and analysis of biological reactors
- Do economic analysis bioprocess

Section-A

Overview of Biochemical Engineering with emphasis on cell structure and cell types.

Chemicals of life: structural and functional characteristics of RNA, DNA and proteins.

Kinetics of enzymatic reactions: enzyme commission classification system, Michaelis-Menten kinetic model, factors affecting enzyme kinetics, enzyme reactions in heterogeneous system, application of enzyme in industries.

Section-B

Metabolic stoichiometry and. energetic: Thermodynamic principles, coupling by ATP and NAD, Embden-Meyerhof- Parna pathway, TCA cycle, electron transport and phosphophorylation, transport across cell membranes.

Molecular genetics and control: gene expression, alteration of cellular DNA, recombinant DNA technology.

Biomass production: Monod growth curve and forms, growth cycle phases for batch cultivation.

Transport phenomena in bioprocess: basic mass transfer concepts, rates of metabolic oxygen utilization, factors affecting mass transfer.

Section-C

Design and analysis of Biological reactors: fermentation technology for a medium formulation, environmental requirements for animal cell cultivation, plant cell cultivation.

Product recovery: commercial enzymes, antibiotics, organic acids, ethanol and single cell protein.

Bioprocess economics: bio-products regulations and general fermentation process economics with example.

Recommended Books:

1. Bailey, J. E., & Ollis, D. F. (1986). Biochemical engineering fundamentals. New York: McGraw Hill Publishing Company.
2. Wiseman, A. (1985). Handbook of enzyme biotechnology. E. Horwood.
3. Schomburg, D., Stephan, D., & Gesellschaft fu r Biotechnologische Forschung (Braunschweig, Germany). (1996). Enzyme handbook: 12. Berlin: Springer.
4. Pye, E. K, & Wingard, L. B. (1974). Enzyme engineering: 2. New York: Plenum Press.
5. Palmer, T., & Bonner, P. L. (2007). Enzymes: biochemistry, biotechnology, clinical chemistry. Elsevier.

E-resource(s): <https://nptel.ac.in>

Chemical Plant Simulation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Understand the stages involved in the development of a process model
- Formulate a chemical engineering problem as a mathematical model from basic engineering principles
- Identify the appropriate numerical solutions used in solving the models
- Apply various simulation tools for solving the chemical engineering models developed

Section-A

Introduction to Modeling and Simulation. Analysis of Models: Role of analysis, basic concepts of analysis, the analysis process, simple examples, source of model equations, conservation equations of mass, energy and momentum, constitutive equations, control volume, dimensional analysis, stability analysis, sensitivity analysis.

Section-B

Formulation of Process Models: Development of model equations for simple isothermal non-reacting and reacting liquid systems for both steady state and unsteady state conditions, isothermal two phase systems and rate of mass transfer, equilibrium staged processes, nonisothermal systems.

Section-C

Modeling of distillation column, absorber, heat exchanger, heat transfer in a jacketed vessel. Chemical Process Simulation: Introduction to simulation methodologies, process flowsheet simulators.

Recommended books:

1. Fisher, R. J., & Denn, M. M. (1976). *Introduction to chemical engineering analysis*. John Wiley.
 2. Babu B.V. (2008). *Process plant simulation*. Oxford University Press.
- Biegler, L. T., Grossmann, I. E., & Westerberg, A. W. (1997). *Systematic methods for chemical process design*. Prentice Hall.

Food Processing and Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

The students will be able to:

- Understand the importance of food processing
- Identify process conditions for food processing
- Carryout food processing at ambient temperature
- Select suitable medium such as heat, air, oil etc. for food processing
- Identify post processing operations for storage and distribution

Section-A

Introduction to food processing; properties of foods & processing theory: Units and dimensions: Density and specific gravity, fluids viscosity, rheology and texture, surface properties, thermodynamics of food, heat changes, mass transfer.

Ambient temperature processing: Raw material preparation : cleaning, sorting, grading and peeling; size reduction of solid and liquid food; mixing and forming; separation and concentration of food components; fermentation and enzyme technology; Irradiation; Processing using electric field, high hydrostatic pressure. light or ultrasound.

Section-B

Processing by application of heat: Blanching; Pasteurization; Heat Sterilization; Evaporation and distillation; Extrusion.

Processing using hot air: Dehydration, Baking and Roasting.

Processing using hot oil: Frying

Processing by direct and radiated energy: Dielectric, ohmic and infrared heating.

Section-C

Processing by removal of heat: Chilling, Freezing, Freeze-drying and freeze concentration Minimal Processing methods under Development.

Post-Processing operations: Coating or Enrobing; Packaging; Filling and Sealing of containers; materials handling storage and distribution.

Recommended books:

1. Fellows, P. J. (2009). Food processing technology: principles and practice. Elsevier.
2. Lewis, M. J. (1990). Physical properties of foods and food processing systems. Elsevier.
3. Toledo, R. T. (1997). Fundamentals of food processing engineering. Chapman & Hall.
4. Subbulakshmi, G., & Udipi, S. A. (2007). Food processing and preservation. New Age International.

E-resource(s): <https://nptel.ac.in>

Nano-Science and Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Objectives:

The students will be able to:

- Demonstrate the understanding of length scales concepts, nanostructures and nanotechnology
- Identify the principles of processing, manufacturing and characterization of nanomaterials and nanostructures
- Apply the electronic microscopy, scanning probe microscopy and nano-indentation techniques to characterize the nano-materials and nanostructures
- Evaluate and analyze the mechanical properties of bulk nanostructured metals and alloys, nano-composites and carbon nano-tubes

Section-A

Supramolecular chemistry: Definition and examples of the main intermolecular forces used in supramolecular chemistry. Self-assembly processes in organic systems.

Basic principles and fundamental properties: Size and Confinement Effects, Nanoparticle Morphology, Physical and Chemical Properties.

Section-B

Synthesis of nanomaterials: Introduction to nanomaterials, Equipment and processes needed to fabricate nano devices and structures such as bio-chips, power devices and opto-electronic structures. Top-down (Nanolithography, CVD), Bottom-up (Sol-gel processing, chemical synthesis). Wet deposition techniques, Self-assembly (Supramolecular approach).

Section-C

Different classes of nanomaterials: Metal and Semiconductor Nanomaterials, Quantum Dots, Wells and Wires, Molecule to bulk transitions Bucky balls and Carbon Nanotubes.

Instrumentation for nanoscale characterization: TEM, SEM and SPM technique, Fluorescence Microscopy and Imaging.

Recommended books:

1. Steed, J. W., & Atwood, J. L. (2013). *Supramolecular chemistry*. John Wiley & Sons.
2. Bréchnignac, C., Houdy, P., & Lahmani, M. (Eds.). (2008). *Nanomaterials and nanochemistry*. Springer Science & Business Media.
3. Lehn, J. M. (1995). *Supramolecular chemistry* (Vol. 1). Germany: Vch, Weinheim.

E-resource(s): <https://nptel.ac.in>

Petroleum Refining Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Objectives:

The students will be able to:

- Introduction with the petroleum refinery worldwide
- Develop knowledge of different refining processes
- Develop knowledge of safety and pollution control in the refining industries.
- To find the suitable refining technology for maximizing the gasoline yield

Section-A

Introduction: History & Development of Refining, petroleum industry in India, origin, exploration, drilling and production of petroleum crude, Composition and classification of petroleum crude, Laboratory test methods, Petroleum products – LPG, Gasoline, naphtha, kerosene, diesel oil, lubricating oil, wax etc.

Section-B

Transportation & pretreatment of petroleum products, Separation Processes: Design and operation of topping and vacuum distillation units. Solvent extraction processes for lubricating oil base stocks and for aromatics from naphtha and kerosene, solvent dewaxing.

Section-C

Conversion Processes: Thermal and catalytic cracking, vis-breaking and coking processes, reforming, hydro processing, alkylation, polymerization and isomerisation. Corrosion control in refining processes.

Recommended books:

1. Prasad, R. (2007). *Petroleum refining technology*. Khanna Publishers.
2. Nelson, W. L. (1985). *Petroleum refinery engineering*. Auckland: McGraw-Hill.

E-resource(s): <https://nptel.ac.in>

Polymer Science and Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Objectives:

The students will be able to:

- Comprehend basics of polymer science
- Students would learn concept of average molar masses and molar mass distributions
- Students would be introduced elastomers, plastics and fibers that are used in the industry
- Students would learn fundamentals of Step-growth polymerization
- Students would learn fundamentals of Chain/addition polymerization- ionic and free radical polymerization

Section-A

Polymerization Chemistry: Chain, step and miscellaneous polymerization reactions and polymerization technique.
Polymerization kinetics: Free radical, cationic and anionic polymerization, polycondensation, polymerization.
Polymerization Processes: Bulk, solution, emulsion and suspension polymerization.

Section-B

Molecular Weight Estimation: Average molecular weight: number average and weight average molecular weights.
Thermoplastic composites, fiber reinforcement fillers, surface treatment reinforced thermo set composites -Resins, Fibers, additives, fabrication methods.

Section-C

Manufacturing processes of important polymers: Plastics- polyethylene, polypropylene, polyvinyl chloride & copolymer, polystyrene; Urea-formaldehyde, Teflon, elastomers, rubbers, polyamides (6:6 Nylon), Polyesters (Dacron).

Recommended books:

1. Gowariker, V. R., Viswanathan, N. V., & Sreedhar, J. (1986). *Polymer science*. New Age International.
2. Rodriguez, (1970). *Principles of polymer science*. Tata McGraw Hill.
3. David, J. W. (1971). *Polymer science and engineering*, Prentice Hall

E-resource(s): <https://nptel.ac.in>

Engineering Drawing and Graphics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Learning Outcomes

The Students will be able to:

- Apply the concepts of engineering drawing in their respective field of interest.
- Implement various BIS and ISO concepts of drawing.
- Draw the sectional views of various engineering objects.
- Use engineering curves in tracing the paths of simple machine components.
- Draw various views related to real objects.
- Draw and read plan of industrial standards.
- Visualize the design ideas using software.

Indian Standard –Drawing Instruments, Lines & Lines symbols; Sheet Layout of rules of printing; Line sections & Conventions, Lettering, Scales, Curved used in Engineering Practice, Projection of Points, Projection of Lines, Projection of Planes, Projection of Solids, Orthographic Projections, Sectional Views, Rivets & Riveting Joints, Threads, Foundation Bolts & Nuts.

Computer Aided Drawing using Auto CAD /MICRO STATION.

Text Books:

3. Gill, P. S. (2010). *Engineering Drawing*. Kataria Publication,.
4. Bhatt, N. D. & Panchal, V.M. (2011). *Geometrical and Machine Drawing* (19th ed.). Charotar Publication.

e-Resources:-

5. <https://nptel.ac.in/courses/112103019/>
6. <http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html>
7. https://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/
8. <https://nptel.ac.in/courses/112104172/>

LIST OF EXPERIMENTS

9. Drawing sheet related to lettering.
10. Drawing sheet related to scale.
11. Drawing sheets related to conic sections.
12. Drawing sheets related to Engineering Curves.
13. Drawing sheet related to Projection of points.
14. Drawing sheet related to Projection of lines.
15. Drawing sheet related to orthographic projection by 1st angle.
16. Drawing sheet related to orthographic projection by 3rd angle.

Electrical Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- Understand the importance of electrical engineering
- Solve complex DC circuits
- Solve& predict the behavior of AC circuit
- Understand different machines along with measurement techniques
- Select appropriate element, device or machines with respect to application

Section A

DC Networks: Node Voltage and Mesh Current Analysis; Source Conversion. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power Transform, Laplace transforms and inverse Laplace transforms: Basic Theorem and Circuit analysis using Laplace transformations, Initial and final value theorem.

Section B

Single Phase AC Circuits: EMF Equation, Average, RMS and Effective Values. RLC Series, Parallel and Series, Parallel Circuits, Complex Representation of Impedances. Phasor Diagram, Power and Power Factor.

Three Phase A.C. Circuits: Delta-Star and Star-Delta Transformation, Line & Phase Quantities, 3-Phase Balanced Circuits, Phasor diagram, Measurement of Power in Three Phase Balanced Circuits.

Section C

Transformer: Magnetic coupled circuits, Dot convention for coupled circuits, coefficient of coupling, mutual inductance, EMF Equation, Voltage & Current, Relationship and Phasor Diagram of Ideal Transformer.

Introduction to principle of DC Machines, synchronous machines and induction motors.

Text Books

1. Toro, V. D. (1989). *Electrical Engineering Fundamentals* (2nd ed.). PHI Publication.
2. Bobrow, L. S. (1996). *Fundamental of Electrical Engineering* (2nd ed.). Oxford Publication.
3. Nagrath, J. & Kothari, D.P. (2017). *Basic Electrical Engineering* (3rd ed.). India: TMH.
4. Sahdev, S. K. (2015). *Basic Electrical Engineering*. India: Pearson Education India.

Reference Books

1. Chakrabarti, A.K. (2018). *Circuit Theory* (7th ed.). Dhanpat Rai and Co.
2. Alaxender, C. & Sadiku, M. N. O. (2003). *Fundamentals of Electrical circuits*. Oxford University Press.
3. Choudhary, D. R. (2013). *Networks and Systems*. Wiley Eastern Ltd.
4. Hayt, W. H., Kemmerly, J. & Durbin, S. M. (2013). *Engineering Circuit analysis* (8th ed.). Tata Mc Graw Hill.
5. Valkenburg, M.E.V. (2006). *Network Analysis*. New Delhi: Prentice Hall.

E-Resources:

1. <https://nptel.ac.in/courses/108108076/>
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/>
3. <https://swayam.gov.in/electrical/c/4/engineering>
4. <https://swayam.gov.in/courses/4746-july-2018-fundamentals-of-electrical-engineering>

5. [https://nptel.ac.in/courses/108105053/pdf/L-03\(GDR\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-03(GDR)(ET)%20((EE)NPTEL).pdf)
6. [https://nptel.ac.in/courses/108105053/pdf/L-04\(GDR\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-04(GDR)(ET)%20((EE)NPTEL).pdf)
7. [https://nptel.ac.in/courses/108105053/pdf/L-06\(GDR\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-06(GDR)(ET)%20((EE)NPTEL).pdf)
8. [https://nptel.ac.in/courses/108105053/pdf/L-07\(GDR\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-07(GDR)(ET)%20((EE)NPTEL).pdf)
9. [https://nptel.ac.in/courses/108105053/pdf/L-08\(GDR\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-08(GDR)(ET)%20((EE)NPTEL).pdf)
10. [https://nptel.ac.in/courses/108105053/pdf/L-14\(NKD\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-14(NKD)(ET)%20((EE)NPTEL).pdf)
11. [https://nptel.ac.in/courses/108105053/pdf/L-15\(NKD\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-15(NKD)(ET)%20((EE)NPTEL).pdf)
12. [https://nptel.ac.in/courses/108105053/pdf/L-17\(NKD\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L-17(NKD)(ET)%20((EE)NPTEL).pdf)
13. [https://nptel.ac.in/courses/108105053/pdf/L23\(TB\)\(ET\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/courses/108105053/pdf/L23(TB)(ET)%20((EE)NPTEL).pdf)
14. https://www.scribd.com/doc/123459017/basic-electrical-engineering?campaign=SkimbitLtd&ad_group=725X1342X724adc86fb3fde3cdc1f294ab4f382ea&keyword=660149026&source=hp_affiliate&medium=affiliate

Electrical Engineering Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes

The Students will be able to:

- Handle measuring instruments and apparatus
- Identify the various electrical and electronic components as per the ratings
- Verify circuit laws and solve electrical networks
- Analyze the characteristics of semiconductor devices
- Design basic AC & DC circuits

LIST OF EXPERIMENTS

1. Study of electronic components and apparatus.
2. Study of digital & analog Multimeter.
3. Study of Cathode Ray Oscilloscope (CRO)
4. Verification of principle of Superposition Theorem with DC.
5. Verification of principle of Thevenin's theorem with DC.
6. Verification of principle of Norton's theorem with DC.
7. Verification of principle of Maximum Power Transfer with DC.
8. Determine the frequency response of current in RL & RC circuit.
9. Determine the frequency response of current in RLC circuit.
10. Study of VI characteristics of PN junction diode.
11. Study of VI characteristics of Zener diode.
12. Study of VI characteristics of LED, LDR and Photodiode.
13. Study of VI characteristics of BJT in CE configuration.

Basic Electronics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Understand the fundamental of semiconductors and design semiconductor circuits.
- Understand the different type of diode/ transistors with their responses.
- Analyze various types of oscillators available with their utilization.

Section A

Electronics component- Active & Passive components, Types of resistors, inductors & capacitors, Recapitulation of semiconductor, Intrinsic and Extrinsic Semiconductor, Charge density of semiconductors generation and recombination of charges, diffusion, the continuity equation, Injected minority carrier charges, potential variation with in a graded semiconductor, Potential variation in step graded junction, PN Junction diode, current components, volt Ampere characteristic-temperature dependency, space charge & diffusion capacitance, switching time

Section B

Breakdown diode, Tunnel diode, LED, Photo diode, load line, clipping, clamping. The junction Transistor, current, components, configuration - CB, CE, CC, Typical junction values, Ebers-Moll model, photo transistor, analysis of transistor amplifier using h parameter Transistor Hybrid Model, , Emitter follower, Darlington pair, Miller theorem & its Dual, cascading amplifier

Section C

Biasing and stabilization - Static & Dynamic, Bias stability, load line, Need of stabilization, self-bias, fixed bias, emitter bias, feedback bias, Transistor as an Inverter, brief introduction of different coupling techniques

FET- Pinch off, V-I characteristics, MOSFET- Depletion & Enhancement type, Oscillators- Barkhausen criterion, phase shift oscillator, General form of oscillator circuit - Colpitts, Hartley, Wein bridge, crystal oscillator

Recommended Books:

1. Millman. J, Halkias. C, Parikh. C. (2017). *Integrated Electronics*. (2/e). New Delhi: TMH Publications.
2. Boylestad.R. (2012). *Electronic Devices& Circuits Theory*.(6/e). New Delhi: Pearson Publications.
3. Somanathan B. Nair. (2006). *Electronics Devices and Applications*. New Delhi: Prentice Hall India Learning Private Limited
4. Smith. S.(2008). *Microelectronics Circuits*. (5/e). New Delhi: Oxford press, India.
5. Streetman Ben. G. (2006). *Solid State Electronic Devices* (6/e). New Delhi: PHI Publications.

Suggested E-resources:

1. **Basic Electronics** by Prof. Pramod Agarwal, Department of Electrical Engineering, Indian Institute of Technology, Roorkee. <https://nptel.ac.in/courses/117107095/4>
2. **Circuits and Electronics** by Anant Agarwal, Massachusetts Institute of Technology: MIT OpenCourseWare. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/6002_116.pdf

Digital Electronics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes

The Students will be able to:

- The students will become competent enough to identify different digital integrated circuits utilized in complex electronic circuits.
- Students will have the ability to put together the knowledge of combinational logic circuits in designing of real time applications.
- The students will become proficient in designing of basic memory elements and their applications.
- Students will have the ability to implement various real life applications using asynchronous sequential logic circuits.

LIST OF EXPERIMENTS

1. To verify the truth table of various Logic gates.
2. To implement the X-OR gate with the help of Universal Gate -NAND.
3. To implement the X-NOR gate with the help of Universal Gates - NOR.
4. Verification of theorems of Boolean algebra.
5. Study of Binary Adder &Subtractor (Half).
6. Study of Binary Full Subtractor.
7. Study of Binary Full Adder.
8. Study of Multiplexer (2*1) and Demultiplexer (1*2) circuits.
9. Study of Decimal to Binary Decoder (2*4) and Encoder (4*2).
10. Study and designing with the help of gates of flip-flops (SR, D).
11. Study and designing with the help of gates of flip-flops (JK, T).
12. Study and designing with the help of gates of circuit of given Binary Up asynchronous counter.
13. Study and designing with the help of gates of circuit of given Binary Down asynchronous counter.

Analog Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Explain different blocks in communication system and how noise affects communication using different parameters.
- Distinguish between different amplitude modulation schemes with their advantages, disadvantages and applications and analyse generation and detection of FM signal and comparison between amplitude and angle modulation schemes.
- Identify different types of radio receiver circuits.

Section-A

Introduction to signals: Size of signals, Classification of signals, Some useful signal operations, Unit impulse function, Signals and vectors, Signal comparison- correlation, Signal representation by orthogonal signal set, Trigonometric Fourier series, Exponential Fourier series

Analysis and Transmission of Signals: Fourier transform of some useful signals, Some properties of Fourier Transform, Signal Transmission through linear system, Ideal and practical filters, Signal distortion over a communication channel, Signal energy and energy spectral density, Signal power and power spectral density

Section- B

Amplitude Modulation: Baseband and carrier communication, Double sideband modulation, Single sideband modulation, Quadrature amplitude modulation, Vestigial sideband modulation, Carrier acquisition, Superhetrodyne receiver

Angle Modulation: Concept of instantaneous frequency, Bandwidth of angle modulated waves, Generation of FM waves, Demodulation of FM, Interference in angle modulated systems, FM receiver

Section-C

Random Signal and Noise: Gaussian Noise, Bandpass noise and its representation, Noise power, SNR ratio, PSD of white noise.

Analog Systems in The Presence of Noise: Baseband system, Double sideband modulation- Suppressed carrier, Single sideband modulation- Suppressed carrier, Amplitude modulation, Angle modulated systems- Phase and Frequency modulation, Optimum preemphasis-deemphasis systems

Systems and Noise Calculations: Electrical Noise, Noise Figure, Equivalent Noise Temperature, Cascade Connection of Two-Port Networks, Free-Space Link Calculations

Recommended Books:

1. Lathi, B.P., Ding, Zhi., & Gupta, Hari Mohan. (1998). *Modern Digital and Analog Communication Systems*. New Delhi: Oxford University Press
2. Haykin, S. & Moher, M. (2007). *Introduction to Analog and Digital Communication*. New York, United States: John Wiley & Sons.
3. Shilling, D.L., & Taub, H. (2008). *Principles of Communication Systems*. New Delhi: Mc Graw Hill Publication.

Suggested E-Resource:

1. **Analog Communication** by Prof. Goutam Das, G S Sanyal School of Telecommunications, Indian Institute of Technology, Kharagpur. <https://nptel.ac.in/courses/117105143/>

Microprocessors and Microcontrollers

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- Analyze the architecture, programming and interfaces for higher versions of Microprocessor like 80286, 80386, Pentium.
- Evaluate the detailed working of microprocessor based computers and development boards.
- Implement the interfacing of peripheral devices with Microprocessor base in real time projects
- Utilize the architecture, programming and interfacing skills to build projects using Microcontroller 8051
- Understand the concepts of industrial and real time embedded system applications.

Section A

8086/8088 Microprocessor: Pin Assignment, Architecture, Functional Diagram, Register Organization, Memory address space & data organization, Segment registers & Memory segmentation, Dedicated & general use of memory,

Addressing modes, Instructions, Functional schematic, Minimum and Maximum mode operations of 8086, 8086 Control signals interfacing, Timing Diagrams, Interrupts, Bus timings, Demultiplexing.

Assembly Language Programming of 8086: Instruction Format, Instruction Set, Data Transfer instructions, Arithmetic instructions, Logical instruction, Shift instructions, Rotate instructions, Flag control instructions, Compare instructions, Jump instructions, Subroutine & the subroutine handling instructions, Loop & loop handling instructions, String instructions.

Section B

Peripheral Devices and Their Interfacing: Introduction, memory and I/O interfacing with 8086, data transfer schemes, programmable peripheral interface (8255), programmable DMA controller (8257), programmable interrupt controller (8259), programmable communication interface (8251), programmable counter/interval timer (8253 and 8254), special purpose interfacing devices, elements and circuits for interfacing.

Communication Interface: Serial Communication Standards, USART Interfacing RS-232, IEEE-488, 20mA Current Loop, Prototyping and Troubleshooting, Software Debugging tools, MDS.

Section C

Introduction to Microcontrollers: Overview of 8051 Micro Controller, Architecture, I/O ports and Memory Organization, Addressing modes and Instruction set of 8051,

Simple Programs using Stack Pointer, Assembly language programming. 8051

Interrupts Communication: Interrupts, Timer/Counter and Serial Communication, Programming Timer Interrupts, Programming External H/W interrupts, Programming the serial communication interrupts, Interrupt Priority in the 8051, Programming 8051 Timers, Counters and Programming.

Interfacing & Industrial Applications: Applications of Micro Controllers, Interfacing 8051 to LED's, Push button, Relay's and Latch Connections, Keyboard Interfacing, Interfacing Seven Segment Display, ADC and DAC Interfacing.

Text books:

1. Ayala, K. J. (2007). *The 8051 Micro Controller Architecture, Programming and Applications* (3rd. ed.). Thomson Publishers.
2. Hall, D.V. (2005). *Micro Processor and Interfacing*. Tata McGraw-Hill.

Reference books:

1. Deshmukh, A. V. (2005). *Microcontroller's theory applications*. Tata McGraw Hill.
2. Bhurchandi, K.M. & Ray, A.K. (2017). *Advanced Micro Processors*. Tata McGraw Hill.
3. Ayala, K. J. (2005). *The 8086 Micro Processors Architecture, Programming and Applications* (3rd. ed.). Thomson Publishers.
4. Carr, J. J. (2003). *Elements of Electronic Instrumentation & Measurements*. Pearson Education India.
5. Placko, D. (2007). *Fundamentals of Instrumentation and Measurements*. ISTE Ltd.

e-Resources:

1. <https://swayam.gov.in/course/4446-microprocessors-and-microcontrollers>
2. <https://nptel.ac.in/courses/108105102/53>
3. <https://nptel.ac.in/courses/108105102/7>
4. https://onlinecourses.nptel.ac.in/noc19_ee11/preview
5. [https://nptel.ac.in/courses/Webcourse-contents/IIT KANPUR/microcontrollers/micro/ui/TOC.htm](https://nptel.ac.in/courses/Webcourse-contents/IIT_KANPUR/microcontrollers/micro/ui/TOC.htm)
6. <https://nptel.ac.in/downloads/108105102/>
7. <https://nptel.ac.in/courses/106108100/>

Microwave Electronics

SECTION A

Introduction to Microwaves & its application. Transmission Lines: General equation, input independence characteristic independence, reflection & reflection coefficient, standing wave ratio, resonant and anti resonant line impedance matching, smith chart & its applications, coaxial, twin, strip & micro strip lines & baluns.

SECTION B

Wave Guides: Wave propagation in rectangular & circular wave-guides, wave-guide modes, Q of wave-guides, wave-guide coupling. Microwave Passive Components: s-parameter representation and analysis of microwave component such as tees, two hole direction coupler, attenuators, phase shifter, Rectangular cavity resonator, circulator & isolator.

SECTION C

Microwave Tube Devices: Conventional Vacuum tubes at microwave, O type device - Klystron (two cavity & reflex). M type device magnetron, Introduction to TWT (Traveling Wave Tubes). Microwave Semiconductor Devices IMPATT, TRAPATT & Gunn Devices.

Text Books:

1. Sisodia-Raghuvanshi: **Microwave Circuits & Passive Devices:** (Wiley-eastern).1st edition.1987
2. S.Y. Liao: **Microwave Devices & Circuits**, (Prentice Hall).1st Edition 1995,
3. Collins: **Foundation Of Microwave Engineering**, (Mc Graw Hill) 2nd Edition 1992
4. P.A. Rizzi: **Microwave:** (Prentice Hall). 1st Edition 1998

EC 5.6 Microwave Lab

1. Determine the operating frequency of reflex klystron.
2. Draw the VI characteristics of Reflex klystron.
3. Draw the characteristics of attenuator.
4. To verify the wave-guide law.
5. To study the directivity and coupling coefficient of Directional Coupler.
6. To study the properties of magic Tee and also determine isolation and coupling coefficient.
7. To Measure the VSWR of (i) Short circuit (ii) Open circuit (iii) Matched Load (iv) Unmatched Load.
8. To study the properties of E-plane and H-plane Tee. Determine isolation and coupling coefficient.

Economics For Engineers

Objectives : To introduce the fundamental concepts of economics/finance and to explain how these will contribute to decision making in engineering operations.

SECTION A

What Economics is all about? Micro and Macro Economics. Origin and meaning of Engineering Economics, Role of Economics in Engineering, Scope of Engineering Economics.

Theory of Demand: Law of Demand, Demand Function and Determinants of Demand, Types of Demand.

Elasticity of Demand: Concept, Types and Measurement.

SECTION B

Production function and Laws of Production. Optimal Input combination. Cost concepts and cost output relationship.

Types of market structures; Determination of equilibrium price and output under perfect competition.

SECTION C

Timevalue of Money and Project Evaluation: Interest Formulas; Cash Flow Diagram; Principles of Economic Equivalence, Evaluation of Engineering Projects using methods of Present Value and Internal Rate of Return.

Capital Budgeting: Concept and significance of capital budgeting.

Depreciation Analysis: Meaning and causes of depreciation; methods of calculating depreciation – straightline and declining balance methods.

Books Recommended:

1. Gerald J. Thuesen and W.J. Fabrycky: **Engineering Economy, Ninth Edition:** PHI Learning Private Limited, New Delhi.
2. S. ParkChan: **Contemporary Engineering Economics:** 3rd Edition, Prentice Hall.
3. M. Parkin: **Economics:** 5th Edition, Addison Wesley.
4. Mahendra P. Agasty: **Engineering Economics and Costing, Second Edition:** Scitech Publications (India) Pvt. Ltd.
5. R. Panneerselvam: **Engineering Economics, Tenth Printing:** PHI Learning Private Limited, New Delhi.

Principles of Management

SECTION A

What is management? Scientific approach-Taylor's contribution, administrative approach-Henry Fayol's contribution, human relation approach-Elton Mayo's contribution, system approach.

Planning: Need and process, types of plans-goals, objectives, policies and strategies; decision making-situations and process.

SECTION B

Organizing: Organization structure, departmentation, centralization v/s decentralization, span of management, delegation and power of authority.

Motivation-importance, theories of motivation-Maslow, McClelland Herzberg, theories.

SECTION C

Theories and styles of leadership-Trait, behavioral.

Communication: Process and principles, types of communication, barriers to communication.

Control: Process of evaluation & control, method of control.

References:

1. Agarwal R.D.: **Organization and Management**. Tata Mcgraw Hill, New Delhi.
2. Koontz O. Donnel: **Principles of Management**. Tata Mcgraw Hill, New Delhi.
3. Gupta C.B.: **Management: Theory and Practice**.
4. Tripathi P.C. & Reddy P.N.: **Principles of Management**. Tata Mcgraw Hill, New Delhi.
5. Robbins & D.Cenzo: **Fundamentals of Management**. Pearson Education.

Digital Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Analyse and implement the concept of Probability Theory, Random Variables, Error Control Theory and Information Theory in Digital Communication Systems
- Explain the concept of Analog to Digital Conversion, Sampling, Quantization, Pulse Modulation and PCM
- Describe and analyse mathematically the Digital Modulation Techniques-ASK, FSK, PSK

Section A

Introduction to Digital Communications, Sampling Theorem, Pulse amplitude modulation, Pulse code modulation: Uniform and Non- uniform quantization, T1 Carrier System, Differential pulse code modulation, Delta Modulation Line Coding: PSD of various line codes: polar signaling, on-off signaling, bipolar signaling; Pulse shaping: Nyquist criteria for zero ISI, signaling with controlled ISI, Duobinary pulse, Scrambling, Regenerative repeaters.

Section B

Digital Modulation Techniques: Various techniques of phase shift, BPSK modulation, spectrum, Bandwidth efficiency, geometrical representation of BPSK modulation, spectrum, Bandwidth efficiency, geometrical representation of ASK, FSK & Minimum shift keying

Noise in digital Communication: PCM and Companded PCM SNR, Matched filter, Calculation of error probability for ASK, ASK, FSK.

Section C

Information Theory: The concept of amount of information, Entropy, Information rate, Huffman coding, Channel capacity of a discrete memoryless channel, Shannon's Theorem, Channel capacity, capacity of a Gaussian channel, Bandwidth-S/N trade – off.

Error control coding: Rationale of coding and types of codes, Discrete memory less channel, some Algebraic concepts -Code efficiency and Hamming bound, linear block codes, Cyclic codes, Convolution codes, maximum likelihood decoding of convolution codes.

Recommended Books:

1. Lathi, B.P., Ding, Zhi., & Gupta, Hari Mohan. (1998). *Modern Digital and Analog Communication Systems*. New Delhi: Oxford University Press
2. Haykin, S. & Moher, M. (2007) *Introduction to Analog and Digital Communication*. New York, United States: John Wiley & Sons.
3. Shilling, D.L., & Taub, H. (2008). *Principles of Communication systems*. New Delhi: Mc-Graw Hill Publication.

Suggested E-Resources:

1. **Digital Communication** by Prof. Bikash Kumar Dey, Department of Electrical Engineering, Indian Institute of Technology, Bombay. <https://nptel.ac.in/courses/117101051/>

POWER ELECTRONICS

Section A

Need of power electronics, Introduction to power electronics devices (static and dynamic characteristics) power diodes, power transistor, power MOSFETS, IGBT, MCT, GTOs, Triac. Thyristor SCR: Operational characteristics, Turn ON methods, switching characteristics, thyristor protection, over voltage protection, over current protection, gate protection, snubber circuit Firing circuits for Thyristors, heating, series and parallel combination of Thyristors.

Section B

Commutation Techniques: Load commutation, resonant- pulse commutation, complementary commutation, impulse commutation, line commutation, Phase controlled rectifier: Principal of phase control, single and three phase converters. Effect of source impedance on the performance of converters, dual converter (ideal and practical) DC choppers: Principle, control strategies, step-up and step-down choppers.

Section C

Inverters: Single-phase voltage source inverters 180 and 120 mode operation; Fourier analysis of single-phase inverter output voltage. Pulse width modulated inverters, Reduction of harmonics in the inverter output, single-phase current source inverters with ideal switch. Cyclo-converters: Step-up and step-down cyclo-converter, Single phase to single-phase cyclo-converters three-phase half wave cyclo-converters.

Text Books:

1. Rashid Mohammad H. "Power Electronics circuits, devices and applications"; PHI publication, 14th reprint Edition.
2. Bimbhra P.S. "Power electronics"; Khanna Publication, 3rd Edition.

Reference:

1. Rama Moorthy, "An introduction to Thyristors and their application"; 2nd Edition, ISBN-81-85336-67-9.

POWER ELECTRONICS PRACTICAL

1. To study the V-I characteristics of a DIAC.
2. To study the V-I characteristics of a TRIAC.
3. To study the V-I characteristics of a SCR.
4. Micro controller based Problem Assignment.

Microwave Engineering

Section-A

Transmission Lines: Introduction to Microwaves & its applications. **Transmission Lines:** General equation, input impedance characteristic independence, Reflection & reflection coefficient, standing wave ratio, resonant and anti resonant line impedance matching, smith chart & its applications, coaxial, twin, strip & micro strip lines & baluns.

Section-B

Wave Guides: Wave propagation in rectangular & circular wave-guides, wave-guide modes, Q of wave-guides, wave-guide coupling. **Microwave Passive Components:** s-parameter representation and analysis of microwave component such as tees, two hole direction coupler attenuators, phase shifter, Rectangular cavity resonator, circulator & isolator.

Section-C

Microwave Tube Devices: Conventional Vacuum tubes at microwave, O type device - Klystron (two cavity & reflex). M type device magnetron, Introduction to TWT (Traveling Wave Tubes). **Microwave Semiconductor Devices** IMPATT, TRAPATT & Gum Devices.

Text Books:

1. Microwave Circuits & passive devices, Sisodia-Raghuvanshi (Wiley-eastern).1st edition.1987
2. Microwave devices & circuits, S.Y. Liao (Prentice Hall).1st Edition 1995,
3. Foundation of microwave engineering, Collins (Mc Graw Hill) 2nd Edition 1992
4. Microwave P.A. Rizzi, (Prentice Hall). 1st Edition 1998

Control Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Formulate mathematical model for physical systems and simplify representation of complex systems using reduction techniques.
- Use standard test signals to identify performance characteristics of first and second-order systems.
- Apply root locus technique for stability analysis.
- Analyse performance characteristics of system using Frequency response methods.

Section A

Open loop and closed loop systems, servomechanism, mathematical model of systems, differential equations and transfer functions, Block diagram algebra, signal flow graphs; +ve and -ve feedback effects of feedback.

Standard test signals, time response of first and second order systems, steady state errors and error constants, Design specifications of second order systems.

Section B

Effects of derivative and integral error compensation, PID controller, Design considerations for higher order systems in brief, performance indices.

Concept of stability, necessary conditions for stability, Routh Hurwitz stability criterion, relative stability criterion, relative stability in terms of Routh Hurwitz criterion; Root-locus technique.

Correlation between time and frequency response specifications; Frequency domain plots, polar plots.

Section C

Bode plot, log magnitude versus phase plots; Gain-margin, Phase-margin, Nyquist stability criterion; Constant-M and constant-N circles; closed loop frequency response from these.

Preliminary considerations of classical design, cascade and feedback compensation, time-domain design using lag, lead and lag lead compensation, frequency domain design using lag.

State Variable model and solution of state equation of LTI systems.

Recommended Books:

2. Nagrath, I. J. (2006). *Control systems engineering*. New Delhi: New Age International.
2. Ogata, K., & Yang, Y. (2002). *Modern control engineering* (Vol. 4). India: Prentice hall.

Suggested e-resource:

1. **Control System** by Prof. S. D. Agashe, Indian Institute of Technology, Bombay.
<https://nptel.ac.in/courses/108101037/>

ANTENNA AND RADAR

Section A

Introduction to antennas, network theorems, directional properties of dipole antennas, traveling wave antenna & effect of point of feed on standing wave antenna, two element array, linear array, multiplication of patterns, effect of earth on vertical patterns, binomial array, antenna gain, effective area, antenna terminal impedance, antenna as spread out transmission line, transmission loss between antenna.

Section 8.01 Section B

Practical antennas: Hertz and Marconi antenna, antenna losses, effects of antenna height, electrically short antennas, wave antenna, medium and high frequency antenna, half wave dipole or dipole antenna, harmonic, rhombic, V, inverted V, traveling wave antenna, loop antennas, folded dipole, yagi-uda, horn, biconical, helical, slot, notch, frequency independent and microwave antennas. Antenna measurements.

Section C

Radio-wave propagation, phenomena and problems encountered in practice: effect of earth and atmosphere in radio waves. Physical principles & basic equations of radar, pulsed, continuous wave and pulsed Doppler radar, antenna systems, transmitters, detection theory, waveform considerations including pulse compression, principle of synthetic aperture radar, propagation clutter, and airborne radar.

References:

1. Electromagnetic - John D. Kraus [Mc Graw Hill.]
2. Electromagnetic Engineering. –William, Hayt Mc Graw Hill.]
3. Electromagnetic Fields & Radiation Systems -Jordan & Balmain [PHI.]
4. Elements of Electromagnetic - Sadiku [Oxford University Press.]
5. Introduction to radar systems, 3rd Ed, Merrill. I. Skolnik, Mc-Graw-Hill.
6. Radar handbook, 2nd Ed, Merrill. I. Skolnik, Mc-Graw-Hill, 1990.
7. Antenna and wave propagation by K. D. Prasad.

Fiber Optics and Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Explain the light propagation through optical fibers.
- Explain the various light sources and optical detectors.
- Design fiber optic transmitter and receiver system.

Section A

Fiber optics: Introduction, optical fibers -geometrical Optics description, wave propagation, fiber modes, step index, graded index single and multimode fibers, dispersion, limitation on bit rate, fiber bandwidth, fiber loss, fiber manufacturing: design issue, fabrication methods, cables and connectors, fiber splicing and fiber couplers.

Section B

Optical Sources and detectors: Light-Emitting diodes: LED characteristics, modulation response, LED structures. Semiconductor Lasers: structures, Laser characteristics, single longitude mode operation, DFB and VCSEL laser, Receivers: photo detector design: P-N, PIN, Schottky barrier and Avalanche photodiode, Phototransistor, receiver noise: noise mechanisms in PIN and APD receivers, Receiver structures.

Section C

Optical Fiber Systems: optical transmitter circuit: source limitations, LED and Laser drive circuits, Optical receiver circuit, system design considerations, Digital systems, Digital optical receiver, BER, Optical power budgeting, rise time budget, line coding, analog systems: Direct intensity modulation, subcarrier intensity modulation, coherent systems, computer, sensor and military applications.

Recommended Books:

1. Agarwal, Govind. P. (2007). *Fiber-Optic Communication Systems*. New Delhi: Wiley India.
2. Senior, John.M. (2009). *Optical Fiber Communication Principles & Practice*. New Delhi: PHI Publication.
3. Bhattacharya, Pallab. (2002). *Semiconductor Optoelectronics Devices*. New Delhi: PHI Publication.
4. Keiser, Gerd. (1991). *Optical Fiber Communication*. New Delhi: McGraw Hill Publication.

Fiber Optics and Communication Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes: After completion of this laboratory course, students will be able to:

- Understand the characteristics of an optical fiber and LED.
- Understand and measure the basic properties of propagation of light in dielectric Optical fibre including losses, attenuation and coupling.
- Explain the working of optical power meter and various sensors.

List of experiments:

1. To study Analog Link.
2. To study Digital link.
3. To measure Numerical aperture.
4. To study Propagation Loss.
5. To study Bending Loss.
6. To study EYE Pattern.
7. To calculate BER.
8. To study the characteristics of optical source.
9. To study the characteristics of Optical detector.

VLSI Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Explain the basic theory of crystal growth, wafer fabrication and IC fabrication technology.
- Explain the different VLSI design styles, overview of ICs and fabrication steps of MOS, CMOS and BJT.
- Design and analyse the output characteristics of different MOS inverters
- Design combinational and sequential circuit.

Section A

Recapitulation of basics, semiconductor devices, orientation effect, impurities, defects, Fabrication: Crystal growth & wafer preparation, Epitaxial growth, oxidation, photo-lithography, etching technology (wet & dry), Diffusion Fick's law, chemical vapor deposition, CVD reactors, ion implantation, metallization & patterning, photo resistive material, packaging.

Section B

Overview of VLSI methodologies, VLSI design flow, type of ICs (monolithic, thick film, thin film, hybrid), Fabrication steps involve in, different type of resistors, capacitor, diode, transistor (Darlington etc), JFET, MOSFET, isolation technique used in fabrication, fabrication of typical circuits.

Section C

Digital CMOS circuit, MOS devices, V-I characteristics, Design & detailed analysis of MOS inverters (resistive load, enhancement load, depletion load, CMOS), delay & power analysis, Design layout of simple CMOS gates. Circuit implementation of combinational circuit, circuit implementation of sequential circuits - FFs, SRAM, DRAM.

Recommended Books:

1. Sze, S.M.(2017). *VLSI Technology*. New Delhi: TMH Publications.
2. Kang, S.M., &Leblebici, Y. (2002). *CMOS digital Integrated Circuits Analysis & Design*. New Delhi: McGraw Hill Publications.
3. Botkar, K. R. (2004). *Integrated Circuits*. New Delhi: Khanna Publishers.
4. Gandhi, S.K. (1994). *VLSI Fabrication Principle Silicon and Gallium Arsenide*. New Delhi: Willey Publications.
5. Plummer, J., Deal, M., & Griffin, P. (2000). *Silicon VLSI Technology: Fundamentals, Practice and Modeling*. New Delhi: Pearson Publications.
6. Sarrafazadeh, M.,& Wong, C.K. (1996). *An introduction to VLSI Physical Design*. New Delhi: McGraw Hill Publication.
7. Ken, Martin. (1999). *Digital Integrated Circuits Design*. New York, United State: Oxford University Press.
8. Neil, H.E., Weste, &Eshraghian, Kamran (1994). *Principle of CMOS VLSI Design*. Boston, New York: Addison Wesley Publication.

Suggested E-Resources:

1. **VLSI Circuits** by Prof. S. Srinivasan, Department of Electrical Engineering, IIT-Madras.
<https://nptel.ac.in/courses/117106092/1>
2. **VLSI Technology** by Dr. Nandita Das Gupta, Department of Electrical Engineering, IIT-Madras.
<https://nptel.ac.in/courses/117101058/>

VLSI Design Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Learning Outcomes: After completion of this laboratory course, students will be able to:

- Use VHDL for design of digital circuits
- Model complex digital systems at several level of abstractions; behavioral and structural, synthesis and rapid system prototyping.
- Develop and simulate register-level models of hierarchical digital systems

List of experiments:

1. Write a program for the implementation of half adder and Full adder.
2. Write a program for implementing half subtractor and full subtractor.
3. Write a program for implementing MUX 4x1 and DEMUX (1X4)
4. Write a program for implementing Encoder and Decoder.
5. Write a program to implement gray code to binary code converter and vice versa.
6. Write a program to implement COMPARATOR.
7. Write a program for the implementation of S-R Flip flop and D Flip flop.
8. Write a program for the implement up-counter and down-counter.
9. Write a program to design JK Flip-flop and write design summary
10. Write a program to design T Flip-flop and write design summary

Mobile Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- To understand the various generations of mobile communications and basics of wireless communication
- To understand the concept of cellular communication
- Can test mobile communication equipment for the technical functionality
- Knowledge of GSM mobile communication standard, its architecture, logical channels, advantages and limitations

Section A

Introduction to Wireless Communication System: Evolution of mobile radio communication, Mobile radiotelephony in U.S Mobile radio system around the world, second generation (2G) cellular network, evolution to 2.5G wireless network evolution for 2.5G TDMA standards, third generation (3G) wireless network. The Cellular concept- System design fundamentals, frequency reuse channel, assignment strategies. Hand off strategies Interference and system capacity, improving coverage and capacity in cellular system.

Section B

Propagation model and Spread Spectrum Modulation Techniques: Longley rice model, kumara model hata model pcs extension to hata model, wolfish and betony model, Pseudo Noise (PN) sequence,. Direct sequence spread spectrum (DSSS), frequency hopped spread spectrum (FHSS). Multiple Access Techniques for Wireless Communication, Introduction to multiple access. Frequency division multiple access (FDMA) Time division Multiple access (TDMA).

Section C

Spread spectrum multiple access. Packet Radio. Global System for Mobile Communication, channel types, Example of a GSM cell. Frame structure of GSM, Data over low power wireless Re-cordless Network.

Recommended Books:

1. Rappaport, Theodore. S. (2014) *Wireless Communication*. New Delhi: Pearson Publication.
2. Pandya, Raj. (1999). *Mobile and Personal Communication System and Services*: New Delhi: PHI Publication.
3. Goddman, David.J. (1997). *Wireless Personal Communication System*:Addition Wesley Publication.
4. Tesal, Joachim. (1997). *GSM cellular Radio*: New Delhi: John Wiley Publication

Suggested E-Resources:

1. **Wireless Communications** by Prof. Dr.Ranjan Bose, Department of Electrical Engineering, IIT Delhi.

<https://nptel.ac.in/courses/117102062/>

Satellite Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Identify the fundamentals of orbital mechanics, the characteristics of common orbits used by communications and other satellites.
- Understand the systems required by a communications satellite to function and the trade-offs and limitations encountered in the design of a communications satellite system.
- Understand the radio propagation channel for Earth station to satellite and satellite to satellite communications links, and the basics of designing antenna systems to accommodate the needs of a particular satellite system.
- Understand how analog and digital technologies are used for satellite communications networks and the topologies and applications of those networks, as well as the comparison to alternative communications systems.

Section A

Elements of Satellite Communication, Orbital mechanics, look angle and orbit determination, launches & launch vehicle, orbital effects, Geostationary Orbit, Satellite subsystems, attitude and orbit control systems, TTC&M, communication subsystem, satellite antenna, satellite link design: basic transmission theory, system noise temperature and G/T ratio, downlink design, uplink design, satellite systems using small earth station, design for specified C/N.

Section B

Modulation and multiplexing techniques for satellite links: FM, pre-emphasis and de-emphasis, S/N ratios for FM video transmission, digital transmission, digital modulation and demodulation, TDM. Multiple access: FDMA, TDMA, DAMA and CDMA.

Section C

Error control for digital satellite links: error detection and correction, channel capacity, error control coding, convolutional codes, linear and cyclic block codes. Propagation effects and their impact on satellite-earth links: attenuation and depolarization, atmospheric absorption, rain, cloud and ice effects etc. Introduction of various satellite systems: VSAT, low earth orbit and non-geostationary, direct broadcast satellite television and radio, satellite navigation and the global positioning systems.

Recommended Books:

1. Bostian, Charles., Pratt, Timothy., & Allnutt, Jeremy. (2006). *Satellite Communications*. New Delhi: John Wiley & Sons.
2. Maral G., Bousquet M., Sun Z. (2010) *Satellite Communications Systems : Systems, techniques and technology*, 5th edition, , John Willy and sons.
3. Roddy, Dennis. (2017). *Satellite Communications*. New Delhi: McGraw-Hill Publication
4. Ha, Tri. T. (1990). *Digital Satellite Communications*. New Delhi: McGraw-Hill Publication

Suggested e-resources:

1. **Satellite Communication Systems** by Prof. Kalyan Kumar Bandyopadhyay Department of Electronics and Electrical Communication Engineering Indian Institute of Technology, Kharagpur. <http://textofvideo.nptel.ac.in/117105131/lec1.pdf>
2. **Satellite Link Design** by Dr. Marwah Ahmed. <https://net425site.files.wordpress.com/2017/02/net-425-d-feb-2016-lec-5.pdf>

Biomedical Instrumentation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- To describe the origin of biopotentials and explain the role of biopotential electrodes;
- To inspect common biomedical signals and distinguish characteristic features;
- To identify common signal artifacts, their sources and formulate strategies for their suppression;
- To outline the design of cardiac pacemakers, neurostimulators and defibrillators;
- To explain and contrast measurement principles for blood flow, pressure and volume as well as respiratory variables
- To define and discuss biochemical sensors; and identify, explain and judge patient safety issues related to biomedical instrumentation.

Section A

Electrode electrolyte interface, half-cell potential, polarization and non-polarisable electrode electrode-metal micropipette Ag-Cl electrodes Microelectrodes, skin surface electrode, and lead for EG, ECG EMG Transducer for biomedical applications, factors governing the selection of transducer pressure temperature, flow, biomedical ultrasonic transducer.

Section B

Noise preamplifier, main amplifier and driver amplifier, inkjet recorder thermal array recorder, photographic recorder, magnetic tape recorder, X-Y recorder, medical oscilloscope pH, PO, PCO₂, PHCO₃, Electrophoresis colorimeter, spectrophotometer, flame photometer, auto analyzer.

Section C

Respiration, heart rate, temperature, pulse blood pressure, cardiac output O₂, CO₂ measurements. Measurement of blood pressure, blood flow, and heart sound, cardiograph: Phonocardiography, vector cardiography, Echocardiography pacemaker. Defibrillators, Ventilator, Computer patient monitoring system.

Text Book:

1. Cromwell, L. (2015). *Biomedical Instrumentation and measurement* (2nd ed.). New Delhi: Pearson Education India.

Reference books:

1. Webster, J. G. (2015). *Medical Instrumentation Application and Design* (4th ed.). New York: John Wiley and sons.
2. Khandpur, R.S. (2014). *Handbook of Biomedical Instrumentation* (3rd ed.). New Delhi: Tata McGraw-Hill.
3. Carr, J. J. & Brown, J. M. (2002). *Introduction to Biomedical equipment Technology* (4th ed.). New York: John Wiley and sons.

e-Resources:

1. <https://nptel.ac.in/courses/108105101/>
2. <https://nptel.ac.in/courses/117108037/15>
3. <https://ocw.mit.edu/courses/materials-science-and-engineering/3-051j-materials-for-biomedical-applications-spring-2006/>
4. <https://ocw.mit.edu/courses/health-sciences-and-technology/hst-590-biomedical-engineering-seminar-series-developing-professional-skills-fall-2006/>

Optical Network

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of the course, student will be able to:

- Describe the important components such as multiplexer, filters.
- Explain the multiplexing technique
- Explain the signalling and routing of WDM network elements
- Describe the protection technique in SONET/SDH and IP network

Section A

Introduction to Optical Networks, Characteristics of Optical Fiber (Emphasis on Non Linear Characteristics) Timing & Synchronization, Components: Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Tunable Lasers, Switches, Wavelength Converters, Networks SONET/SDH, Multiplexing, SONET/ SDH Layers, Frame, Structure, Frame Structure, Physical Layer, Elements of a SONET/SDH Infrastructure

Section B

ATM : Functions of ATM, Adaptation Layers, Quality of Service, Flow Control, Signaling and Routing, WDM Network Elements, Optical Line Terminals, Optical Line Amplifiers, Optical Add/ Drop Multiplexers, Optical Cross Connects, WDM Network Design, Cost Trade-offs, Light path Topology Design, and Routing and wavelength assignment problems, Dimensioning Wavelength Routing Networks,

Section C

Network Survivability Basic Concepts, Protection in SONET/SDH, Protection in IP networks, Optical Layer Protection, Different Schemes, Interworking between Layers

Access Networks, Network Architecture Overview, Enhanced HFC, FTTC, Optical Switching, OTDM, Synchronization, Header Processing, Buffering, Burst Switching. Deployment Considerations

Recommended Books:

1. Ramaswami, Rajiv.,& Sivarajan, Kumar. N.(2009). *Optical Networks: A Practical Perspective*. San Francisco, California: Morgan Kaufmann Publisher.
2. Uysell, Black. (2009). *Optical Networks Third Generation Transport Systems*: New Delhi: Pearson Publication.
3. Tanenbaum, Andrew. S. (2010). *Computer Networks*. New Delhi: Pearson Publication.
4. Murthy, C. Siva Ram.,&Gurusamy Mohan. (2001). *WDM, Optical Networks Concepts, Design & Algorithms*. New Delhi: Pearson Publication.

Suggested e-resources:

1. **Introduction to Optical Networks** by Yatindra Nath Singh, Department of Electrical Engineering, Indian Institute of Technology, Kanpur. <http://home.iitk.ac.in/~yensingh/seminars/OptNets.pdf>
2. **Optical Networks and Switching Systems** by Prof. Yatindra N Singh, Department of Electrical Engineering Indian Institute of Technology, Kanpur. <https://nptel.ac.in/syllabus/117104021>

Analytical Instrumentation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

The Students will be able to:

- To understand the basic principles & importance of Analytical Instruments in industrial process plants
- To understand the use of block diagrams for the design of analytical and industrial instruments.
- To understand the importance and application of various chromatographic techniques.
- To understand the importance of Environmental Pollution monitoring instruments.

Section A

UV-Visible Spectroscopy: Introduction, Electromagnetic Radiation and Spectrum, Beer's Law, Atomic techniques- emission, absorption and fluorescence, Radiation Sources: Continuum Sources, Line Sources and Laser Sources. Wavelength selectors: Optical Filters and Monochromators, Sample Holder, Radiation Detectors: Photon Transducers (Phototube, Photo voltaic cell and Photomultiplier tube) and Thermal Transducers (Thermocouple, Bolometer, Pyroelectric transducer). Colorimeters. Block diagram of Single Beam and Double Beam Spectrophotometer. Infrared Spectroscopy: IR Sources and detectors, Types of IR spectrophotometers, FT-IR Spectrometer, Dispersive Spectrometry using monochromators.

Section B

Spectroscopic Analysis: Mass Spectrometers, X-Ray Spectrometer, Photo-Acoustic Spectroscopy, Flame Spectrometer, NMR Spectrometer.

Liquid Analysis: pH meter, Conductivity meter, dissolved oxygen analysis, Polarography- Apparatus, Circuits techniques-pulse polarography and applications, Electrodes-Ion Selective, Molecular selective types-their variations and application.

Gas Analysis: Paramagnetic Oxygen Analyzer, Thermal Conductivity Analyzer, Infrared Gas Analyzer, Chemiluminescence Analyzer.

Section C

Chromatography: Basic parts of Gas Chromatography, Types of Columns, Detection Systems: thermal conductivity. Flame ionization, Electron capture detector. Liquid Chromatography: Types of Liquid chromatography (Paper and Thin Layer). Types of columns and detection systems of Liquid Chromatography.

Environmental Pollution Monitoring: Air pollutants, Air pollution monitoring instruments-carbonmonoxide, sulphur dioxide, nitrogen oxide, hydrocarbon and ozone. Smoke monitor, Dust monitor, visible emission monitoring system.

Text Books:

1. R.K. Jain, "Mechanical and Industrial Measurements", Khanna Publications
2. R.S.Khandpur, "Handbook of Analytical Instruments", TMH New Delhi.
3. D.A. Skoog, "Principles of Instrumental Analysis", Saunders College Publishing, Philadelphia.

Reference Books:

1. H. H. Williard, L. L Meritt, J.A. Dean and F.A. Settle, "Instrumental Methods of Analysis", CBS Publishers, Delhi.
2. D. Patranabis, "Principles of Industrial Instrumentation", TMH, New Delhi.

e-Resources:

1. <https://nptel.ac.in/courses/103108100/15>
2. <https://nptel.ac.in/courses/103108100/>
3. <https://ocw.mit.edu/courses/biological-engineering/20-309-biological-engineering-ii-instrumentation-and-measurement-fall-2006/>

Chemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcome:

On completion of course, the students will be able to:

- explain the basics of atomic structure and chemical bonding.
- explain the behavior of the system through phase, degree of freedom and component.
- explain the basics of electrochemistry, different type of corrosion and their prevention.
- differentiate nanoscience, nanotechnology, nanochemistry, conventional and non-conventional energy sources and their applications.

Section A

Atomic Structure:Schrodinger wave equation, significance of Ψ and Ψ^2 , quantum numbers, radial and angular wave function and probability distribution curves, shapes of *s*, *p*, *d* orbitals. Aufbau and Pauli principles, Hund's multiplicity rule, exchange energy, pairing energy, symmetrical distribution of charge, extra stability of half-filled and completely-filled orbitals, effective nuclear charge, shielding effect, Slater's rules for evaluation of shielding constant.

Chemical Bonding:Covalent bond: - resonance, valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shell electron pair repulsion (VSEPR) theory with reference to BF_3 , BF_4^- , NH_3 , H_2O , H_3O^+ , PCl_5 , SF_4 , ClF_3 , I_3^- , SF_6 , IF_7 , ICl_2^- , and POCl_3 ; MO theory, sigma, pi and delta molecular orbitals, homonuclear and heteronuclear (CO and NO) diatomic molecules and their ions.

Section B

Electrochemistry:Electric transport in electrolytic solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its uses and limitations, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), applications of conductivity measurement: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of sparingly soluble salt, conductometric titrations.

Phase Rule: Phase, component, degree of freedom or variance; phase diagram of one-component system: - water system, sulphur system, CO_2 system, phase rule for two-component system: - Pb-Ag system and its applications, reduced phase rule, eutectic point.

Corrosion:Definition and its significance, Mechanisms of corrosion: Chemical (Dry) corrosion and Electrochemical (Wet) corrosion, Protection from corrosion: Protective coatings, cathodic protection, sacrificial anode and modification in designs etc.

Section C

Water: Hardness of water, determination of hardness by Clark's test and Complex metric (EDTA) method, degree of hardness, numerical based on hardness and EDTA method, Softening of water by Lime-Soda Method, Permutit (Zeolite) Method and Deionization or Demineralization Method, Boiler troubles their causes, disadvantages and prevention, Formation of solids (Scale and Sludge), Carry over (Priming and Foaming), Corrosion and Caustic Embrittlement, Advanced methods of water starelization, Numerical problems based on Lime-Soda and Zeolite softening methods

Organic Electronic Materials: Including conducting polymers- poly (p-phenylene), polythiophenes, Polyphenylenevinylenes, polypyrroles, polyaniline.

Optical Fibers- Introduction, properties, preparation, optical fiber grade glass and uses.

Nano-chemistry- Introduction, Size dependent properties, Synthesis (bottom-up and top-down method) and Applications of nanomaterials, Future prospective of nanomaterials.

Non-conventional Energy: Introduction of solar energy, Application of solar energy, Photovoltaic cell, conversion of solar energy, silicon, bio-fuel and biomass, Superiority of non-conventional source of energy over conventional energy.

Recommended Books:

1. B.R. Puri and L.R. Sharma & K.C. Kalia (2017), *Principles of Inorganic Chemistry*, 33rd Ed., Vishal Publications.
2. L.R Sharma, M.S Pathania B.R Puri and Navjot Kaur (2018), A Textbook of Physical Chemistry, Vishal Publications.
3. W. U. Malik, G.D.Tuli & R. D. Madan (2010), *Selected Topics in Inorganic Chemistry*, Revised Ed., S. Chand Publications.
4. Gurdeep Raj(2014), *Advanced Physical Chemistry*, goel publications.
5. J.D. Lee (1998), *Concise Inorganic Chemistry*, 5th Ed, Oxford Publications.
6. F. A. Cotton and G. Wilkinson (1994), *Basic Inorganic Chemistry*, 3rd Ed., John Wiley Publications.
7. P. Bhagchandani (2017), *Inorganic Chemistry*, Sahitya Bhawan Publications.
8. S.S. Dara and S.S.Umare (2004), Textbook of Engineering Chemistry, S. Chand Publications.

Suggested e-Sources:

1. National Programme on Technology Enhanced Learning
<https://nptel.ac.in>
2. Online Chemistry Courses
<https://www.edx.org/learn/chemistry>
3. Free Online Education SWAYAM
<https://swayam.gov.in>

Linear Algebra

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students will be able to:

- Define basic terms and concepts of matrices, vectors and complex numbers
- Use basic vector space concepts such as linear space, linear dependence, basis, dimension, linear transformation;
- Be familiar with the concepts of eigenvalue, eigenspace and eigenvector and know how to compute these objects;
- Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to diagonalise matrices when this is possible; discriminate between diagonalizable and non-diagonalisable matrices.
- Use gauss-jordan elimination to solve systems of linear equations and to compute the inverse of an invertible matrix

Section A

Vectors, Algebra of vectors, vector spaces, subspaces, Linear sum and direct sum of subspaces, Linear combination, Linear span, Linear dependence and independence of vectors and its properties. Basis and dimension of vector space and subspace. Linear mappings, Kernel and Range of linear mapping, Singular and non-singular mappings.

Section B

Linear operator, Algebra of linear operators, Invertible operators, Matrix representation of a linear transformation, Change of basis, Range, rank and Kernel, nullity of a matrix, Elementary transformations, Matrix inversion with elementary transformations, Normal form of a matrix, System of linear equations.

Section C

Characteristics polynomial of a matrix, Characteristics values, Characteristics vector, Cayley-Hamilton theorem, Diagonalization of Matrices, Properties of characteristic values and characteristic vectors of Hermitian, skew-Hermitian, Unitary and Normal matrices (including Symmetric, Skew-symmetric and Orthogonal matrices).

Inner product spaces, Orthogonality, Orthogonal sets and bases, Gram-Schmidt orthogonalization process.

Suggested Books:

1. Axler, S. J. (1996). *Linear algebra done right*. New York: Springer.
2. Krishnamurthy, V., Mainra, V. P., & Arora, J. L. (1976). *An introduction to linear algebra*. New Delhi: East-West Press.
3. Friedberg, S. H., Insel, A. J., Spence, L. E., & Thiel, L. (2017). *Linear algebra*. Pearson Education.
4. Halmos, P. R. (2013). *Linear Algebra Problem Book*. Cambridge: Cambridge University Press.
5. Kumaresan, S. (2000). *Linear Algebra: A Geometric Approach*. New Delhi: Prentice-Hall (India).

Suggested E-learning material:

1. Lecture notes on linear Algebra
<https://nptel.ac.in/downloads/111102011/>
2. Videos on Linear Algebra topics
<http://web.mit.edu/18.06/www/videos.shtml>

Applied Optics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcome:

After completion of the course students will be able to:

- Appreciate the efficacy of Fourier transforms and their application to physical systems.
- Understand linear, time-invariant systems.
- Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems
- Understand dispersion in waves and model dispersion using Fourier theory.
- Understand diffraction and imaging in terms of Fourier optics and gain physical and intuitive insight in a range of ph

Section A

Wave Optics- Interference: Superposition of Waves, Theory and method of measurement of wavelength of light and thickness of a thin transparent plate using Fresnel's Bi-prism, Interference in thin films, Newton's rings, Michelson's Interferometer,

Diffraction I: Fraunhofer's diffraction due to single slit, two parallel slits and N slits.

Section B

Diffraction II: Diffraction by plane transmission Grating (PTG), Characteristics of Grating Spectra, Measurement of Wavelength of light using PTG, Concept of resolving power, Rayleigh's criterion of resolving limit, Resolving power of a Grating, Diffraction of X-rays and Bragg's law.

Polarization: Production and detection of plane, Circularly and elliptically polarized light, theory of the polarized light, Optical Activity, Fresnel's Explanation for optical rotation, Measurement of Specific rotation of a cane sugar solution using a Half Shade and a biquartz device polarimeter.

Section C

Modern Optics-Lasers : Spontaneous & Stimulated Emission, Einstein's Coefficient, Criterion of Laser action, Ruby and He-Ne Lasers, Characteristics of Laser light, Application of Laser with special emphasis on Holography.

Optical Fiber: Elementary idea of optical fiber, Light wave communication using optical fibers, Types of optical fibers, Step Index (Single mode and Multi mode) and Graded Index fiber, Light Propagation through optical fiber,

Ray Optics: Critical angle, Total internal reflection, Acceptance angle, Numerical aperture of an optical fiber.

Suggested Readings:

1. Prakash S., Verma A. S., Gupta S. K. and Alvi P. A. (2015) A textbook of Optics and Modern Physics, Pragati Prakashan Meerut.
2. Allen S. R. (1997) An introduction to Fiber Optics, PHI
3. Seth S. P. (2007) Elements of Electromagnetic Field, Dhanpat Rai & Company.
4. Ghatak A. (2005) Optics, Tata McGraw hill publication
5. Beynon (1996) Introductory University optics, Prentice Hall of India Pvt. Ltd.
6. Thyagarajan and Ghatak (1981) Lasers Theory and Applications: Macmillan India Ltd
7. Senior John M. (2005) An introduction to Fiber Optics, PHI
8. Sadiku M. N. O (2007) Elements of Electromagnetics, Oxford University Press.

Suggested E-Learning Materials:

1. <https://nptel.ac.in/course.php>

Engineering Mechanics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcome:

After completion of the course students will be able to:

- Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.
- Students will show that they have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyze the measurements to draw valid conclusions.
- Students will be capable of oral and written scientific communication, and will prove that they can think critically and work independently

Section A

System of forces, Fundamental laws of mechanics, Composition of forces, Free body diagram, Lami's theorem, Moments and couple, Varignon's theorem, Condition of equilibrium, Types of support and loading, Reaction, Analysis of simple trusses by methods of joints and methods of sections. The laws of Coulomb friction, Ladder, wedges, Belt friction and rolling, Principle of virtual work and its applications.

Section B

Location of centroid and center of gravity, area moment of inertia, mass moment of inertia law of mechanics, Variation of mechanical advantages, efficiency, reversibility of machine Pulleys, wheel and axle, wheel and differential axle, Transmission of power through a belt and rope, Moment of inertia of masses- Transfer formula for mass moments of inertia- Mass moment of inertia of composite bodies.

Section C

Kinematics of a Particle: Rectilinear motion, plane curvilinear motion, Projectile motion, Constrained motion of connected particles.

Dynamics of Particles and Rigid Body: Newton's Law of motion, D'Alembert's principle.

Work & energy: Work, Energy (Potential, kinetic and spring), Work-Energy relation, Law of conservation of energy,

Impulse & momentum: Impulse, momentum, Impulse-momentum relation, Impact

Vibration: Definitions, Concepts- simple harmonic motion-free vibrations-simple and compound pendulums-torsional vibrations.

Suggested Books:

1. Kumar D. S. (2009) Engineering Mechanics, Laxmi Publication
2. Dubey N. H (2015) Engineering Mechanics, McGraw Hill Edu
3. Sharma M. (2009) Engineering Mechanics, CBH
4. Sharma (2009) Mechanics, Pearson

Suggested Web Resources:

1. <https://nptel.ac.in/course.php>

Applications of Remote Sensing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Identify the potentials of remote sensing in allied sectors.
- Describe trends in remote sensing applications.
- Apply remote sensing technology in natural resource and disaster management.
- Explain basics about Environmental Impact Assessment (EIA).

Course Content:

Section A

Introduction

Emergence of Remote Sensing technology in application areas, Understanding potentials of Remote Sensing in Defence Applications, Indian satellite missions with focused applications, recent trends in Remote Sensing applications.

Application in Land and Water Resource

Remote sensing in mapping Land use / land cover classification and monitoring, Crop forecasting, Forest resources management, soil taxonomy and degradation, geomorphology and surface mining on land resources, groundwater modelling, Water quality Monitoring, Reservoir sedimentation, Snow covers mapping and modelling approaches.

Section B

Application in Climate Change and Disaster Management

Concept of climate and weather, Climatic classification, Paleo-climate, Adaptation and vulnerability, mapping of landslide, Floods, Cyclones, Forest fire and Drought.

Application in Urban Planning

Mapping urban land use, Urban sprawl, Site selection for urban development, Urban Information System, Urban master plans, urban green spaces, 3 D city modelling, SMART city

Section C

Application in Geo-Technical Engineering

Digital Terrain Modelling, Geoinformatics in water harvesting site selection, Highways and Tunnel alignment studies.

Application in Environmental Management

Selection of disposal sites for industrial and municipal wastes, Solid waste management, Environmental Impact Assessment (EIA).

Recommended Books:

1. Jenson, J. R. (2000). *Remote Sensing of the environment-An Earth Resource Perspective* (2nd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
2. Joshi, P. K., & Singh, T. P. (2011). *Geoinformatics for Climate Change Studies*. New Delhi, India: TERI Press.

3. Joshi, P. K., Pani, P., Mohapatra, S. N., & Singh, T. P. (2010). *Geoinformatics for Natural Resource Management*. New Delhi, India: Nova.
4. Lillesand, T. M., Kiefer, R. W., & Chipman, J. (2015). *Remote Sensing and Image interpretation* (7thed.). New York, NY: John Wiley & Sons.
5. Roy, P. S., Westen, C. J. V., Jha, V. K., Lakhera, R. C., & Ray, P. K. C. (Eds.). (2000). *Natural disasters and their mitigation: a remote sensing perspective*. Dehradun, India: IIRS.
6. Schultz, G. A., & Engman, E. T. (2000). *Remote Sensing in Hydrology and Water Management*. Berlin, Germany: Springer.

Suggested e-learning materials:

1. Applications Guide
<https://www.itc.nl/ilwis/applications-guide/>
2. Data & Products
<http://glcf.umd.edu/data/>
3. Bhuvan Portal
<http://ww12.bhuvan.com>
4. Data & Products
<https://earthexplorer.usgs.gov/>
5. Meteorological and Oceanographic Satellite Data Archival Centre
<https://www.mosdac.gov.in/>
6. National Information System for Climate and Environment Studies
<https://nrsc.gov.in/nices>
7. Agriculture Practices
<https://nptel.ac.in/courses/126104002/>
8. Water Resources Information System
http://www.indiawris.nrsc.gov.in/wrpinfo/index.php?title=Main_Page

Applied Statistics and Research Methodology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Formulate research problems using geo-statistical methods.
- Apply statistical knowledge to the geospatial variability.
- Define research problems and selection of survey methods.
- Writing project proposal for various funding agencies.

Course Content:

Section A

Data Distribution and Basic Statistics

Scope and importance of statistics, Source of data-primary and secondary, Collection of data-sampling methods; Random and systematic method; Organization of data-array, Frequency, Class intervals, Histograms, and distribution, Presentation of data-Tables, Diagrams; Geometric form (Bar diagrams, Pie-diagrams), Frequency diagrams (histogram, polygon), Arithmetic line graphs (time series graph); Data grouping, Geographical data-Discrete and continuous series, Scales of measurement, Measures of central tendency-Mean, Median, Mode, Quartiles, Arithmetic mean, Geometric mean, Harmonic mean, Quadratic mean and their interrelated relations; Measures of dispersion-Absolute dispersion (range, quartile deviation, mean deviation, standard deviation); Relative dispersion (Coefficient of quartile deviation, Coefficient of variation), Moments, Skewness, Kurtosis

Section B

Correlation, Probability and Hypothesis Testing

Correlation-meaning, Scatter diagram, standard deviation, Variance, Measures of Correlation-Karl Pearson's method (Two variables ungrouped data) Spearman's rank correlation methods.

Probability-Binomial, Normal, and Poisson distribution; Theory of Sampling - Sampling distributions of means and proportions, Standard errors, Confidence interval estimation for population means, Standard deviations, Testing of Hypothesis – Large and small sample test.

Basic Concept of Research Methodology

Definition of Research Problem, Identification of problems of regional and Local level, Considerations in selection of problem, Research process, Review of literature, Research objectives and research questions, Research scheme/design.

Section C

Data Collection, Analysis and Reports

Methods of data collection, Survey methods, Samples-Type and methods, Data processes and analysis, Reporting of results, References, Future scope of work.

Preparation of Research Projects

Writing of proposals, Objectives of project, Research hypothesis and design, Research Questions, Scope of project, Brain storming sessions, Finalization of methodology, Review of similar studies and present level of research, Time scheduling (PERT), Financial estimates, Submission of Proposal.

Project planning, Project activities/tasks, Feasibility, Resource requirements and allocation, Project management software, Project review, Project Completion-Quality assurance, Evaluation of individual tasks, Financial auditing, Problems and opportunities in Projects

Recommended Books:

1. Gupta, S. C., & Kapoor, V. K. (2000). *Fundamental of Mathematical Statistics* (10thed.). New Delhi, India: S. Chand.
2. Gupta, S. L., & Gupta, H. (2011). *Research Methodology Text and Cases with SPSS Applications*. New Delhi, India: International book House.
3. Kothari, C. R. (2004). *Research Methodology Methods and Technique* (2nded.). New Delhi, India: New Age International.
4. Meyer, P. L. (1970). *Introductory Probability and Statistical Applications* (2nded.). Washington, WA: Addison-Wesley.
5. Spiegel, M. R. (2011). *Theory and Problems of Statistics* (4thed.). New York, NY: McGraw Hills.

Suggested e-learning materials:

1. Sampling distribution
<https://nptel.ac.in/courses/111105041/23>

Digital Image Processing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Explain sources of image degradation and their rectification.
- Describe various filtering operation and multispectral image enhancement techniques.
- Describe geospatial data dimensionality reduction techniques for fast and effective interpretation of the image variables.
- Describe utilization of artificial intelligence techniques for solving problems related to environmental monitoring and management.

Course Content:

Section A

Basic Principles

System design considerations, Sources of image degradation, Radiometric errors and corrections: Types of atmospheric correction - absolute and relative; atmospheric correction for hyperspectral imagery. Slope and aspect induced errors: topographic corrections - Minnaert method. Geometric errors and corrections: Interpolation: Spatial and Spectral. Image Enhancement techniques: Contrast stretching: Linear and non-linear methods.

Section B

Multi-Band Enhancement Techniques

Image gradient, thresholds and segmentation. Image Filtering: LPF, HPF, Directional, non-directional, Gradient, and Statistical filters, Edge detection, Band Ratio/Indices: vegetation, water, snow, and built-up indices; Factors affecting development of band indices. Principal Component Analysis, Tasseled Cap Analysis. Image Texture analysis: Gray-Level Co-occurrence Matrix (GLCM). Frequency component, Fourier Transformation.

Pattern Recognition

Concept of Multi-spectral pattern recognition, Image Classification: Concepts, Spectral discrimination, Classifiers: Parametric and Non-Parametric; Methods: Unsupervised, Supervised, Object-oriented, and knowledge base classification; Accuracy Assessment: $\bar{K}$ statistics. Multi-temporal information extraction: concepts and considerations. Change detection analysis.

Section C

Advanced Techniques

Artificial intelligence and Machine Learning: concepts, techniques: Fuzzy logic, Artificial Neural Networks (ANN), Genetic Algorithms (GA). Image Fusion. Imaging spectroscopy for vegetation, Martian and Lunar surfaces: Mineral Spectra Extraction: concepts and considerations. LiDAR: Principles, Types, LiDAR Intensity, and Processing of LiDAR data. Terrestrial Laser Scanning (TLS).

Recommended Books:

1. Campbell, J. B., & Wynne, R. H. (2011). *Introduction to Remote Sensing* (5thed.). New York, NY: The Guilford Press.
2. Cracknell, A. P., & Hayes, L. (2007). *Introduction to remote sensing* (2nded.). Boca Raton, FL: CRC Press.
3. Dong, P., & Chen, Q. (2018). *LiDAR Remote Sensing and Applications*. Boca Raton, FL: CRC Press.
4. Jensen, J. R. (2007). *Remote Sensing of the Environment-An Earth Resources Perspective* (2nded.). Upper Saddle River, NJ: Pearson Prentice Hall.
5. Jensen, J. R., (2004). *Introductory Digital Image Processing: A Remote Sensing Perspective* (4thed.), Glenview, IL: Pearson Education.
6. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote Sensing and Image Interpretation* (7thed.). New York, NY: John Wiley & Sons.
7. Rencz, A. N., & Ryerson, R. A. (Eds.). (1999). *Manual of Remote Sensing: Remote Sensing for the Earth Sciences* (3rd ed. vol. 3). New York, NY: John Wiley & Sons.
8. Sabins, F. F. (2007). *Remote Sensing: Principles and Interpretation* (3rded.). Long Grove, IL: Waveland Press.
9. Shan, J., & Toth, C. K. (2018). *Topographic Laser Ranging and Scanning- Principles and Processing* (2nded.). Boca Raton, FL: CRC Press.
10. Tso, B., & Mather, P. M. (2009). *Classification methods for Remotely Sensed Data* (2nded.). Boca Raton, FL: CRC Press.

Suggested e-learning materials:

1. Image Processing
<http://geoinfo.amu.edu.pl/wpk/rst/rst/AppB/B4.html>
2. Fundamentals of Satellite Remote Sensing
<https://arset.gsfc.nasa.gov>
3. Digital Image Processing: Introduction to Object Recognition
<https://nptel.ac.in/courses/117105079/4>

Fundamentals of Geographic Information Sciences and Digital Cartography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Differentiate GIS and science of map making, non-spatial vs. spatial data.
- Georeference the Topomaps and imagery and handle geospatial database.
- Describe concepts of database management system within spatial analytical framework.
- Design and frame initial requirements for WebGIS development.

Course Content:

Section A

Fundamental Geographic Concepts for GIS

Basic concepts about spatial information: Brief history and definition of GIS, Manual mapping Vs GIS mapping, Geometrical feature and real word Pictures, Variables- Points, Lines and Areas, Network and Surface, Application and Trends of GIS including Desktop GIS, Mobile GIS, Web GIS. Basic Objectives and Component of GIS – details of hardware, software and management

Map and Map Projection

Basic Concept, Categories of maps, Interpretation of topographic maps, Coordinate system, Polar and Cartesian, Map projections, Grouping of map Projections-Conical projection, Cylindrical projection, Azimuthal Projection; Mercator, Transverse Mercator, Polyconic, Lambert and UTM.

Geographical Data, Model and Data Input

Conceptual models of real world phenomena, Geographical data models; Fundamentals of data storage: entities or Fields, Information organization and data structure; Basic file structures, Tabular databases, Introduction to database system: Definition, Purpose, Data abstraction, Instances, Schema, Database Languages, database manager, RDBMS, keys. Advantages of databases, Types of Data Model-Hierarchical systems, Network systems, Relational systems and Object-oriented database systems (OODS); Entity relationship model, Attribute data query, SQL

Section B

Spatial Data Input and Editing

Spatial and Non-spatial data base, spatial data model: Geo relational Vector data model, Object based vector data model, Geodatabase, Raster data model, Hybrid relational database Vs Object orientation. Comparative analysis of spatial database, GIS data Requirement, sources and collection, Methods of data capture-scanning, digitization and associated errors; Conversion from other digital Sources, Attribute data input and management, creating digital data-remote sensing, GPS; data exchange; generating data from existing data; metadata; Different kinds of geospatial data, Topological relationships; Creation of topology and error correction, Edge matching, Data quality measurement and assessment, Digital output options.

Data Storage, Integration and Management

Data retrieval; Data compression; GIS and integration of other types of data; GIS and Remote Sensing data Integration, Image storage formats, Sources of errors in GIS database: Errors through processing, Errors associated with overlaying of polygons, Survey of available data, Public access to geographic information; Digital libraries, National & Global Standard - NSDI, GSDI; Global geospatial portals, OGC.

Section C

Introduction to Vector Data Analysis

Logical, Boolean, Arithmetical operation and function, Overlay operations (union and intersection), Feature base topological function –buffer, point in polygon, Layer based overlay analysis: Reclassification, point in polygon, line in polygon, polygon on polygon, (Eliminate, dissolve, clip, erase, split, identity, union and intersection)

Introduction to Raster Data Analysis

Raster Data base and structure, Local operations, Neighbourhood operations, Extended Neighbourhood, Zonal operations.

Recommended Books:

1. Burrough, P. A., & McDonnell, R. (1998). *Principles of Geographical Information Systems* (3rded.). New York, NY: Oxford University Press.
2. Chang, K. T. (2002). *Introduction to Geographic Information Systems* (3rded.). New Delhi, India: Tata McGraw Hill.
3. Clarke, K. C., Parks, B. O., & Crane, M. P. (Eds.). (2002). *Geographic Information Systems and Environmental modelling*. New Delhi, India: PHI Learning.
4. Drummond, J., Billen, R., Joao, E., & Forrest, D. (Eds.). (2006). *Dynamic and Mobile GIS*. New York, NY: CRC Press.
5. Harvey, F. (2008). *A Primer of GIS*. New York, NY: The Guilford Press.
6. Lo, C. P., & Yeung, A. K. W. (2005). *Concepts and Techniques of Geographic Information Systems* (2nded.). New Delhi, India: Prentice Hall India Learning.
7. Magwire, D. J., Goodchild, M. F., & Rhind, D. M. (1991). *Geographical Information Systems: Principles and Applications*. Harlow, England: Longman Scientific & Technical.

Suggested e-learning materials:

1. Introduction to GIS
<https://nptel.ac.in/courses/105102015/1>
2. Spatial Analysis
<https://nptel.ac.in/courses/105102015/25>
3. Introduction to geographic information systems, overlaying operations
<https://swayam.gov.in/courses/3691-introduction-to-geographic-information-systems>
4. Digital Elevation Models and Applications
<https://swayam.gov.in/courses/4395-digital-elevation-models-and-applications>
5. Interpolation
<https://nptel.ac.in/courses/105102015/14>

RS 505 GIS Programming and Scripting

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe object-oriented models and functional modeling in GIS Framework.
- Explain concepts of common language infrastructure and class library.
- Explain .NET and Python programming languages for geospatial tool development.
- Rationalize the concepts of WebGIS, Server, and geo-processing functionalities.

Course Content:

Section A

Introduction to Object Oriented

Introduction to Object Oriented modelling and Design; Definition object oriented (OO), Object modelling Concepts, OO methodology, OO themes, Introduction to OO modelling techniques: Modelling, modelling techniques, object model, Dynamic Model and Functional Model, relationship among models. Object Modelling: Object and Classes: Object modelling concepts in details: links, association, generalization, inheritance, metadata, etc. A sample Object Model.

Dynamic Modelling: Dynamic modelling concepts. A sample dynamic model, Relation of object and dynamic model with example. Functional Modelling: Functional Modelling Concepts, A sample functional model.

Section B

.NET Framework

Concept of .NET framework, Common Language Infrastructure, Base Class Library and Framework Class Library.

Visual Studio.NET – IDE, Languages Supported, Components. Visual Programming, VB.NET- Features, IDE-Menu System, Toolbars, Code Designer, Solution Explorer, Object Browser, Toolbox, Class View Window, Properties Window, Server Explorer, Task List, Output Window, Command Window.

Elements of Visual Basic .NET

Properties, Events and Methods of Form, Label, TextBox, ListBox, Combo Box, Radio Button, Button, Check Box, Progress Bar, Date Time Picker, Calendar, Picture Box, HScrollbar, VScroll Bar, Group Box, ToolTip, Timer.

Data Types, Keywords, Variables and Constants, Operators, Scope and accessibility of variables, Conditional Statements, Looping Statement, Arrays- Static and Dynamic.

Menus and toolbars, Built-In Dialog Boxes, InputBox, MsgBox Functions and Procedures- Built-In Functions/ User Defined Functions and Procedures.

Creating Classes, Objects, Fields, Properties, Methods, Events, Inheritance, Polymorphism, Constructors and Destructors, Exception handling.

Section C

Python Programming

Introduction to Python, variables, Built-In data types, statements and expressions, strings, lists, python objects, Conditional Statements, Looping Statement commenting scripts, Modules and packages, functions, classes.

Geoprocessing Python Scripts: Importing ArcPy, accessing data, accessing toolboxes, intersection, union and buffering, querying.

Web GIS Development

Introduction to Web GIS, Principles, Architecture - Web Server, Map Server and Data Server, Technologies for WebGIS applications, Scripting for serving maps, map editing and geo-processing functionalities for GIS server.

Recommended Books:

1. Fu, P., & Sun, J. (2011). *WebGIS principles and applications*. New Delhi, India: ESRI press.
2. Pimpler, E. (2013). *Programming ArcGIS 10.1 with python cookbook*. Birmingham, England: Packt.
3. Zandbergen, P. A. (2013). *Python scripting for ArcGIS*. New Delhi, India: ESRI Press.
4. Zhuang, V., Wrazien, D. R., Wang, M., & Huang, X. (2005). *Programming ASP.NET for ArcGIS Server*. Florence, KY: Thomson Delmar Learning.

Suggested e-learning materials:

1. VB.NET Programming Tutorial
<https://www.tutorialspoint.com/vb.net/index.htm>
2. VBA Tutorial
<https://www.tutorialspoint.com/vba/index.htm>
3. Algorithm and programming
<https://nptel.ac.in/courses/106106145/>
4. Python – Tutorial
<https://www.tutorialspoint.com/python/index.htm>

Microwave, Thermal and Hyperspectral Remote Sensing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Explain concepts and components of satellite radar imaging.
- Explain different microwave sensors data (SLC and GRD) and their characteristics.
- Describe pre-processing requirements and discuss SAR image processing techniques.
- Rationalize outlook of SAR, thermal, and hyperspectral images.

Course Content:

Section A

Concepts of Imaging RADAR

Concept of Microwave RS and its components: - Wavelength, Frequency, Pulse and Chirping of SAR Signals, Coherence, Scattering matrix, Looks, polarization. RAR/SAR Imaging Geometry and Concepts: - Directions: Azimuth and Range; Angles: Look, Depression, and Incident; Ranges: Slant and Ground; Resolutions: Range and Azimuth; Penetration of radar signals: Skin depth. Radar Relief Displacement: Layover, Foreshortening, Shadows. Antenna induced radiometric distortions. Radar Equation. Radar Image interpretation variables: Surface roughness, Dielectric properties, Backscattering, Speckles. Concepts of Radar Polarimetry, Interferometry, and Altimetry. GPR: Principals, scope, and interpretation of Radargrams.

Section B

Thermal Infrared Remote Sensing

Introduction to Thermal IR radiation Laws, Thermal properties of terrain: Thermal capacity, Thermal conductivity, Thermal Inertia. Thermal IR scanners and bands. Retrieval of LSE from RS Data: Definition of LSE, r , e and Apparent Emissivity, Characteristics of emissivity: Angular and Spectral variation of Emissivity. LST retrieval from TIRS data: Definition of LST, Definition of temperature for flat and rough surfaces, Single-Channel method of LST Retrieval, Difficulties in the estimation of LST from Space Measurement. Thermal Image Interpretation: Considerations.

Section C

Hyperspectral Remote Sensing

Spectral Radiometry – Principle, solid angle, Radiance Vs. Reflectance, Imaging Spectroscopy - Introduction, absorption processes – charge transfer, electronic and vibrational, Spectral library and Bank- concept, development, parameters controlling the spectra- spectral range, bandwidth, Full Width Half Maximum (FWHM), spectral sampling, S/N ratio, Bidirectional Reflectance Distribution Function (BRDF), Continuum removal, Imaging Spectrometers

Recommended Books:

1. Baghdadi, N., & Zribi, M. (2016). *Microwave Remote Sensing of Land Surfaces - Techniques and Methods*. London, United Kingdom: ISTC Press-Elsevier.
2. Borengasser, M., Hungate, W. S., & Watkins, R. (2007). *Hyperspectral Remote Sensing: Principles and Applications*. Boca Raton, FL: CRC Press.
3. Campbell, J. B., & Wynne, R. H. (2011). *Introduction to Remote Sensing* (5thed.). New York, NY: The Guilford Press.
4. Henderson, F. M., & Lewis, A. J. (1998). *Principles & Applications of Imaging Radar - Manual of Remote Sensing* (3rd ed. vol. 2). Hoboken, NJ: John Wiley & Sons.
5. Jensen, J. R. (2007). *Remote Sensing of the Environment - An Earth Resources Perspective* (2nded.). Upper Saddle River, NJ: Pearson Prentice Hall.
6. Joseph, G., & Jeganathan, C. (2018). *Fundamentals of Remote Sensing* (3rded.). Hyderabad, India: Universities Press.
7. Richards, J. A. (2009). *Remote Sensing with Imaging Radar*. Heidelberg, Germany: Springer.
8. Thenkabail, P. S., Lyon, J. G., & Huete, A. (2011). *Hyperspectral Remote Sensing of Vegetation*. Boca Raton, FL: CRC Press.
9. Woodhouse, I. H. (2006). *Introduction to Microwave Remote Sensing*. Boca Raton, FL: CRC Press.

Suggested e-learning materials:

1. How Does SAR Works
www.radartutorial.eu/20.airborne/ab07.en.html
2. History of Radar Imaging
<https://www.geos.ed.ac.uk/homes/ihw/timeline.html>
3. Visual Introduction to radar imaging
<https://www.geos.ed.ac.uk/~ihw/hype/radar/intro2radar.html>
4. Hyperspectral Image Analysis
<https://www.harrisgeospatial.com/Support/SelfHelpTools/Tutorials.asp>

Photogrammetry, Global Positioning Systems and Mobile Mapping

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Explain concepts related to aerial photography, planning and execution of photographic flights.
- Describe standard digital photogrammetric operations i.e., Ortho-rectification.
- Describe concepts related to aerial camera lenses, and digital terrain modeling.
- Integrate the knowledge about GPS.

Course Content:

Section A

Aerial Photography

Fundamentals of aerial photography, geometry of aerial photograph, Basic concepts of Perspective projection and Orthographic projection, Types of aerial photographs: Vertical and Oblique/High Oblique aerial photography Scale of photograph, Concept of stereoscope, Relief displacement and applications, tilt displacement, stereoscopic parallax, measurement of height difference from aerial photograph. Planning and execution of photographic flight, Computation of flight plan.

Aerial Film and Filters and Digital Photogrammetry

Basics of photography, Aerial cameras lenses, Filters and Films, Photographic scale: Object height and Length, Basic of Optics: Reflection & refraction and lens distortion; Photo mosaic, Ortho photo, Photograph co-ordinate and ground coordinate of Vertical and tilted photographs, Types of Photogrammetry Block adjustment, orthorectification, Digital Terrain Model, Terrain editing, Digital orthophotos.

Section B

Fundamentals of GPS and Its Components

Introduction of Global Positioning System, Control Segment, Space Segments, User Segment, GPS signals and data, Geopositioning – Basic concepts; NAVSTAR, GLONASS and GAGAN, GPS Positioning, **Satellite-based Augmentation System.**

Geodesy

Basics geodesy, Geoid/ datum/Ellipsoid-definition and basic concepts, Application of Geodesy, Coordinate system: Cartesian 3-D coordinate systems, Earth Centred, Earth Fixed X, Y and Z, Geographic Coordinate System Transformation, Geocentric Translation

Section C

Surveying Methods and Factors Affecting Accuracy

Satellite Geometry, Satellite signals and its strength, Number of satellites, Effects of Multi path, Ionosphere, Troposphere, Methods-Static & Rapid static, Kinematic-Real time kinematic, Survey: DGPS data processing.

Reference Station and Mobile Mapping

Selection of reference station, Reference station equipment- GPS receiver & GPS antenna. Mobile mapping basic concepts and applications, GPS application in surveying and mapping: Navigation military, Location based services, Vehicle tracking, Seismic Applications-Crustal deformation and tectonic movements. New Cellular mapping- Global System for Mobile Communication (GSM) and Code Division Multiple Access (CDMA) technology.

Recommended Books:

1. Drummond, J., Billen, R., Joao, E., & Forrest, D. (Eds.). (2006). *Dynamic and Mobile GIS*. New York, NY: CRC Press.
2. Gopi, S. (2005). *GPS and Surveying using GPS*. New Delhi, India: Tata McGraw-Hill.
3. Leick, A. (2004). *GPS Satellite Surveying* (3rded.). New York, NY: John Wiley & Sons.
4. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote Sensing and Image Interpretation* (7thed.). New York, NY: John Wiley & Sons.
5. Moffitt F. H., & Mikail, E. M. (1980). *Photogrammetry* (3rded.). New York, NY: Happer & Row.
6. Rampal, K. K. (1999). *Handbook of Aerial Photography and Interpretation*. New Delhi, India: Concept.
7. Colwell, R. N. (1983). *Manual of Remote Sensing* (2nd ed. vol.1). Falls Church, VA: ASPRS.
8. Sabins, F. F. (2007). *Remote Sensing: Principles and Interpretation* (3rded.). Long Grove, IL: Waveland Press.
9. Terry, K. S. (2000). *Integrating GIS and the Global Positioning System*. New Delhi, India: ESRI Press.

Suggested e-learning materials:

1. Aerial Photography
<https://nptel.ac.in/courses/105104167/4>
2. Photogrammetry
<https://nptel.ac.in/courses/105104100/18>
3. Drone
<https://www.dronethusiast.com/tutorials>

Spatial Database Systems, Analysis and Modeling

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Statistically evaluate the spatial entities their topological, geometric, or geographic properties.
- Learn different analytic approaches.
- Describe and design the concept of spatial databases its components, models, mining, analysis and visualization.
- Apply the strength and applications of Arc model builder.

Course Content:

Section A

Advance Attribute Analysis

Basics Matrix: Addition, subtraction, multiplication, Identity, Determinant and Inverse, Linear equation solutions using matrix

Spatial Modeling

Spatial analysis concept: Distance, Adjacency, Interaction and neighbourhood Geospatial models- types and Modeling: Descriptive, prescriptive and predictive; Normalization, level of measurement, Introduction to modeling& flowcharting, Map algebra-operators & operations, Functional operations, Modeling essentials, Spatial interaction models. Conceptualizing the model, Model formulation, Conflict resolution and Prescriptive modeling, Model verification.

Section B

Spatial Analysis

Point Analysis: Coordinate, Distance – Nearest Neighbour Distance, Density – Quadrant and other methods

Geo-Statistics

Spatial Interpolation and Geostatistics: Local and global methods, Gravity model, Regression model, Pattern analysis, Moran's Index, Cluster analysis, Trend surface Analysis

Thiessen polygon, Density estimation, Inverse Distance Weight (IDW), Thin – plate Spline, Kriging – ordinary and Universal, Semivariogram; Spatial Autocorrelation.

Section C

Geocoding and Network Analysis

Address Geocoding, Optimum Routing, Closest facilities, Resource Allocation, Network Analysis, Dynamic Segmentation: Route, Section, Events and its application.

Digital Terrain

Terrain mapping: Source of existing elevation data, quality and standard of DEM data, Counting, Vertical profile, Hill shading, Slope, Aspect, Surface Curvature, Digital terrain visualization 2D and 3D; Application of Digital terrain models

Arc GIS Model Builder

Concepts of Model Builder, Model elements: Tools, Variables, Connectors, setting up Models, Executing Model, Model Validation, Model builder to create Tools – Advance techniques in Model Builder, Geoprocessing Techniques in Model Builder

Recommended Books:

1. Allen, D. W. (2011). *Getting to know ArcGIS Model builder*. New Delhi, India: ESRI Press.
2. Carter, G. B. (1994). *GIS for Geoscientists: Modeling with GIS*. Amsterdam, Netherlands: Elsevier.
3. Burrough, P. A., & McDonnell, R. (1998). *Principles of Geographical Information Systems* (3rded.). New York, NY: Oxford University Press.
4. Chang, K. T. (2002). *Introduction to Geographic Information Systems* (3rded.). New Delhi, India: Tata McGraw Hill.
5. Fotheringham, A. (1988). *Spatial Interaction Models: Formulations and Applications*. Dordrecht, Netherlands: Springer.
6. Laurini, R., & Thompson, D. (1998). *Fundamentals of Spatial Information Systems*. London, England: Academic Press.
7. Lo, C. P., & Yeung, A. K. W. (2005). *Concepts and Techniques of Geographic Information Systems* (2nded.). New Delhi, India: Prentice Hall of India.
8. MacDonald, A. (1999). *Building a Geodatabase*. Redlands, CA: ESRI Press.
9. Samet, H. (1990). *The Design and Analysis of Spatial Data Structures*. Washington, WA: Addison–Wesley.
10. Silberschats, A., & Korth, H. F. (1998). *Database System Concepts* (3rded.). New York, NY: McGraw-Hill.
11. Sullivan, D. O., & Unwin, D. (2010). *Geographic Information analysis* (2nded.). Hoboken, NJ: John Wiley & Sons.
12. Verbyla, D. L. (2002). *Practical GIS Analysis*. London, England: Taylor & Francis.

Suggested e-learning materials:

1. Digital Elevation Model and applications
<https://swayam.gov.in/courses/4395-digital-elevation-models-and-applications>
2. Digital Elevation Model
<http://gazebo-sim.org/tutorials?tut=dem>
3. Hydrologic Simulation Models
<https://nptel.ac.in/courses/105101002/36>
4. Model Builder
<http://desktop.arcgis.com/en/arcmap/10.3/analyze/modelbuilder/what-is-modelbuilder.htm>

Spatial Decision Support Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Study the spatial information systems developed for a specific problem or decision-making situation.
- Observe key concepts and theories underlying spatial information systems and technology trends.
- Explore and reform the solutions to spatial problems by generating a set of alternatives and selecting from among those that appear to be viable through multi criteria analytics.
- Illustrate and assess the emerging concepts that may impact spatial information system development and applications.

Course Content:

Section A

Introduction

GIS and decision support systems, SDSS definition and characteristics, Introduction to decision making process and decision support systems, Introduction of a frame work for planning and decision making, Spatial Decision Making, SDSS architecture.

Database Management

Data base management system, Model based management system, Graphical and tabular report generator, User interface.

Section B

Analysis and Decision Making

Principles and elements of multiple-criteria decision analysis, Spatial multiple criteria decision analysis, Main multiple-criteria evaluation methods/techniques, criteria, alternatives, weights, decision rules and sensitivity analysis. Spatial multiple criteria evaluation in planning and decision making.

Technology and Development

Development of DSS, Technology levels, Functions and roles, Status of SDSS, Open source tools.

Section C

SDSS Software and Its Applications

Classification of DSS software, Problem specific SDSS, Generic SDSS, Domain level SDSS, Desktop SDSS, Web-Based SDSS, SDSS applications in: natural resource management, environmental, urban, agriculture, utilities and business.

Recommended Books:

1. House, W. C. (1983). *Decision Support Systems*. New York, NY: Petrocelli.
2. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2011). *Database System Concepts* (6thed.). New York, NY: McGraw Hill.
3. Malczewski, J. (1999). *GIS and Multicriteria Decision Analysis*. New York, NY: John Wiley & Sons.
4. Ramanathan, S. (2011). *Spatial Decision Support Systems: Principles and Practices*. Boca Raton, FL: CRC Press.
5. Sprague, R. H., & Carlson, E. D. (1982). *Building Effective Decision Support Systems*. Englewood Cliffs, NJ: Prentice-Hall.

Suggested e-learning materials:

1. Database Management Systems (DBMS)
https://onlinecourses.nptel.ac.in/noc18_cs15/preview
2. Geographic Information and Analysis
<http://www.ncgia.ucsb.edu/>

Geoinformatics in Human Settlement Analysis

Introduction

Geoinformatics for human settlement analysis; Planning definition; Scope and evaluation of human settlement, Economic planning, Data requirement of Urban and Regional planning.

Interpretation of rural settlement

Type of rural settlement, existing rural land use, Interpretation of rural land use / land cover classification, rural development plan in India, rural poverty programme in India, Geoinformatics for soil type, water, drainage system and transportation system in rural area.

Interpretation of urban settlements

Urban Master plan, city development plan and guidelines, urban land use classification; environmental and socioeconomic factors for urban development.

Details development plans

Population projection, exiting urban land use, housing problems and development, urban information system

TEXT BOOKS:

- T1 Jean-Paul Donnay, Michael J.Barnsley and Paul A.Longley,2001, “Remote Sensing and Urban, Taylor & Francis, London
- T2 Tarek Rashed and Carsten Jurgen, 2010, “ Remote Sensing for Urban and Suburban Areas” Springer, London
- T3 Peter Hall and Mark Tewder-Jones, 2011, “Urban and Regional planning”, Taylor & Francis, London

Pattern Recognition and Processing

L	T	P	C
0	0	4	2

Max. Marks : 100

(CA: 40 + ESA: 60)

Fundamental

Radiometric and Geometric correction technique for various sensors, gains and bias value of different sensor, Atmospheric correction types and methods, Interpolation methods – linear and non linear transformation for geometric corrections.

Advance Research

Advance research in Spatial and Spectral interpolation, spatial enhancement techniques, Contrast stretching: Linear and non-linear methods. Principal component analyses, TCA, Texture Analysis and its types, Conversion of radiance to temperature.

Pattern Recognition & Information Extraction

Concept of pattern recognition, Multi-spectral pattern recognition, Spectral discrimination Artificial intelligence, Fuzzy algebra, Artificial Neural networks, Expert systems, analysis of hyper spectral data, Image compression technique and types. Image fusion techniques and application

TEXT BOOKS:

- T1 Jensen, JR., Remote Introductory Digital Image Processing (3rd Edition), Prentice Hall, 2004
- T2 Jensen, JR., Remote Sensing of the Environment-An Earth Resources Perspective, Prentice Hall Inc.
- T3 Sabins, Floyd F., Remote Sensing: Principles and Interpretation, H. Freeman and C., New York.

REFERENCE BOOK:

- R1 Gibson, P.J., Introduction to Remote Sensing, 2nd ed., Taylor & Francis, London.

Remote Sensing in Environment Studies

L	T	P	C
0	0	4	2

Max. Marks : 100

(CA: 40 + ESA: 60)

Principles

Ecological and biological aspects of environment, Atmosphere, Hydrosphere, Lithosphere, Biosphere.

Pollution

Types of pollution, Chemistry of pollution, Concentration of pollution, Remote sensing application for air, water and land and soil pollution.

Environmental management

Water, Land and air quality management, Solid waste management, Application of Remote Sensing in solid waste management, Pollution monitoring.

Impact Assessment

Basic concept, Environmental Impact Assessment (EIA), method of EIA, Benefit of EIA, Impact of man on biosphere, Natural disaster.

TEXT BOOKS:

- T1 Jenson, J.R. 2000. Remote Sensing of the environment-An Earth Resource Perspective, Prentice Hall Inc.
- T2 P.K. Joshi, P. Pani, S. N. Mohapatra and T.P. Singh, Ed 2010 "Geoinformatics for Natural Resource Management", Nova Publishers, India
- T3 P.K. Joshi and T.P. Singh (2011). Geoinformatics for Climate Change Studies, TERI Press, New Delhi.
- T4 P. S. Roy (2000). Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing (IIRS), 2000.

Remote Sensing in Hydrology and Water Resources

L	T	P	C
0	0	4	2

Max. Marks : 100

(CA: 40 + ESA: 60)

Basic Concept

Hydrological cycle, Hydrological parameter, Darcy's Law, porosity, permeability, Transmissibility, specific yield, specific capacity, Field capacity and depression storage; Role of Remote Sensing in evaluation hydrological Investigations.

Ground water exploration

Surface and ground water, Classification of stream and rivers, Type of aquifer, aquiclude, Aquitard, Aquifuge, Ground water regimes, Application of Remote Sensing for the hydro geomorphological interpretation.

Watershed management

Drainage network and drainage pattern, Watershed definition and scope, Morphometric parameter, Watershed inventory and management.

Remote sensing in water resource evaluation

Estimation of precipitation, Interception, Soil moisture, Evaporation run off and discharge, Hydrological models in GIS and snow cover mapping.

TEXT BOOKS:

T1 Karanth, K.A, 2008, "Ground water assessment Development and management Tata McGraw Hill

T2 JVS Murty, 2004, "Watershed management" New Age International Pvt Ltd, New Delhi

T3 Jenson, J.R. 2000. Remote Sensing of the environment-An Earth Resource Perspective, Prentice Hall Inc.

Remote Sensing in Resource Management

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Concept of Resources

Resources classification systems, criteria of classification, natural and cultural resources

Resources Inventories

Identification, resources survey, base map preparation, problem identification, thematic mapping and resources monitoring

Desertification Monitoring and habitat assessment

Desertification Assessment and monitoring, wildlife habitat assessment, animal population.

Resources regions

Demarcation of resource potential, resource conservation and planning for development, resource and geographical information system.

TEXT BOOKS:

- T1 Lillisand, T. M. and Keifer, R. W. 1994. Remote Sensing and Image interpretation', John Willey and Sons, New York, Third Edition.
- T2 Jenson, J.R. 2000. Remote Sensing of the environment-An Earth Resource Perspective, Prentice Hall Inc.
- T3 Skidmore, Andrew, 2002, "Environmental Modelling With GIS and Remote Sensing", Taylor & Francis Routledge

Spatial Modeling and Resource Model

L	T	P	C
0	0	4	2

Max. Marks : 100

(CA: 40 + ESA: 60)

Vector Base Modeling

Clustering methods and application; Network analysis and its process: shortest path model, Smeed's Index; address Geocoding, Optimum Routing Dynamic Segmentation: Route, Section, Events; application of network and dynamic segmentation.

Raster Base Modeling

Process and derivation of local neighbourhood operation: Reclassification, Filter, Slope, Aspect; Method of optimum path and cost allocation; environmental modeling on cost analysis, Corridor mapping

Geo-Statistics

Spatial Interpolation and Geostatistics with equation: Local and global methods, Gravity model, Regression model, Pattern analysis, Moran's I, Cluster analysis, Trend surface Analysis

Spatial Interpolation

Equation and derivation: Thiessen polygon, Density estimation, Inverse Distance Weight (IDW), Thin – plate Spline, Kriging – ordinary and Universal, Semivariogram; Spatial Autocorrelation and its procedure, Application of spatial statistics in natural resources.

TEXT BOOKS:

- T1 David L. Verbyla, 2002, "Practical GIS Analysis", Taylor & Francis
- T2 David O' Sullivan and David Unwin, 2003 "Geographic Information analysis, John Wiley and Sons, Hoboken, USA
- T3 Principles of Geographical Information Systems. Oxford University Press, New York Burrough, Peter A. and Rachael McDonnell. 1998.
- T4 Kang-tsung Chang 2002, 'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi.
- T5 C.P.Lo and Albert K.W.Yeung 2005 "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India, New Delhi

Advanced Communication Networks

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes:

On successful completion of the course students will be able to

- Learn TCP/IP protocol and various routing algorithms
- Understand details of Wireless network, Network architecture
- Able to evaluate communication networks using different performance parameter.

Section A

TCP/IP protocol: - Introduction to Computer Networks, Layered protocol, Network Interface, Internet Addressing, Subnetting, mapping internet address to physical address, Internet Protocol, Routing algorithms (BGP), ICMP.

Transport Protocols: - UDP, TCP, TCP finite state machine implementation, SNMP.

Section B

ATM Networks: - ATM protocol stack, ATM switching, traffic management in ATM networks, Internetworking with ATM networks.

Wireless Networks: - Wireless channels, Channel Access, Network Architecture, Mobility management, WLAN. Introduction to internet telephone.

Section C

Performance evaluation of communication networks: Introduction to queuing theory, performance evaluation of ATM networks and wireless network.

IPv6 : Introduction, Type of services, Addressing scheme, Notation, Packet Format.

Suggested Books:

1. Comer, D. E. (1995). Internetworking with TCP/IP, Vol. I: Principles, Protocols, and Architecture, 3/e. PHI
2. Walrand, J., & Varaiya, P. P. (2000). *High-performance communication networks*. Morgan Kaufmann.
3. Handel, R., Huber, M. N., & Schroder, S. (1998). *ATM networks: concepts, protocols, applications*. Addison-Wesley Longman Ltd..
4. Kasera, S. (2006). *ATM Networks Concepts and protocols*. Tata McGraw-Hill Education.
5. Stallings, W. (2002). *High-speed networks and internets: performance and quality of service*. Pearson Education India.
6. Tanenbaum, A. S. *Computer Networks* (3rd ed.). PHI Learning.

Suggested E-Resources:

1. TCP/IP and Advanced Topics
<https://www.coursera.org/learn/tcp-ip-advanced>
2. Kurose, J. F., & Ross, K. W. (2009). *Computer networking: a top-down approach*. Boston: Addison Wesley.
https://www.bau.edu.jo/UserPortal/UserProfile/PostsAttach/10617_1870_1.pdf

Advanced Java Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand advance concepts of Java like swings and RMI
- Able to develop complex application for networking.
- Design and develop JSP pages.
- Understand basics of AJAX,CORBA and EJB.

Section A

Java Script : Introduction to Java Scripts-Variables and Data Types. Statements and Operators. Control Structures, Functions, Dialog Boxes, Events, Event Handlers, Forms.

XML : Introduction to XML.

Swing : Introduction to Swing-Swing class heirarchy, Swing Components, Containers and Layout Managers.

Networking : Classes and Interfaces, Client-Server Architecture, Socket Overview, TCP/IP Sockets, Datagrams.

Section B

RMI : An Overview of RMI Applications, Remote Classes and Interfaces, RMI Architecture, Generating Stubs and Skeletons.

J2EE : Introduction to J2EE, J2EE Architecture, J3EE APLs, J3EE Containers, Installing and managing web server.

Servlets : Overview, Servlet Lifecycle, Generic Serlet, Servlet Request and Servlet Response, Http Servlet Request, Http Servlet Response and Http Servlet Request-response, handlers, Session management and cookies.

Section C

JSP : Basics and Overview, JSP declaration, expressions, directives, Data Sharing among servlets & JSP, Request, application, session and page scope, JSP implict objects.

Beans : Enterprise Java Beans : Introduction, Types of EJB's, Elements of EJB's, EJB implicit objects.

Introduction to AJAX, CORBA, Hibernate, Struts, JSF.

Suggested Books:

1. Eckstein, R., Loy, M., & Wood, D. (1998). *Java swing*. O'Reilly & Associates, Inc..
2. Kumar, B. V. (2006). *J2EE architecture*. Tata McGraw-Hill Education.
3. Goodwill, J. (2001). *Developing java servlets*. Sams, Sams Techmedia.
4. Chopra,V. Eaves, J. Jones, J. *Beginning Java Server Pages*, Wrox Publication.
5. Farley, J., & Crawford, W. (2006). *Java Enterprise in a nutshell*. " O'Reilly Media, Inc."

6. Schildt, H. (2007). *Java : The Complete Reference* (7th ed.). Tata McGraw-Hill .
7. Hunter, J., & Crawford, W. (2001). *Java Servlet Programming: Help for Server Side Java Developers*. " O'Reilly Media, Inc."
8. Jaworski, J., & Jaworski, J. (1999). *Mastering JavaScript and Jscript*. .
9. Goodwill, J., & Hightower, R. (2004). *Professional jakarta struts*. John Wiley & Sons.
10. Crane, D., Bibeault, B., & Sonneveld, J. (2008). *Ajax in practice: das Praxisbuch für die Web 2.0-Entwicklung mit Frameworks*. Pearson Deutschland GmbH.
11. Harold, E. R. (2004). *Java network programming*. " O'Reilly Media, Inc."

Suggested E-Resources:

1. W3Schools website
<https://www.w3schools.com/xml/>
2. Java point website
<https://www.javatpoint.com/java-swing>

Artificial Intelligence

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Develop algorithms based on search, knowledge representation.
- Develop applications based on NLP Concepts
- Develop a Cognitive Agent

Section A

Introduction to Artificial Intelligence, General problem solving, state space and graph model techniques, Heuristic designs, Aim-oriented heuristic algorithms versus solution guaranteed algorithms, Game playing strategies.

Knowledge Representation: Knowledge representation tools, First order predicate calculus. Understanding Logic Programming Using PROLOG. Semantic Nets, Frames, production rules, knowledge base, the inference system, forward and backward deduction.

Section B

Cognitive Computing: Introduction, Elements of Cognitive Systems. Understanding Complex Relationships Between Systems. Understanding Cognition. Transformation of Artificial Intelligence into Cognitive Computing Systems. Uses of Cognitive Computing Systems. System of Judgment and Choice. Designing a Cognitive System. Gaining Insight from Data. Bringing Data into Cognitive System. Defining Objective. Defining Domain. Understanding the Intended Users and Defining their Attributes. Defining Questions and Exploring Insights. Creating and Refining the Corpora. Training and Testing.

Understanding Natural Language, Parsing techniques, context free and transformational grammar, transition net, augmented transition nets, Fillmore's grammar, Shanks conceptual dependency. Grammar free analysers, Sentence generation, Translation.

Section C

Enabling Reasoning in Cognitive Systems Through Probabilistic Learning: Bayesian Networks, Approximate Inference, Constructing Bayesian Networks. Markov Chains, Hidden Markov Model: Forward Algorithm,

Viterbi Algorithm, Baum-Welch Algorithm.

Application of Cognitive Computing: Enhancing the Shopping Experience. Leveraging the Connected World of Internet of Things. Voice of the Computer. Fraud Detection. Case Study of Cognitive Computing Systems.

Suggested Books:

1. Russell, S. J., & Norvig, P. (2013). *Artificial Intelligence: A Modern Approach* (3rd ed.). PHI Learning.
2. Vernon, D. (2014). *Artificial Cognitive Systems: A Primer*. MIT Press.
3. Rich, E., & Knight, K. (2011). *Artificial Intelligence* (3rd ed.). Tata McGraw-Hill.
4. Patterson, D. W. (1990). *Introduction to Artificial Intelligence and Expert Systems*. PHI Learning.
5. Barr, A., Cohen, P. R., & Feigenbaum, E. A. (1982). *The Handbook of Artificial Intelligence*. Addison-Wesley.
6. Allen, J. (1995). *Natural Language Understanding* (2nd ed.). Pearson Education India.
7. Nilsson N.J., (1991). *Principles of Artificial Intelligence*. Narosa Publishing.
8. Nilsson, N. J. (1998). *Artificial intelligence: A New Synthesis*. Morgan Kaufmann Inc.
9. Luger, G. F. (2002). *Artificial intelligence: Structures and Strategies for Complex Problem Solving*. Addison-Wesley.
10. Charniak E., & McDermott D. (1985). *Introduction to Artificial Intelligence*. Addison-Wesley.

Suggested E-Resources:

1. Artificial Intelligence
<https://nptel.ac.in/courses/106105077/>
2. Artificial Intelligence: Principles and Techniques
<https://web.stanford.edu/class/cs221/>

Machine Translation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Develop MT systems based on Example Based Approach.
- Develop Translation Memories.
- Develop basic transfer-based MT system
- Develop statistical MT system
- Develop Neural MT System

Section A

Computers in translation, history of machine translation, strategies for machine translation, direct, transfer based, example based and statistical, role of ai in machine translation, basic linguistics knowledge, formal background, character sets and typology, input methods, translator's workbench, translation memory, bilingual alignment, substantial alignment.

Section B

Computational morphology, syntactic analysis, parsing and generation, role of syntax, semantics and pragmatics in development of various types of machine translators, minimal recursion semantics, constraint systems, pos tagging, disambiguation of syntactic analysis, word sense disambiguation, transfer disambiguation.

Section C

Statistical Machine Transition, role of parameter estimation in machine transition, word based models, EM Algorithm, decoding process, phrase based models, Syntax based models, Statistical Phrase Based Transition, Syntax Based Statistical Transition Model, Clause Restructuring for SMT, evaluation of machine translation, evaluation strategies, quality measures, software evaluation, some popular evaluation metrics, future trends.

Suggested Books:

1. Trujillo, A. (2012). *Translation engines: techniques for machine translation*. Springer Science & Business Media.
2. Koehn, P.(2010), *Statistical Machine Translation*, Cambridge University Press.
3. Arnold, D. J., Balkan, L., Meijer, S., Humphreys, R. L., & Sadler, L. (1994). *Machine Translation: an Introductory Guide*. Blackwells-NCC, London. 1994.
4. Nirenburg, S., Somers, H. L., & Wilks, Y. (Eds.). (2003). *Readings in machine translation*. MIT Press.
5. Goutte, C., Cancedda, N., Dymetman, M., & Foster, G. (2009). *Learning machine translation*. Massachusetts Institute of Technology.
6. Wilks, Y. (Eds.). (2008), *Machine Translation: Its Scope and Limits*, Springer

Suggested E-Resources:

1. Arnold, D., Balkan, L., Meijer, S., Humphreys, R. L., & Sadler, L. (2001). *Machine Translation: An Introductory Guide*. Blackwell Publishers.
<http://promethee.philo.ulg.ac.be/engdep1/download/bacIII/Arnold%20et%20al%20Machine%20Translation.pdf>

Natural Language Processing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Develop algorithms based on NLP Concepts.
- Develop applications based on Statistical Approaches of NLP
- Create applications for Indian Language Processing

Section A

Introduction to Natural Language Understanding, Language as a knowledge base process, Processing Indian Languages, Basic linguistics.

Morphology - Types and Parsing, N-gram Model, Maximum Likelihood Estimation, Smoothing techniques on N-gram Model, Words and Word Classes, POS Tagging.

Grammar and Parsing - Top Down Parsing, Bottom-up Parsing, Dependency Grammar, Parsing Indian Languages.

Section B

Meaning Representation, First Order Predicate Calculus, Elements of FOPC, Semantics and FOPC, Syntax Driven Semantic Analysis, Principle of Compositionality, Semantic Augmentation of CFG Rules, Robust Semantic Analysis, Introduction to Semantic Grammar, Structure of Words, Thematic Roles, Word Sense Disambiguation - Selectional Restrictions, Machine Learning Approaches, Dictionary Based Approaches

Section C

Context and World Knowledge, Knowledge Representation and Reasoning, Discourse and World Knowledge, Cohesion, Reference Resolution, Various Resolution Algorithms, Discourse Coherence, Coherence Relations, Language Learning.

Suggested Books:

1. Jurafsky, D., & Martin, J. H. (2000). *Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. Pearson Education.
2. Allen, J. (1995). *Natural Language Understanding* (2nd ed.). Pearson Education.
3. Bharati, A., Chaitanya, V., Sangal, R., & Ramakrishnamacharyulu, K. V. (1995). *Natural language Processing: a Paninian Perspective*. PHI Learning.
4. Manning, C. D., Manning, C. D., & Schütze, H. (1999). *Foundations of Statistical Natural Language Processing*. MIT press.
5. Iwanska, L. M., Shapiro, S. C. (2001). *Natural Language Processing and Knowledge Representation*. Universities Press.

Suggested E-Resources:

1. Natural Language Processing
<https://www.coursera.org/learn/language-processing>
2. Natural Language Processing
<https://nptel.ac.in/courses/106101007/>

Neural Networks

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand need of Neural network along with its architecture.
- Develop neural network algorithms like back propagation etc.
- Learn concepts of learning models for different applications.

Section A

Introduction and ANN Structure: Biological neurons and artificial neurons, Model of an ANN, Activation functions used in ANNs, network architectures.

Mathematical Foundations and Learning mechanisms: Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning; supervised, unsupervised and Reinforcement learning.

Single layer perceptrons: Structure and learning of perceptrons, Pattern classifier - introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence, Limitations of a perceptrons.

Section B

Feedforward ANN: Structures of Multi-layer feed forward networks, Back propagation algorithm, Back propagation - training and convergence, Functional approximation with back propagation, Practical and design issues of back propagation learning.

Radial Basis Function Networks: Pattern separability and interpolation, Regularization Theory, Regularization and RBF networks, RBF network design and training, Approximation properties of RBF.

Recurrent Networks: Architectures, NARX, Back-propagation through time, Real-time recurrent learning.

Section C

Associative Networks: Auto-associative and Hetro-associative network, Bidirectional Associative memory network, Hopfield Network.

Competitive Learning and Self organizing ANN: General clustering procedures, Learning Vector Quantization (LVQ), Competitive learning algorithms and architectures, Self organizing feature maps, Properties of feature maps.

Stochastic Model: Statistical mechanics, Simulated annealing, Boltzmann machine.

Suggested Books:

1. Haykin, S. (1994). *Neural networks: a comprehensive foundation*. Prentice Hall PTR.
2. Kumar, S. (2004). *Neural networks: a classroom approach*. Tata McGraw-Hill Education.
3. Demuth, H. B., Beale, M. H., De Jess, O., & Hagan, M. T. (2003). *Neural network design*. Thomson Learning,.
4. Freeman, J. A., & Skapura, D. M. Neural networks: algorithms, applications and programming techniques. 1991. Reading, Massachussets: Addison-Wesley.

Suggested E-Resources:

1. Introduction to Neural Networks
<http://www.cs.bham.ac.uk/~jxb/NN/>
2. Neural Networks and Deep Learning
<https://www.coursera.org/learn/neural-networks-deep-learning>

Geographic Information System

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand data models for GIS applications.
- Able to design & develop GIS applications using different GIS software
- Implement map projection on spatial data.

Section A

Introduction to GIS – definitions, concept and history, Hardware and software requirements in GIS, various elements of GIS. Concept of Layers and Coverages in GIS. Applications of GIS.

Introduction to map projections - Earth's shape and geodetic datums , Projection Types- Azimuthal, Cylindrical, Conic, Properties of map projections- Equal Area, Conformal, Distance, Common GIS Projections-Mercator, Lambert, Conformal Conic, State Plane, Lambert Equal Area, Map Scale, Tissot's Indicatrix

Co-ordinate system-overview, concept of latitude and longitude, Geographical and Projected Coordinate System, UTM

Data structures and formats, Spatial data models – Raster and Vector.

Data compression techniques – run length codes, quad trees.

Spatial data sources-Census and survey data, Aerial Photographs, Satellite images, GPS.

Section B

GIS Database Management Systems-Role in GIS, database creation, spatial and non-spatial data, Attribute Query, spatial query, GIS database applications.

Data input-analogue and digital data, methods-keyboard entry, digitizing-manual and automatic, electronic data transfer

Data editing-Detecting and Correcting errors, Re-projection, transformation and Generalization, Edge matching and rubber sheeting, Geocoding.

Data Quality and Output, Sources of Errors-errors in data encoding, editing and conversion, data processing and analysis, data output, Error modeling

Section C

Data analysis and modeling-Measurements, Queries, Reclassification.

Buffer analysis – its features, Overlay-vector and raster overlay, Spatial Interpolation,

Network Modeling and analysis-network elements, application context

Surface Modeling and Analysis-, Surface Significant Points.

Digital Elevation Models (DEM)-overview, structures and uses.

Overview of image processing & GIS packages.

Recent Trends in GIS – Virtual 3D GIS, Internet GIS, Open GIS.

GIS Case studies-Environment & facility management, Telecommunication, Water supply, Transportation

Suggested Books:

1. Ian, H. (2010). *An introduction to geographical information systems*. Pearson Education India.
2. Burrough, P. A.,(1988). *Principles of geographical information systems*. Oxford University Press.

3. Chang.T.K(2003)., *Geographic Information Systems(2ed)*. Tata McGrawHill.
4. DeMers, M. N. (2005). *Fundamentals of geographic information systems*. John Wiley & Sons.
5. Lo, C. P., & Yeung, K. W. (2002). *Concepts and techniques of geographic information systems*, Prentice Hall.
6. Skidmore, A.(2002). *Environmental modelling with GIS and remote sensing*. Taylor and Francis.
7. Clarke K.C., Bradley O. P, Michael P. C.(2002), *Geographic Information Systems and Environmental Modeling*, Prentice-Hall,
8. Elangovan, K. (2006). *GIS: fundamentals, applications and implementations*. New India Publishing.
9. Ormsby, T., Napoleon, E., Burke, R., Groessl, C., & Feaster, L. (2004). *Getting to know ArcGIS desktop: basics of ArcView, ArcEditor, and ArcInfo*. ESRI, Inc..

Suggested E-Resources:

1. GIS in Civil Engineering
<https://nptel.ac.in/courses/105102015/>
2. Geospatial Information and Services
<http://www.oc.nps.edu/oc2902w/gis/gisdemo/>

Human Computer Interaction

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Develop effective UI.
- Design menus using STM.
- Develop applications based on cognitive architecture

Section A

Introduction to Human Computer Interaction: Need and advantages.

Humans in HCI: Input-output channels; human memory; Reasoning and problem solving; emotional and psychological issues.

Computers in HCI: Text entry devices; positioning, pointing and drawing; display devices; devices for virtual reality and 3D interaction; physical controls; printing and scanning; memory; processing and networks.

Interaction Issues: Models of interaction; frameworks and HCI; Ergonomics; interaction styles; elements of WIMP interface; interactivity and the context of the interaction.

Section B

Interaction Design Basics: Introduction to design; the process of design; user focus and scenarios; navigation design; screen design and layout; iteration and prototyping.

HCI in the Software Process: Usability engineering; iterative design and prototyping; design rationale.

Design Rules: Principles to support usability; standards and guidelines; golden rules and heuristics; HCI patterns.

Section C

Cognitive Models: Introduction to cognitive models; goal and task hierarchies; linguistic models; the challenge of display-based systems; physical and device models; cognitive architectures.

Socio-organizational Issues: Organizational issues including free rider problem, critical mass, workflow and BPR in automating processes; capturing requirements - stakeholders, socio-technical models, soft systems methodology, participatory design and ethnographic methods.

Case Studies: HCI in health care; user-centered designs in games.

Suggested Books:

1. Dix A., Finlay J.(2008) *Human-Computer Interaction(3ed)* , Pearson Education.
2. Caroll J.M., *Human-Computer Interaction in the new millennium*, Pearson,

Suggested E-Resources:

1. Human-Computer Interaction
<https://nptel.ac.in/courses/106103115/>
2. Human Computer Interaction <http://www.cs.ru.ac.za/courses/honours/HCI/lectures/lectureslides.php>

Information Retrieval

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Develop algorithms based on various IR concepts.
- Develop applications based on textual classification
- Create applications for Indian Language Information Retrieval Systems

Section A

Introduction, Building an inverted index, Processing Boolean Queries, Ranked Retrieval, Document delineation and character sequence decoding, determining vocabulary of terms, Positional posting and phrase queries, dictionary retrieval, Index construction, various types of indexing techniques, Parametric and zone indexing, term frequency and weighting, vector space model for scoring.

Section B

Efficient scoring and ranking, Tiered indexes, Query term proximity, designing parsing and scoring functions, vector space scoring and query operator interactions, IR system evaluation, Evaluation of ranked and unranked result sets, assessing relevance, Relevance feedback, global methods for query reformulation.

Section C

Bayesian Text Classification Model, Vector Space Classification, KNN classifier, Linear classifiers, classification of documents using SVM Model, machine learning methods in adhoc IR, Clustering in IR, evaluation of clustering, k-means, model based clustering, hierarchal clustering, Web search basics, Web crawling and indexes, link analysis, page rank algorithms, information extraction, sentiment analysis and opinion mining, social network analysis.

Suggested Books:

1. Manning, Christopher D., Raghavan Prabhakar, Schütze Hinrich(2008), Introduction to Information Retrieval, Cambridge University Press..
2. Baeza-Yates, R., & Ribeiro, B. D. A. N. (1999). *Modern information retrieval(1ed)*. Pearson Education Limited
3. Grossman, D. A., & Frieder, O. (2004). *Information retrieval: Algorithms and heuristics (2ed)*. . Netherlands: Springer
4. Van Rijsbergen, C. J. (2004). *The geometry of information retrieval*. Cambridge University Press.
5. Manning, C. D., Manning, C. D., & Schütze, H. (1999). *Foundations of statistical natural language processing*. MIT press.
6. Jurafsky, D., & Martin, J. H. (2008). *Speech and language processing (2ed)*. Pearson Education.

Suggested E-Resources:

1. Schütze, H., Manning, C. D., & Raghavan, P. (2008). *Introduction to information retrieval*. Cambridge University Press.
<https://nlp.stanford.edu/IR-book/newslides.html>
2. Information Retrieval and Web Search
<https://www.cs.utexas.edu/~mooney/ir-course/>

System Testing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Learn different types of testing methods.
- Able to solve testing problems in software projects.
- Learn importance of documentation in testing.

.Section A

Introduction to Software testing, Error fault, Failure, Incident, Test cases, Test Plan, Software testing processes overview, Incremental testing approach, Test outlines, Limitation of Testing.

Section B

Functional Testing: Boundary value analysis, Equivalence Class Testing, Decision Table Based Testing and cause effect - graphing Technique, Structural Testing: Path Testing, Cyclomatic Complexity, Graph metrics, Data Flow testing, Mutation Testing. Object Oriented Testing: Issues, Class Testing, GUI Testing, Object Oriented Integration and System testing, Testing Web Based Systems

Section C

Reducing the number of test cases : Prioritization guidelines, Priority category scheme, Risk analysis, Regression Testing, slice based Testing,

Testing activities : Unit Testing, Levels of Testing, and Integration Testing, System Testing, Debugging, Domain Testing, Testing Tools: Static Testing Tools, Dynamic testing Tools, and characteristics of Modern Tools.

Building and applying standards to test Documentation : Configuration management, Reviews, Industry Standards - ISO 9001, CMM for Software, IEEE standards.

Suggested Books:

1. Tamres L.(2002), *Introducing Software Testing(2ed)*, Pearson Education.
2. William P.(2006), *Effective Methods for Software Testing(3ed)*, Wiley India.
3. Beizer B(2003), *Software Testing Techniques(2ed)*, Dream Tech Press.
4. Singh,Y. *Software Testing* : Cambridge University Press.
5. Pressman, R. S. (1997). *Software Engineering: a practitioner's approach* (4th ed.). Tata McGraw-Hill.
6. Aggarwal K.K & Singh Y.(2008), *Software Engineering(3ed)*, New Age International Publishers.
3. Mathur, A.P. (2001), *Foundations of software testing*, Pearson Education.
4. Patton R.(2000), *Software Testing*, Techmedia.
5. Jorgensen, P.C.(2008), *Software Testing a Craftsman Approach*, Auerbach blisher.

Suggested E-Resources:

1. Software Testing
<https://nptel.ac.in/courses/106105150/>
2. Software Testing
<https://www.coursera.org/lecture/software-processes/software-testing-introduction-XmIRH>

System Testing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Learn different types of testing methods.
- Able to solve testing problems in software projects.
- Learn importance of documentation in testing.

.Section A

Introduction to Software testing, Error fault, Failure, Incident, Test cases, Test Plan, Software testing processes overview, Incremental testing approach, Test outlines, Limitation of Testing.

Section B

Functional Testing: Boundary value analysis, Equivalence Class Testing, Decision Table Based Testing and cause effect - graphing Technique, Structural Testing: Path Testing, Cyclomatic Complexity, Graph metrics, Data Flow testing, Mutation Testing. Object Oriented Testing: Issues, Class Testing, GUI Testing, Object Oriented Integration and System testing, Testing Web Based Systems

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Reducing the number of test cases : Prioritization guidelines, Priority category scheme, Risk analysis, Regression Testing, slice based Testing,

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Building and applying standards to test Documentation : Configuration management, Reviews, Industry Standards - ISO 9001, CMM for Software, IEEE standards.

Suggested Books:

1. Tamres L.(2002), *Introducing Software Testing(2ed)*, Pearson Education.
2. William P.(2006), *Effective Methods for Software Testing(3ed)*, Wiley India.
3. Beizer B(2003), *Software Testing Techniques(2ed)*, Dream Tech Press.
4. Singh,Y. *Software Testing* : Cambridge University Press.
5. Pressman, R. S. (1997). *Software Engineering: a practitioner's approach* (4th ed.). Tata McGraw-Hill.
6. Aggarwal K.K & Singh Y.(2008), *Software Engineering(3ed)*, New Age International Publishers.
3. Mathur, A.P. (2001), *Foundations of software testing*, Pearson Education.
4. Patton R.(2000), *Software Testing*, Techmedia.
5. Jorgensen, P.C.(2008), *Software Testing a Craftsman Approach*, Auerbach blisher.

Suggested E-Resources:

3. Software Testing
<https://nptel.ac.in/courses/106105150/>
4. Software Testing
<https://www.coursera.org/lecture/software-processes/software-testing-introduction-XmIRH>

Electronic Commerce

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

On successful completion of the course students will be able to

- Recognize the business impact and potential of e-Commerce;
- Explain the technologies required to make e-Commerce viable;
- Discuss the current drivers and inhibitors facing the business world in adopting and using e-Commerce;
- Explain the economic consequences of e-Commerce;
- Discuss the trends in e-Commerce and the use of the Internet.

Section A

Whats and hows of Internet: Development and growth, DNS, Commercialisation of internet. Introduction to e-commerce: e-commerce, Opportunities, Framework, Recent Developments. Planning for Network Infrastructure & Web Architecture, Recent trends.

Section B

Introduction to Internet Protocols: Layers and Networking, Internet Protocol suite, Desk topTCP/IP, Mobile TCP/IP based Networking, Multicast IP.

Principles of Web Site Hosting and Promotion: Decision on Website Design, Legal issues, Domain Name Registration, Site Hosting, Web Site Registration, Offline & online web site promotion.

Section C

E-commerce Business Models: Brokerage, Advertising, Infomediary, Merchant, Manufacturer, Affiliate, Community, Subscription, Utility, Tried and True models. Auctions as a price setting mechanism, Pricing Information, Versioning Information. Cyberlaws, Electronic payment systems: Digital cash.

Suggested Books:

1. Turban, E., King, D., Lee, J., & Viehland, D. (2002). *Electronic Commerce: A Managerial Perspective*. PHI Learning.
2. Kalakota, R., & Whinston, A. B. *Frontiers of E-Commerce*. Pearson Education.
3. Chan, H., Lee, R., Dillon, T., & Chang, E. (2007). *E-Commerce: Fundamentals and Applications*. John Wiley & Sons.

Enterprise Resource Planning

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

On successful completion of the course students will be able to

- To make students able to learn fundamental concepts of ERP system and ERP related technologies.
- To provide students knowledge of different ERP modules and manufacturing perspectives of ERP.
- Use ERP system in different business organizations by having knowledge of latest scenario of ERP market in e-business.

Section A

Introduction to ERP - Predecessors(DSS, MIS, EIS, MRP-I, MRP-II, MR.P-III), Origin, Evolution, and Structure; ERP Overview; Reasons for the growth of ERP market, ERP Benefits - Direct and Indirect; Reasons for failure of ERP Implementations; Reasons Organizations should implement ERP; ERP and related Technologies; Business Process Re- Engineering (BPR) - Evolution and different Phases; Data Warehousing - Advantages, Components, Structure, Uses, and Obstacles to successful Data Warehouse Projects; Data Mining - Verification v/s Discovery, Advantages, Technologies used, ; OLAP- 12 rules, OLAP benefits. Introduction to MOLAP, DOLAP, and ROLAP; Supply Chain Management (SCM) - Objectives , Enabling Technologies; Expert System

Section B

ERP - A Manufacturing Perspective - CAD/CAM, MRP-II, BOM, Closed Loop MRP, DRP, JIT & Kanban, PDM (Product Data Management) & its benefits. Data Management, MTO v/s MTS, ATO, ETO, CTO; The Best Practices in ERP; ERP Modules - Finance, Plant Maintenance, Quality Management, Materials Management; ERP Market - SAP AG, BaaN, J D Edwards, Oracle, PeopleSoft; ERP in India

ERP Implementation Life Cycle - Different Phases, Approaches; ERP Implementation - Problems in Implementation; Cost of ERP - The Hidden Costs; Implementation Methodology; Organizing the Implementation; Key Players in Implementation - Vendors, Consultants, Users; Contracts with Vendors, Consultants, Employees; Project Management & Monitoring; After ERP Implementation; In-house Implementation - Pros & Cons

Section C

The ERP Market - Vendor analysis; Turbo Charge the ERP; Enterprise Integration Applications (E1A); Future Directions in ERP - New Channels, New Markets, Faster Implementation methodologies, Business Models & BAPIs, Web Enabling; ERP & the World Wide Web - E-Commerce, Background, Using ERP though ASP; Making ERP a Success; Critical factors guiding Selection and Evaluation; Strategies for successful Implementation; Impediments & initiatives to achieve success; CSF (Critical Success Factors); Integrating ERP into Organizational Culture; ERP Case Studies

Using ERP Tool: Either SAP or ORACLE formats for Case Study.

Suggested Books:

1. Leon, A. (2014). *Enterprise Resource Planning*. Tata McGraw-Hill.
2. Leon A. (2001). *ERP Demystified*. Tata-McGraw Hill.
3. Monk, E., & Wagner, B. (2012). *Concepts in Enterprise Resource Planning*. Cengage Learning.
4. Altekar, R. V. (2004). *Enterprisewide Resource Planning: Theory and Practice*. PHI Learning.
5. Jacobs, F. R., & Whybark, D. C. (2000). *Why ERP? A Primer on SAP Implementation*. Tata McGraw-Hill.

Semantic Web

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

On successful completion of the course students will be able to

- Understand role of semantic web in real world applications.
- Develop knowledge implementation in different domains
- Learn different types of ontologies.

Section A

Introduction to Semantic Web: History of the (Semantic) Web, Vision of Next Generation Web Technology, Semantic Web Services and Challenges, life cycle of Semantic web, difference between syntactic and semantic web.

Section B

Ontology: Origins and history. Ontologies and schema languages on the web-Introduction to Ontology Development, elements of Ontology, development methodologies, languages of Ontology, types of Ontologies, Ontology Acquisition with Examples.

Section C

Static and dynamic Semantics of the web - Sources of dynamic semantics Information retrieval and theorem-Proving perspectives, Semantic web enabled web services, Applications of Semantic web.

Suggested Books:

1. Akerkar, R. (2009). *Foundations of the semantic Web*, Narosa Publishing House
2. Hitzler, P., Krotzsch, M., & Rudolph, S. (2009). *Foundations of semantic web technologies*. Chapman and Hall/CRC.
3. Fensel, D., Hendler, J., Henry, L., & Wolfgang, W. (2005). *Spinning the Semantic Web*,. Mit Press.

Advanced Computer Architecture

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Use the concepts and design of all type of sequential, combinational circuits for modern processor.
- Have knowledge to design and conduct experiments, as well as to analyze of the hardware of a parallel computer models, Multiprocessors.
- Design techniques such as pipelining and microprogramming in the design of the central processing unit of a computer system.
- Identify, formulate, and solve problems for vector processing.

Section A

Overview of modern processor architectures. Processor Design. Memory Hierarchy - Cache and Cache Coherence, Bus Architecture, Types of parallel machine. Vector Pipeline Architectures (Replicated Architectures, Shared Memory, Distributed Memory).

Section B

Parallel Computer Models: The state of computing, multiprocessors and multicomputers, multivector and SIMD computers, architectural development tracks. Program and Network Properties: conditions of parallelism, program partitioning and scheduling.

Section C

Linear Pipeline Processors, Nonlinear Pipeline processors, Instruction Pipeline Design, Arithmetic Pipeline Design, Multiprocessors System Interconnects, Vector Processing Principles, Multivector Multiprocessors and Data Flow Architecture.

Suggested Books:

1. Hwang, K.(1993). *Advanced Computer Architecture*, McGraw-Hill Education.
2. Sima D, FOUNTAIN, T., & Kacsuk, P. (2003). *Advanced computer architectures: a design space approach*. Pearson Education India.
3. Patterson, D. A., & Hennessy, J. L. (2000). *Computer Organization and Design* (2nd ed) kaufmann.
4. Hayes J.P.(1998), *Computer Architecture and Organization*(3rd ed), McGraw Hill.
5. Cragon, H. G. (1998). *Memory systems and pipelined processors*. Narosa Publication.
6. Ghose R. K., Moona R. & Gupta Phalguni(1995), *Foundation of Parallel Processing*, Narosa Publications.
7. Hwang, K., & Xu, Z. (1998). *Scalable parallel computer architecture*, McGraw-Hill.
8. Stalling W(2006), *Computer Organization & Architecture*(7th ed), Pearson .

Suggested E-Resources:

1. Advanced Computer Architecture

<https://www.iitg.ac.in/asahu/cs523e/>

2. Computer Architecture

<https://www.coursera.org/learn/comparch>

Advanced Topics in Algorithms

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Analyze the performance of various algorithms in terms of time and space and understand the concept of Amortization.
- Understand the concept and design of algorithms including matching, flow and circulator problems
- Understand numerous algorithm design techniques for problems like min-cut, Monte Carlo, minimum spanning tree.
- Choose appropriate algorithm design techniques for solving real world problems.
- Ability to understand how the choice of the algorithm design methods impact the performance of programs

Section - A

Analyzing algorithms, Lower and Upper bounds, Analysis of Heap sort and quick sort. Amortization, advanced Data Structures: B Trees, Bionomial heaps, Fibonacci heaps, the Union-Find data structure, splay trees

Section - B

Advanced algorithms: Theory of NP-completeness and approximation algorithms for NP Completeness problems (cg vertex cover, travelling salesman), Planar and plane graphs, the planar separator theorem and applications, Algorithms for Matching, flow and circulator problems, A discussion on Parallel Algorithms.

Section - C

Algorithms in number theory : GCD, Chinese Remainder theorem, Polynomial roots and factors, Primality testing.

Randomized Algorithms: Introduction, Las Vegas and Monte Carlo, The min-cut problem, Minimum spanning trees, Binary planar partitions.

Suggested Books:

1. Cormen Thomas H. ,Leiserson Charles E., Rivest Ronold L. *Introduction to Algorithms*. MIT Press
2. Motwani Rajeev and Raghavan Prabhakar *Randomized Algorithms*, Cambridge University Press,
3. Kozan Dexter C., *The Design & Analysis of Algorithms*, Springer- Verlag, 1991.
4. Aho, Hopcraft & Ullman, *The Design and Analysis of Computer Algorithms*, Addison Wesley, 1975.
5. Garey M.R and Johnson D.S, *Computers & Intractability: A Guide to the Theory of NP-Completeness*, W.H. Freeman, 1979.
7. Tarjan R.E., *Data Structures and Network Algorithms*. SIAM Regional Conference series in Applied Mathematics 44, 1983.
8. Berman K.A., Paul J.L., *Algorithms*, Cengage Learning

Suggested E-Resources:

1. Digital Image Processing by Stanford University
<https://web.stanford.edu/class/ee368/>
2. Digital Image Processing
<https://nptel.ac.in/courses/117105079/>

Information and Communication Technology

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

On successful completion of the course students will be able to

- Understand importance of ICT and its various components.
- Learn about different types of Network & internet terminologies.
- Able to understand the usability of human computer interaction.

Section A

Information Technology:

IT Infrastructure : Basics, Infrastructure Components, Contemporary Hardware Platform Trends,

Managing Data Resources: Traditional File Environment, Database Approach,

Introduction to DBMS, Introduction to ERP, current trends in DBMS and ERP, MIS : Introduction, structure, current trends

Section B

Communication Technology : Introduction to telecommunication. Networks, Intranet and the Internet, Networking Infrastructure, Technologies and Tools for communication and E-Commerce, Wireless computer Networks and Internet Access(with example Bluetooth, Wi-Fi, WiMax and EV-DO)Technologies and Tools for Security and Control

Section C

Human Computer Interaction (HCI) :

HCI and interactive system design from an ICT perspective, psychological issues in HCI, Issues for interactive system design and the ICT context (social and organizational interactivity), tools and techniques for interaction design, user centered design, prototype and evaluation

Suggested Books:

1. Laudon, K. C., & Laudon, J. P. (2016). *Management information system*. Pearson Education India.
2. Preece, J., Rogers, Y., & Sharp, H. (2015). *Interaction design: beyond human-computer interaction*. John Wiley & Sons.
3. Dix A., Finlay J. et al.. *Human Computer Interaction*, Pearson LPE
4. Connolly M.T., Begg E.C.; *Database Systems : A Practical Approach to Design, Implementation and Management*, Addison-Wesley Publication
5. Comer D.E., *Computer Networks and Internets(5ed)*, PHI publication
6. McLeod, R., & Schell, G. P. (2007). *Management information systems*. Pearson/Prentice Hall.
7. Jawadekar, W. S. (2013). *Management Information Systems: Text and Cases: a Global Digital Enterprise Perspective*. Tata McGraw-Hill Education.

Software Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand and implement the concept of SDLC
- Understand the concept of project management
- Apply software quality assurance practices to ensure that software designs, development, and maintenance.
- Perform various testing techniques

Section A

Introduction to Software engineering concepts, Software processes- Software Project Management, Software Configuration Management, Process Management, Software Requirement Specification (SRS) - problem analysis, structured analysis, object oriented modeling, ER and other modeling approaches, Prototyping. Project Planning, software metrics, project monitoring plans, Risk management, overview of ISO 9000, CMM, SEI.

Section B

Design principles, Modularity, Data Structures, Information Hiding, Cohesion, Coupling, Analysis modeling (SADT, JSD, DSSD, Warner Diagram), Function Oriented Design, Object Oriented Design, Design Notations and specifications, Detailed design, Logic / Algorithmic design, Specification Languages, Design metrics, source code (Halstead, Cyclomatic complexity), Component level design, Real time system design, Coding - Programming Practice, Top down, Bottom up, Structured programming, Object Oriented programming, style, Internal Documentation.

Section C

Software Testing, white box testing, Black box testing, Structural Testing. Test case generation and tool support. Object oriented program testing, State based testing, Incremental testing, Testing process, Level of testing, Test Plan, Test Case specification. Software Testing Strategies, System testing, Maintenance metrics (SMI, BMI, %bad fix), Debugging, Re-engineering.

Suggested Books:

1. Pressman, R. S. (1997). *Software Engineering: a practitioner's approach* (4th ed.). Tata McGraw-Hill.
2. Jalote, P. (2003). *An Integrated approach to Software Engineering*, Narosa Publications.
3. Fairley, R. (1997). *Software Engineering Concepts*. Tata McGraw- Hill.
4. Mall, R. (2004). *Fundamentals of Software Engineering*. PHI Learning, New Delhi.
5. Sommerville, I. (2008). *Software Engineering*. Pearson Education.

Suggested E-Resources:

3. Software Engineering

<https://nptel.ac.in/courses/106101061/>

4. Pressman, R. S. (2005). *Software engineering: a practitioner's approach*. Palgrave Macmillan.

<http://qiau.ac.ir/teacher/files/911610/13-11-1387-17-31-03.pdf>

Advanced Database Management Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Learn basic concepts of Intelligent, Object relational Databases.
- Understand components of active, object, and deductive database
- To have knowledge of temporal, spatial, multimedia, mobile and web databases
- Able to write down queries in XML for parallel databases and information retrieval.
- Learn various security and authorization details related with advance database management system.

Section A

INTELLIGENT DATABASES :

Active Databases- passive (conventional) vs. active databases, syntax and semantics of active databases (Starburst, Oracle, DB2), applications, Design principles, Rule modularization, Rule debugging, Rule monitoring, IDEA methodology.

OBJECT AND OBJECT RELATIONAL DATABASES:

Introduction to Object–Oriented Data models ,Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects , Object Reference.

Relational Extensions: Object Relational DBMS Database design for an ORDBMS, Query processing and optimization issues, overview of SQL3, Comparison of ORDBMS and OODBMS.

DEDUCTIVE DATABASES:

Logic of Query Languages – Datalog- Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL.

Section B

Temporal Databases: Temporal projection and join, Time domain, Time data types, Fact Association with time, Time ontology, Data Model, Language constructs.

Spatial, Text & Multimedia Databases: Traditional indexing Methods; secondary keys, special access methods, text retrieval, Multimedia Indexing; 1-D Time Series, 2-D Color Images, Subpattern Matching.

Mobile Databases: Data, processing and technology requirements.

Information Retrieval and XML Data: Web Search Engines, Information Retrieval and Structured Data, Directories. XML: structure, schema, querying and transformation, application program interface, storage of XML, XML applications.

Section C

Parallel Databases: Parallel Database Architectures, Parallel Query Evaluation, Data Partitioning, Parallelizing Sequential Operator Evaluation Code, Parallelizing Individual Operations.

Database Security and Authorization: Database Security Objective and Issues, Security Violations, Authorization (Access Rights), Access Control, Discretionary Control, Mandatory Access Control, Covert Channels, DoD Security Levels, Additional Issues Related to Security, Role of Database Administrators (DBA).

Suggested Books:

1. Connolly, T. M., & Begg, C. E. (2005). *Database systems: a practical approach to design, implementation, and management*. Addison Wesley.
2. Ramakrishnan, R., & Gehrke, J. (2000). *Database management systems*. McGraw Hill.
3. Harrington, J. L. (2000). *Object-oriented database design clearly explained*. Academic Press
4. Piattini, M., & Diaz, O. (2000). *Advanced database technology and design*. Artech House, Inc..
5. Garcia-Molina, H., Ullman, J. D., & Widom, J. (2008) *Database Systems: The Complete Book*, Pearson..
6. Lynne, D. (2003). *Multimedia Databases: An Object Relational Approach*. Pearson Education India.
7. Teorey, T. J., Lightstone, S. S., Nadeau, T., & Jagadish, H. V. (2011). *Database modeling and design: logical design*. The Morgan Kaufmann Series in Data Management Systems
8. Prabhu, C. S. R. (2004). *Object oriented database systems*. Prentice-Hall of India Pvt. Ltd.
9. Leon, A., & Leon, M. (2010). *Database management systems*. Vikas Publishing House Pvt. Limited.
10. Zaniolo, C., Ceri, S., Faloutsos, C., Snodgrass, R. T., Subrahmanian, V. S., & Zicari, R. (1997). *Advanced database systems*. Morgan Kaufmann.

Suggested E-Resources:

1. Advanced Database Systems
<https://www2.cs.duke.edu/courses/spring05/cps216/LectureNotes.html>
2. Advanced DBMS <http://www.cse.iitb.ac.in/infolab/Data/Courses/CS632/>

Distributed Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand distributed systems concepts and issues.
- Understanding of communication, naming and file system in distributed system
- Learn synchronization and fault tolerance mechanism, security in distributed systems
- Basic understanding of Parallel Distributed Processing & learning

Section A

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Distributed system models, Issues in design of distributed operating system, message passing, synchronization, process management, resource management; Case studies: DCE, Unix IPC, SUN RPC.

Section B

Communication : Remote Procedure Calls, Remote Object Invocation, Message oriented Communication, Stream oriented Communication, Distributed file systems: Concurrency control, replicated files, consistency, Introduction to distributed data-base

Section C

Naming: Names, Identifiers, and Addresses, Name Resolution, The Implementation of Name Space, The Domain Name System.

Fault tolerance: Basic Concepts, Failure Models, Failure Masking by Redundancy, Security : Threats, Policies, and Mechanisms, Design Issues, Secure Channels, Access Control, Security Management, Introduction to Parallel Distributed Processing: General Framework, Methods of Learning; Case studies: Distributed OS, Amoeba, V-system

Suggested Books:

1. Tanenbaum, A. S. (2009). *Distributed Operating Systems*. Pearson Education .
2. Coulouris, G. F., Dollimore, J., & Kindberg, T. (2005). *Distributed systems: concepts and design*. pearson education.
3. Sinha, P. K. (2002). *Distributed Operating Systems: Concepts and Design*. PHI Learning.
4. Rumelhart D.F, McClelland JI & PDP Group (1999). *Parallel Distributed Processing*, vol I&II, MIT Press.
5. Garg, V. K. (2012). *Principles of distributed systems* , Kluwer Academic

Suggested E-Resources:

1. Distributed Systems
<https://nptel.ac.in/courses/106106168/>
2. Tanenbaum, A. S., & Van Steen, M. (2007). *Distributed systems: principles and paradigms*. Prentice-Hall.
<https://www.distributed-systems.net/index.php/books/distributed-systems-3rd-edition-2017/>

Information Security Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Able to apply cryptography algorithms in real world problems.
- Understand need of security for information.
- Learn the role of digital signatures and cyber cash in digital world.

Section A

Foundations of Cryptography and Security, Ciphers and Secret Messages, Security Attacks and Services, Mathematical Tools for Cryptography, Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Discrete Logarithms, Conventional Symmetric Encryption Algorithms, Theory of Block Cipher Design, DES and Triple DES, Modes of Operation (ECB,CBC, OFB,CFB), Strength of DES, Modern Symmetric Encryption Algorithms, IDEA, RC2, RC5, Rijndael (AES), Stream Ciphers and Pseudo Random Numbers, One Time Pad, Cryptanalysis

Section B

Public Key Cryptography, Prime Numbers and Primality testing, Factoring Large Numbers, RSA, Cryptanalytic attacks on RSA, Diffie-Hellman Algorithm, Hashes and Message Digests, Message Authentication, MD5, SHA, HMAC, Digital Signatures, Digital Signature Standard (DSS and DSA), Elliptic Curve Cryptosystems.

Section C

Authentication of Systems, Kerberos (V4 and V5) , Electronic Mail Security (Pretty Good Privacy, S/MIME) , IPSec and Web Security, Intrusion detection systems, Secure Sockets and Transport Layer (SSL and TLS), Electronic Commerce Security, Electronic Payment Systems, Secure Electronic Transaction (SET), Cyber Cash, Digital Watermarking and Steganography

Suggested Books:

1. Schneier, B. (2006). *Applied cryptography: protocols, algorithms, and source code in C(2ed)*. John Wiley & Sons.
2. Stallings, W. (2011). *Cryptography and Network Security,(4ed)*. Pearson Education India.
3. Katz, J., Menezes, A. J., Van Oorschot, P. C., & Vanstone, S. A. (1996). *Handbook of applied cryptography*. CRC press.
4. Schneier, B. (2004). *Secrets and lies: digital security in a networked world*. John Wiley & Sons.

Suggested E-Resources:

1. Introduction to Computer Security

<https://www.cs.northwestern.edu/~ychen/classes/cs350-w07/lectures.html>

2. Cryptography and Network Security

<https://nptel.ac.in/courses/106105031/>

Software Architecture and Project Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand the development cycle
- Understand the ways to deal with existing software architecture and how to interpret them for the new product development
- Apply basic software quality assurance practices to ensure that software designs, development, and maintenance meet or exceed applicable standards

Section A

Review of software engineering concepts: Principles of software engineering, Features of good software. Quality Requirement in different Application Areas **Software Process:** Software Process and Models, Tools and techniques of Process Modeling, Product and Process

Introduction to Project Management: Definition of the project. Project specification and parameters. Principles of Project management, Project management life cycle

Software Project Planning: Project activities and Work Breakdown Structure (WBS), Criteria for completeness in the WBS, Activity Resource Requirements and Cost, Joint Project Planning Session, Project Management Plan

Case Study

Section B

Project Economics: Project Costing, Empirical Project Estimation Techniques, Decomposition Techniques, Algorithmic methods, Automated Estimation Tools

Project Scheduling and Tracking Techniques: Why are projects delayed? Effort Estimation Techniques, Task Network and Scheduling Methods, Monitoring and Control Progress, Graphical Reporting Tools.

Risk Analysis and Management: Risk Concepts and Identification, Risk Assessment and Control, Risk Components and Drivers, Risk Tracking and Monitoring, Risk Mitigation and Management.

Software Metrics and Project Management: Measures, Metrics and Indicators, Process and project metrics. Statistical Metrics and Process Monitoring, Function-point and project management

Case Study

Section C

Project Management Issues with regard to New Technologies: Object-oriented Methodology, Web-based Projects, Embedded Systems.

Software Architecture: Introduction to Software Architectures, Origin & design process of Software Architectures, Quality Attributes, Scope of software architecture, architectural styles. Software architectural design.

Suggested Books:

1. Hughes, B., & Cotterell, M. (1968). *Software project management*. Tata McGraw-Hill Education.
2. Mary, S., & David, G. (1996). *Software Architecture: Perspectives on an Emerging Discipline*. Prentice-Hall.

3. Jalote,P.(2001) *Software Project Management in Practice*, Addison-Wesley Professional,
4. Rakos, J. J. (1998). *Software project management for small to medium sized projects*, Prentice Hall.
5. Royce, W. (2001). *Software project management: A Unified Framework*, Addison-Wesley
6. Norris, M., Rigby, P., & Payne, M. (1993). *The Healthy Software Project: A guide to successful development and management*. John Wiley & Sons, Inc..
7. Mynatt, B. T. (1990). *Software engineering with student project guidance*. Prentice-Hall, Inc..
8. Larson, E. W., & Gray, C. F. (2008). *A Guide to the Project Management Body of Knowledge(4ed)*,Project Management Institute.
9. Whitten, N. (1995). *Managing software development projects: formula for success*. New York: Wiley.

Suggested E-Resources:

1. Software Engineering

<https://nptel.ac.in/courses/106101061/17>

Offered by: IIT Bombay

2. Software Product Management Specialization

<https://www.coursera.org/specializations/product-management>

Offered by: University of Alberta

Conceptual Design of Chemical Processes

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Identify the mathematical constraints involved in process design.
- Identify other constraints such as local government policy, environment clearance, safety concern and economics which can change feasibility of a process.
- Carryout flow sheeting of the process

Section A

The design process: Steps involve in process design, Environmental protection and Safety consideration.

Developing a conceptual design and finding the best flowsheet: Input information, Batch vs. Continuous, Input output structure of the flowsheet and Recycle structure of the flowsheet.

Separation system: Introduction, General structure of the separation system, Selection of equipment (Absorption, Adsorption Membrane Separation, Distillation, Drying and Crystallization).

Section B

Capital cost estimation: Cost Indexes, Installation Cost, Process plant Cost and Process equipment cost.

Estimation of total capital investment: Order of Magnitude, Study Estimate, Preliminary Estimate.

Earning and profitability analysis: Working capital Investment, Manufacturing and Non-Manufacturing capital Investment, Total Production Cost, Time value of money, cash Flow, Depreciation and Rigorous Profitability Measures.

Section C

Energy integration: Introduction, First law and Second Law Analysis, minimum heating and minimum cooling load Networks for maximum Energy Recovery Minimum number of exchanger Optimum Approach Temperature, Grid diagram and Cascade diagram, Heat Integrated distillation Trains.

Interaction of process of process design and process control: Control System configuration, Qualitative Plant wide control system synthesis.

Scheduling of batch processes: Design of Single and Multiple product processing sequences.

Recommended Books:

1. Seider W. D. & Seader J. D. & Lewin D. R. (2012). Product & Process Design Principles. India: Wiley.
2. Peters M. S. & Timmerhaus K. D. (1989). Plant Design and Economics for chemical Engineering. McGraw Hill.
3. Smith R. (1989). Chemical Process Design. New York: McGraw Hill.
4. Sinnott R. K. (1989). An Introduction to Chemical Engineering Design. Oxford: Pergamon Press.

E-resource(s): <https://nptel.ac.in>

Corrosion Science and Technology

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand the concept of thermodynamics and kinetics of aqueous corrosion
- Recognize the factors, forms and affecting parameters of corrosion
- Monitor, test and prevent corrosion

SECTION- A

Thermodynamics of Aqueous Corrosion: Electrode processes - electrode potential, free energy, emf series, potential measurements with reference electrodes, three electrode systems, computation and construction of Pourbaix diagrams of Fe, Al, Ni, and Zn, practical use of E-pH diagrams. Chemical vs. electrochemical mechanism of corrosion reactions, corrosion rate expressions.

Kinetics of Aqueous Corrosion: Corrosion current density and corrosion rate, exchange current density. Polarization - activation control, Tafel equation, mass transport control, mixed potential theory and behavior of galvanic couples in acidic environments, effect of oxidizer, combined polarization, factors affecting polarizations and rate of corrosion. Passivity, potentiostatic polarization curves, factors affecting passivity, mechanism of action of passivators.

SECTION-B

Factors Affecting Aqueous Corrosion: Effect of environmental variable - effect of pH, oxidation potential, temperature, velocity/fluid flow rate, concentration, biological effects. Effect of metallurgical variables - metals and their surfaces, alloys and their surfaces, effect of alloying on corrosion resistance, effect of heat treatment.

Form of Corrosion: General corrosion - atmospheric corrosion, galvanic corrosion, general biological corrosion. Localised corrosion - filiform corrosion, crevice corrosion, pitting corrosion, localized biological corrosion.

Metallurgically Influenced Corrosion: Inter granular corrosion, de-alloying. Mechanically assisted corrosion - erosion corrosion, fretting corrosion, corrosion fatigue. Environmentally induced cracking – mechanism of stress corrosion cracking and hydrogen embrittlement.

SECTION-C

Prevention and Control of Corrosion: Corrosion control by design. Selection of corrosion resistant materials – alloying, stainless steel and brass. Oxidation resistant materials, control of high temperature oxidation. Cathodic and anodic protection methods. Use of inhibitors-types, applications. Corrosion in cold water pipes – Langlier saturation index.

Corrosion Monitoring: Introduction – On-stream monitoring – Electrical resistance, linear polarization, hydrogen test probe, ultrasonic testing, radiography and corrosion coupons. Off-stream monitoring equipments – Acoustic emission testing, eddy current inspection, liquid penetration inspection.

Corrosion Testing: Purpose and classification. Dimensional change – Ultrasonic thickness measurements, eddy current, microscopic examination. Weight change – Specimen preparation, test conditions and evaluation of results

for overall corrosion, SCC, IGC. Electrochemical techniques – Polarization curves, Tafel extrapolation, linear polarization, AC impedance methods (EIS).

Recommended Books:

1. Jones, D. A. (1992). Principles and prevention of corrosion. Macmillan.
2. Fontana, M. G. (2005). Corrosion engineering. Tata McGraw-Hill Education.
3. Trethewey, K. R., & Chamberlain, J. (1995). Corrosion for science and engineering.
4. Schweitzer, P. A. (1989). Corrosion and corrosion protection handbook (Vol. 1). CRC Press.

E-resource(s): <https://nptel.ac.in>

Polymer Processing and Reaction Engineering

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Get idea about extrusion, blow molding, wire coating etc. and it's affecting parameters
- Carry out various molding techniques, problems and their solutions
- Understand the methods to achieve polymerization by various reactors

Section-A

Basic principles, description of different processing techniques such as extrusion, blow molding, wire coating, calendaring including equipment, detailed discussions of parameters affecting the processing, problems and troubleshooting during processing, compounding and mixing of polymers and additives.

Section-B

Description of different processing techniques such as molding compression, injection, transfer, reaction-injection, thermoforming including equipment details and discussion on parameters affecting the processing, problems and troubleshooting during processing, reinforced polymers and their processing.

Section-C

Review of RTD & macro and micro mixing in reaction vessels. Homogeneous continuously stirred tank, segregated continuous stirred tank reactor and laminar flow tubular reactor in case of ionic, free radical and step growth polymerization. Models of heterogeneous Polymerizations. Solution / precipitation, suspension and Emulsion Polymerization, Smith Ewart Model, Application to continuous emulsion polymerization. Co-ordination polymerization in fluidized bed reactor.

Recommended Books:

- Tadmor, Z., & Gogos, C. G. (1979). Principles of Polymer Processing John Wiley u. Sons, New York, Brisbane, Chichester, Toronto.
- Baird, D. G., & Collias, D. I. (2014). Polymer processing: principles and design. John Wiley & Sons.
- Gupta, S. K., & Kumar, A. (2012). Reaction engineering of step growth polymerization. Springer Science & Business Media.

E-resource(s): <https://nptel.ac.in>

Bioenergy Engineering

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- To judge the different options available given the nature of the feedstock.
- To apply the acquired knowledge to design biomass energy plants and to evaluate their performances.

SECTION – A

Introduction to microbiology and biochemical engineering: Microbial variety; Nomenclature of organisms; Classification of organisms; Cell structure; Gram +ve and Gram – ve bacteria; Growth medium; Enzyme kinetics; Enzyme immobilization technique; Cell counting techniques; Growth phases of microorganism; Factors affecting the growth of microorganisms; Fermentor; Bioproduct recovery and bioseparation.

Introduction to bioenergy: Overview; Needs and Benefits; Types of bioenergy; Bio-facilities; Conversion of biomass to biofuels.

Bioenergy from wastewater: Process of energy recovery-conversion to methane, Internal combustion engine, Fuel cell, Production of hydrogen; Microbial fuel cell; Future direction of research.

SECTION – B

Food waste to bioenergy: Anaerobic digestion (AD) – Biochemical principle of AD, Two phase AD (BIOCELL and HASL); Parameters affecting AD – pH, Composition, Loading rate, Retention time, Biodegradability, Lipid content, C/N ratio, Temperature; Biomethane production.

Energy from municipal solid waste (MSW) and landfill (LF): Sources of MSW; Solid state fermentation (SSF) – Process, Advantages/disadvantages, Affecting parameters; Case studies; Formation of LF gases; Landfill gas facility and utilization of energy; Landfill gas quality and quantity; Factors affecting biogas production; Landfill bioreactors. Future perspectives.

Biohydrogen: Types of waste materials; Processes – Dark fermentation, Photo fermentation, Hybrid process; Future research.

Biodiesel: Production of biodiesel – Blending, Microemulsion, Thermal cracking, Transesterification (reactor systems, mechanism, affecting factors); Conclusion.

SECTION – C

Algal biodiesel: Microalgae; Advantages; Technologies for algal biomass production – Phototrophic production (open pond, closed photobioreactor, hybrid systems), Heterotrophic production, Mixotrophic production; Biofuel productivity factors – Photosynthetic efficiency, Impact of strain, Lipid productivity; Co-processes in microalgal production; Recovery of microalgal biomass; Extraction and purification of algal biomass; Algal biomass to biodiesel; Other fuel generation from microalgae.

Conversion of lignocellulosic biomass: Preprocessing methods; Lignin recovery (Organosolv method); Application of lignin; Cellulose saccharification- Acidic hydrolysis, Enzymatic hydrolysis, Thermochemical transformation, Supercritical water treatment, Solid-acid catalyzed reaction; Conclusion.

Bioethanol: Biomass resources and production method; Ethanol production from waste materials; Microorganisms for ethanol fermentation – microorganism producing ethanol, Microorganisms synthesize hydrolytic enzymes; World status; Future aspects of research; Algal bioethanol – Characteristics and advantages, Sources of algae, Production of bioethanol from algal biomass, Future perspectives.

Recommended Books:

1. Khanal S. K., Rao Y. S. Zhang T. C., Lamsal B. P., Tyagi R. D. & Kao C. M. (1998). Bioenergy and Biofuel from Biowastes and Biomass. ASCE publication.
2. Vesilind P. A., Worrell W. A., Reinhart D. R. & Speight J. G. (1986). Synthetic Fuel Handbook: Properties, Process and Performance. Mc-Graw Hill Publishers.
3. Klass D. L. (1998) Biomass and Renewable Energy Fuels and Chemicals. Academic Press.
4. Sunggyu Lee S. & Shah Y. T. (2007). Biofuels and Bioenergy: Processes and Technologies. CRC Press.

Catalysis and Surface Chemistry

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand colloids, association of colloids and electro-kinetic effects
- Prepare, understand and analyze the properties of catalysis
- Characterize, select the catalyst and design the reactor

Section-A

Introduction: Basics of surface chemistry, surface tension and adsorption.

Surface & colloids: coagulation and kinetics of coagulation, spontaneous aging of colloids.

Aggregation process: Coalescence and particle growth, Stability of colloids, determination of change on colloids, size and shape of colloids.

Association of colloids: Self-assembly system, reversal of phase, emulsion (micro, macro and aerosols), emulsifying agents, theories of emulsification, gel, sol gel transformation.

Electro kinetic effect: Electrosmosis, electrophoresis, streaming potential, dorn effect, stabilization of surfactant solution.

Section-B

Catalysis: Emergence of Catalyst Technology, Basic Variables for Control of Chemical Reactions, Importance of Catalysis and Catalyst Technology, Impact on Society and Life Forms, Scope of Catalyst Technology, Fundamental Catalytic Phenomena, Steps in a Heterogeneous Catalytic Reaction, Reaction and Diffusion Resistances for a Catalytic Reaction, Kinetics of Catalytic Surface Reactions, Effects of Surface Structure and Support on Catalytic Activity.

Catalyst materials, properties and preparation: Catalyst Materials: Active Phase, Carriers, Promoters, Molecular Sieves and Zeolites, Catalyst Properties, Catalyst Engineering, Physical, Mechanical and Chemical Properties, Catalyst Preparation methods. New Concepts of Catalysis Design, Design of New Molecular Sieves, Design of Sophisticated Composite Catalysis Based on Nanostructures.

Section-C

Catalyst characterization and selection: Principles and Objectives of Catalyst Characterization, Determining Physical Properties of Catalysts, Determining Chemical Properties of Catalysts and Catalyst Selection Catalytic fixed Bed Reactor Design and Activity Testing Fundamentals of Reactor Design, Collecting, Analyzing and Reporting Data from Laboratory Reactors, Choosing Reactors in the Laboratory and Plant Design of Adiabatic, Iso-thermal, non-isothermal and non-adiabatic reactors.

Recommended Books:

1. Somorjai, G. A., & Li, Y. (2010). Introduction to surface chemistry and catalysis. John Wiley & Sons.
2. Atkins, P. & de Paula, J. (2006). Physical Chemistry 8th edition. Great Britain. Oxford University Press, 6, 791-830.
3. Upadhyay, S. K. (2007). Chemical kinetics and reaction dynamics. Springer Science & Business Media.
4. Froment, G. F., Bischoff, K. B., & De Wilde, J. (1990). Chemical reactor analysis and design (Vol. 2). New York: Wiley.
5. Smith, J. M. (1981). Chemical engineering kinetics.

Cryogenic Engineering

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand utilization of cryogenic engineering in the benefit of the society
- Understand working principles of various units such as cryo-coolers, gas liquefaction unit, refrigeration etc.

Section A

Gas Liquefaction Systems: Thermodynamically Ideal System, Joule - Thomson Effect, Adiabatic Expansion; Liquefaction Systems for Air, Neon, Hydrogen and Helium - Effect of component efficiencies on System Performance.

Section B

Gas Separation and Purification: Principles - Plate Calculations - Air, Hydrogen and Helium separation systems.

Cryogenic Systems: Ideal and practical systems - Cryogenic Fluid Storage and Transfer systems - Storage vessels , Insulation - Two Phase Flow in Cryogenic Transfer Systems - Cool Down Process Module IV

Section C

Cryogenic Fluid Vacuum Technology: Low Temperature Properties of Materials - Properties of Cryogenic Fluids - Pump Down Time - Applications of Cryogenic Systems - Super Conductive Devices, Rockets and Space Simulation, Cryogenics in Biological and Medicine - Cryo pumping

Recommended Books:

1. Baron, R. (2003). Cryogenic System. New York: McGraw Hill
2. Timmerhaus, K. D. & Flynn, T. M. (2004). Cryogenic Process Engineering. Plenum Press.
3. Russel B. S. (2003). Cryogenic Engineering. Van Nostrand.
4. Yance R. W. & Duke W. M. (2009). Applied Cryogenic Engineering. John Willey.

Industrial Heat Treatment

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand details analysis of heating process, heating or cooling requirements and problems encountered during heat treatment
- Learn about how control material properties with-out using stress
- Identify solution using automation for time-temperature controlled treatment to change material properties

Section A

Time-temperature parameters of a heat treatment process; classification of heat treatment processes; heat treatment as applied to the products of steel-making industry, machine building and automobile industry, tool making industry, etc.

Section B

Heat treatment defects and their rectification, modernization of heat treatment processes for near net shape applications and surface treatments; energy efficiency in heat treatments; furnace atmospheres and their production, heating and cooling media and their characteristics.

Section C

Calculations on heating and cooling of charges; equipment of heat treatment shops and their selection; mechanization, automation, design and layout of heat treatment shops.

Recommended Books:

1. Dieter, G. E. (1999). Engineering Design: A Materials and Processing Approach. New York: McGraw hill.
2. Lakhtin Y. & Weinstein N. (1980). Engineering physical metallurgy and heat treatment. Central Books Ltd.
3. Avner S. H. (2016). Introduction to physical metallurgy. Delhi: TATA McGraw hill.
4. Bralla J. B. (1998). Design for manufacturability handbook. New York: McGraw hill handbooks.

E-resource(s): <https://nptel.ac.in>

Advanced Chemical Engineering Lab

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

The students will be able to:

- Understand the kinetics of various kinds of reaction
- Determination of COD and BOD
- Operate spectrophotometer, HPLC, GC, etc.

Selected experiments are to be performed from the following list:

1. Kinetics of homogeneous reactions
2. Kinetics of heterogeneous reactions
3. Gas-solid reactions
4. Determination of Chemical Oxygen Demand (COD)
5. Determination of Biochemical Oxygen Demand (BOD)
6. Aeration of water/wastewater
7. Boiling heat transfer coefficient
8. Unsteady state heat transfer in solid
9. Determination of heat transfer coefficient in shell and tube heat exchanger
10. Mass transfer with chemical reaction
11. Heat and mass transfer coefficient in cooling tower
12. Bubble-cap distillation
13. Flow control
14. Temperature control
15. Control valve characteristics
16. UV spectrophotometer
17. Gas-liquid chromatography (GLC)
18. HPLC
19. Membrane characteristics
20. Two phase flow pressure drop
21. Collection efficiency of a Cyclone separator
22. Study of batch and continuous filtration process
23. Determination of mass transfer coefficient in a fluidized bed drier

Advanced Process Control

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand the basic principles and importance of process control in industrial process plants.
- Specify the required instrumentation and final elements to ensure that well-tuned control is achieved.
- Understand the use of block diagrams & the mathematical basis for the design of control systems.
- Design and tune process (PID) controllers.
- Use appropriate software tools for the modeling of plant dynamics and the design of well tuned control loops.

Section-A

Brief review on: 1st and 2nd order systems, block diagram; Open and closed loop transfer functions; P, PI, PD and PID controllers; Feedback, feedforward and cascade control systems; matrix algebra.

Advanced control systems: Process with large dead time, Dead time compensation, Selective control system, Split-Range control, Ratio control, Adaptive control, Inferential control.

Section-B

Advanced control configurations for multiple input multiple output (MIMO) processes: Design questions for MIMO control systems, Degree of freedom and number of controlled and manipulated variables, Generation of Alternative loop configurations.

Interaction and decoupling of control loops: Interaction of Control loops, Relative gain array and the Selection of loops, Design of non-interacting control loops.

Section-C

Digital computer control loops: The digital computer, Computer-process interface for data acquisition and control.

Continuous to discrete time systems: Sampling continuous signals, Reconstruction of continuous signals from their discrete-time values, Conversion of continuous to discrete-time models.

z-transforms: Definition of z-transforms, z-transforms of basic functions, Properties of z-transforms, Inversion of z-transforms.

Recommended Books:

1. Stephanopoulos G. (2010). Chemical Process Control: An Introduction to Theory and Practice. New Delhi: PHI learning Private Limited.
2. Luyben, W. L. (1973). Process Modeling, Simulation and Control for Chemical Engineers. McGraw Hill.
3. Coughanowr D. R. (1991). Process System Analysis & Control. McGraw Hill.

E-resource(s): <https://nptel.ac.in>

ADVANCED REACTION ENGINEERING

L T P C

4 0 0 4

Max. Marks 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Heterogeneous Catalysis and Catalytic Processes: characterization of catalysts: engineering properties of catalysts, BET surface area, pore volume, pore size, pore size distribution, nitrogen desorption method, mercury helium method, BET isotherm; physical and chemical adsorption, steps in catalytic reaction.

Mechanism of Catalytic Reactions: Langmuir-Hinshelwood and Eley-Rideal mechanisms, determination of rate expressions using adsorption, surface reaction and desorption as rate controlling step, determination of rate of reaction from experimental data, preparation of catalysts.

Section-B

Catalyst Deactivation: Types of Catalyst Deactivation, Catalyst deactivation kinetics

Global and intrinsic rates: Effect of Diffusion on Reaction Rate, Development of rate equations for solid catalyzed fluid phase reactions, Effective diffusivity, Thiele Modulus, isothermal and non-isothermal effectiveness factor, Estimation of kinetic parameters: Experimental determination of effectiveness factor, weisz-prater criteria, Determination of Global Rate of Reaction, Heterogeneous laboratory reactors.

Section-C

Gas-Liquid Reactions on solid catalyst and Packed bed catalytic reactors: trickle bed, slurry reactors, three-phase fluidized beds, general rate equations & performance equations.

Design of fixed bed catalytic reactor: isothermal, adiabatic, non-isothermal reactors: one dimensional, two dimensional approaches.

Text / Reference Books:

1. Levenspiel, O., "Chemical Reaction Engineering," 3rd ed., John Wiley & Sons, Singapore, 1999.
2. Fogler, H. S., "Elements of Chemical Reaction Engineering," 3rd ed., Prentice-Hall of India, Delhi, 2003.
3. Froment, G.F., Bischoff, K.B., "Chemical Reactor Analysis and Design," 2nd ed, John-Wiley, New York, 1990.
4. Smith, J. M., "Chemical Engineering Kinetics", 2nd Ed., McGraw-Hill, 1981

EQUIPMENT DESIGN

L T P C

4 0 0 4

Max. Marks 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Introduction: Types of materials and their basic characteristics, nature of design, general design considerations, codes and standards, design variables.

Design of Heat exchangers: Codes and standards for heat exchangers. Shell and Tube Heat Exchanger- General design considerations- LMTD correction factor, fluid allocation, fluid velocities, stream temperatures, pressure drop, Shell side and tube side heat transfer coefficients. Plate Heat Exchanger- Advantages, disadvantages, design procedure, temperature correction factor, heat transfer coefficients, pressure drop.

Section-B

Mass Transfer Equipments Design: Introduction to continuous distillation, process description, distillation column design for binary component: design variables, column sizing, plate efficiencies, plate hydraulic design, Packed column design- choice of packing, design procedure, prediction of the HTU, column internals.

Section-C

Design of Mechanical Separation Equipment: Guide to gas-solid separator design: cyclone separator, Guide to Liquid-Gas Separator design: vertical and horizontal separator.

Process Hazards and Safety Measures in Equipment Design: process hazards, hazard identification, risk analysis, pressure relief devices.

Text Books:

1. M. V. Joshi & V. V. Mahajani; "Process Equipment Design", Third Ed; Macmillan India Ltd.
2. R. K. Sinnott, "Chemical Engineering Design", Fourth Ed., Elsevier.
3. Robert E. Treybal, "Mass-Transfer Operations", Third Ed, McGraw Hill Education.

Reference Books:

1. B. C. Bhattacharya, "Introduction to Chemical Equipment Design: Mechanical Aspects", First Ed, CBS Publishers and Distributors Pvt Ltd.
2. Crowl D. A. and Louvar J. A., "Chemical process safety fundamentals with applications", Third Ed, Prentice Hall of India, New Delhi.

Equipment Design

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Identify design parameters
- To design internal pressure vessels and external pressure vessels
- To design special vessels (e.g. tall vessels) and various parts of vessels (e.g. heads)

Section-A

Introduction: Types of materials and their basic characteristics, nature of design, general design considerations, codes and standards, design variables.

Design of heat exchangers: Codes and standards for heat exchangers. Shell and Tube Heat Exchanger- General design considerations- LMTD correction factor, fluid allocation, fluid velocities, stream temperatures, pressure drop, Shell side and tube side heat transfer coefficients. Plate Heat Exchanger- Advantages, disadvantages, design procedure, temperature correction factor, heat transfer coefficients, pressure drop.

Section-B

Mass transfer equipments design: Introduction to continuous distillation, process description, distillation column design for binary component: design variables, column sizing, plate efficiencies, plate hydraulic design, Packed column design- choice of packing, design procedure, prediction of the HTU, column internals.

Section-C

Design of mechanical separation equipment: Guide to gas-solid separator design: cyclone separator, Guide to Liquid-Gas Separator design: vertical and horizontal separator.

Process hazards and safety measures in equipment design: process hazards, hazard identification, risk analysis, pressure relief devices.

Recommended Books:

1. Joshi M. V. & Mahajani V. V. (1999) Process Equipment Design. Delhi: Macmillan India Ltd.
2. Sinnott R. K. (1998). Chemical Engineering Design. Elsevier.
3. Treybal R. E. (1995). Mass-Transfer Operations. McGraw Hill Education.
4. Bhattacharya B. C. (2001). Introduction to Chemical Equipment Design: Mechanical Aspects. Delhi: CBS Publishers and Distributors Pvt Ltd.
5. Crowl D. A. & Louvar J. A. (1995). Chemical process safety fundamentals with applications. New Delhi: Prentice Hall of India.

E-resource(s): <https://nptel.ac.in>

Nano-Science and Technology

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Objectives:

The students will be able to:

- Demonstrate the understanding of length scales concepts, nanostructures and nanotechnology
- Identify the principles of processing, manufacturing and characterization of nanomaterials and nanostructures
- Apply the electronic microscopy, scanning probe microscopy and nano-indentation techniques to characterize the nano-materials and nanostructures
- Evaluate and analyze the mechanical properties of bulk nanostructured metals and alloys, nano-composites and carbon nano-tubes

Section-A

Supramolecular chemistry: Definition and examples of the main intermolecular forces used in supramolecular chemistry. Self-assembly processes in organic systems.

Basic principles and fundamental properties: Size and Confinement Effects, Nanoparticle Morphology, Physical and Chemical Properties.

Section-B

Synthesis of nanomaterials: Introduction to nanomaterials, Equipment and processes needed to fabricate nano devices and structures such as bio-chips, power devices and opto-electronic structures. Top-down (Nanolithography, CVD), Bottom-up (Sol-gel processing, chemical synthesis). Wet deposition techniques, Self-assembly (Supramolecular approach).

Section-C

Different classes of nanomaterials: Metal and Semiconductor Nanomaterials, Quantum Dots, Wells and Wires, Molecule to bulk transitions Bucky balls and Carbon Nanotubes.

Instrumentation for nanoscale characterization: TEM, SEM and SPM technique, Fluorescence Microscopy and Imaging.

Recommended books:

4. Steed, J. W., & Atwood, J. L. (2013). *Supramolecular chemistry*. John Wiley & Sons.
5. Br  chignac, C., Houdy, P., & Lahmani, M. (Eds.). (2008). *Nanomaterials and nanochemistry*. Springer Science & Business Media.
6. Lehn, J. M. (1995). *Supramolecular chemistry* (Vol. 1). Germany: Vch, Weinheim.

E-resource(s): <https://nptel.ac.in>

Advanced Heat Transfer

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand flow behaviour in boundary layers
- Do analogs study between heat, mass and momentum
- Recognize factors affecting during transport of mass and energy
- Do make energy balances in boundary layers

Section-A

Introduction; molecular momentum transport; convective momentum transport; velocity distribution in laminar flow; Equations of change for isothermal systems; Equations of change, applications of equations of change; velocity distribution with more than one independent variables, stream functions and velocity potential, flow near solid surfaces, molecular energy transport, convective energy transport.

Section-B

Energy balances; convection; equation of change for non-isothermal systems; applications of equations of change; temperature distribution with more than one independent variable; molecular mass transport; convective mass transport; mass balances; concentration distribution in solids and laminar flow.

Section-C

Concentration distribution with more than one independent variable: boundary layer theory, turbulent flow, velocity distribution in turbulent flow; temperature distribution in turbulent flow; concentration distribution in turbulent flow.

Recommended Books:

1. Bird, R. B., Stewart, W. E., & Lightfoot, E. N. (2007). *Transport phenomena*. John Wiley & Sons.
2. Deen, W. M. (1998). *Analysis of transport phenomena* (Vol. 2). New York: Oxford University Press.
3. Welty, J. R., Wicks, C. E., Rorrer, G., & Wilson, R. E. (2009). *Fundamentals of momentum, heat, and mass transfer*. John Wiley & Sons.

E-resource(s): <https://nptel.ac.in>

Environmental Safety and Impact Assessment

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Develop the basic idea of impact assessment
- Able to predict the impact of air, water and noise pollution
- Assess and manage the environmental risk

Section-A

Introduction: Historical development of Environmental Impact Assessment (EIA), Definition and scope of EIA, Objectives of EIA, Basic EIA principles.

Impact study: Approach for environmental impact studies, EIA as planning tool, EIA methodology, Predictive model of impact assessment.

Section-B

Impact prediction and assessment for air, water and noise: Air: knowledge of air quality, Air quality standards, Sources of pollutants, Effects of pollutions, Conceptual approach for air impacts prediction.

Water: Information on water quality (Surface water and ground water), water quality standards, identification and prediction of impact and assessment.

Noise: Information on noise legislation and guidelines, Methodology for noise-impacts prediction, Assessment of impact significance.

Section-C

Environmental risk assessment (ERA) and management in EIA: Environmental risk assessment, treatment of uncertainty, key steps.

Management Plan: Impact prediction, evaluation and mitigation, Preparation of EIA plan for industrial project and functions, factors for consideration, managing the EIA process, Monitoring and auditing.

Recommended books:

1. Anjaneyulu, Y. (2003). Environmental Impact Assessment. B.S Publications.
2. Attri S. D. & Tyagi, A. (2010). Climate Profile of India. Ministry of Earth Sciences.
3. Glasson, J., Therivel, R. & Chadwick, A. (1998) Introduction to Environmental Impact Assessment. Routledge-Taylor & Francis Group.
4. Lawrence, D.P. (2003). Environmental Impact Assessment – Practical solutions to recurrent problems. Wiley-Interscience.
5. Petts, J. (1999). Handbook of Environmental Impact Assessment, Vol., I and II. Blackwell Science.

E-resource(s): <https://nptel.ac.in>

Computational Methods in Engineering

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Solve linear and nonlinear algebraic equations
- Approximate functional value, integration and ODE
- Solve the ODE and PDE

Section-A

Linear Algebraic Equations: Introduction, Gauss-Elimination, Gauss-Siedel and LU Decomposition methods. Thomas' algorithm. **Eigen Values and Eigen Vectors of Matrices:** Introduction, Fadeev-Leverrier's method, Power method, Householder's and Givens' method.

Nonlinear Algebraic Equations: Single variable and multivariable successive substitution method, Single variable and multivariable Newton-Raphson technique and Polynomial root finding methods: lin's and Lin Bairstow's Methods.

Section-B

Function Approximation: Least squares curve fit, Newton's interpolation formulae, Lagrangian interpolation, Pade approximation and Finite difference approximation.

Integration formulae: Trapezoidal rule, Simpson's 1/3 & 3/8 rule.

Ordinary Differential Equations: Initial Value Problems: Explicit Adams-Bashforth technique, Implicit Adams-Moulton technique and Runge-Kutta methods.

Section-C

Ordinary Differential Equations: Boundary Value Problems: Finite difference technique, Shooting Technique, Orthogonal Collocation using Legendre Polynomials.

Partial Differential Equations: Classification of PDE Solution of Heat equation using Finite difference technique (Method of lines).

Recommended books:

1. Gupta, S. K. (1995). Numerical methods for engineers. New Age International.
2. Hanna, O. T., & Sandall, O. C. (1995). Computational methods in chemical engineering. Prentice-Hall, Inc...
3. Sastry, S. S. (2012). Introductory methods of numerical analysis. PHI Learning Pvt. Ltd...

E-resource(s): <https://nptel.ac.in>

Advanced Mass Transfer

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand single stage binary distillation
- Understand distillation of binary mixture and LLE
- Understand leaching and crystallization

SECTION A

Distillation: Vapor-liquid equilibria: pressure-temperature-concentration phase diagram, enthalpy-concentration diagram; ideal and non-ideal solutions, Raoult's law and its application, relative volatility, maximum and minimum boiling mixtures.

Single stage binary distillation: flash vaporization, partial condensation, differential (Rayleigh) distillation, differential condensation, constant relative volatility, lever rule, steam distillation

SECTION B

Continuous distillation of binary mixtures: ideal and non-ideal stages, definition of a point, stage and column efficiency; Ponchon Savarit method: adiabatic & non-adiabatic; McCabe Thiele method: plate calculations, feed plate location; use of open steam, tray efficiency, tray type (bubble cap, sieve & valve), flooding, tray layout, delta P. tray hydraulics, determination of column height and diameter; packed column.

Liquid-liquid extraction: principle, usefulness, ternary liquid equilibria, triangular coordinates, mixer rule, choice of solvent; Extractors: mixer settlers, spray & packed column, rotating disk contactor, sieve tray column.

SECTION C

Leaching: solid liquid equilibrium; Batch and continuous operations: single and multistage cross current and counter current operations, number of equilibrium stages; Equipments; percolation tank, agitated vessel, thickeners, classifiers, continuous counter current decantation.

Crystallization: nucleation & crystal growth rate, controlled growth of crystals, equilibrium yield of crystallization, heat and mass transfer rates in crystallization, classification of industrial crystallizers.

Recommended books:

1. Seader, J. D., Henley, E. J., & Roper, D. K. (1998). Separation process principles.
2. Taylor, R., & Krishna, R. (1993). Multicomponent mass transfer (Vol. 2). John Wiley & Sons.
3. Benitez, J. (2016). Principles and modern applications of mass transfer operations. John Wiley & Sons.
4. Holland, C. D. (1981). Fundamentals of multicomponent distillation. McGraw-Hill.
5. Wankat, P. C. (2006).
6. Separation process engineering. Pearson Education.

E-resource(s): <https://nptel.ac.in>

Pinch Technology

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Explain the role of thermodynamics in process design
- Calculate the minimum heating and cooling requirements for a process
- Identify existing non-optimal arrangements of heat exchangers
- Calculate lower cost solutions for arrangements of heat exchangers
- Critically assess any design changes to process.

Section –A

Process Integration and its Building Blocks: Definition of Process Integration (PI), School of thoughts, Areas of application and Techniques available for PI, Onion diagram.

Pinch Technology: An Overview: Introduction, Basic concept, How it is different than energy auditing, Role of thermodynamic laws, Problem addressed by Pinch technology.

Key Steps of Pinch Technology: Data extraction, Targeting, Designing, Optimization-Super targeting. Basic Elements of Pinch Technology: Grid diagram, Composite curve, Problem table algorithm, Grand composite curve.

Section – B

Targeting of Heat Exchanger Network (HEN): Energy targeting, Area targeting, Number of units targeting, Shell targeting, cost targeting.

Designing of HEN: Pinch design methods, Heuristic rules, Stream splitting, Design of maximum energy recovery (MER), Design of multiple utilities and pinches, Design for threshold problem, Loops and Paths.

Heat Integration of Equipments: Heat engine, Heat pump, Evaporator, Drier, Refrigeration systems.

Section – C

Heat integration of Reactors: Heat integration characteristics of reactors; Appropriate placement of reactors, Use of the grand composite curve, Evolving reactor design to improve heat integration.

Heat integration of distillation column: Heat integration characteristics of distillation, Appropriate placement of distillation columns, Use of the grand composite curve for heat integration of distillation, Evolving the design of simple distillation columns to improve heat integration, Heat pumping in distillation.

Heat and Power Integration: Co-generation, Steam turbine, Gas turbine.

Recommended Books:

1. Shenoy, U. V. (1995). Heat exchanger network synthesis: process optimization by energy and resource analysis. Gulf Professional Publishing.
2. Douglas, J. M. (1988). Conceptual design of chemical processes (Vol. 1110). New York: McGraw-Hill.
3. Linnhoff, B. (1982). User guide on process integration for the efficient use of energy. AIChE J., 28, 000-000.
4. Smith, R., & Smith, R. (1995). Chemical process design (pp. 8-13). New York: McGraw-Hill.

Process and Product Development

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- To understand the basic concepts of process design, process development and product development.
- To apply material and energy balances for process development using process data.
- To apply algorithms for feasibility and optimization of flow sheet.
- To apply the scaling up processes.

Section A

Introduction: goal of industrial research and development, production structure of chemical industry, task of process development, creative thinking, preliminary database creation, preliminary process synthesis, examples.

Product Development: development of chemical product on laboratory scale, quality improvement, reproducibility etc. Case studies of products developed.

Chemical Production Plant and Its Components: about catalyst, reactors, product processing, pipelines pumps and compressors, product supply and storage, water disposal, measurement and control technology, plant safety, material selection.

Section B

Process Data: Chemical Data, Mass Balance, Physio-chemical data sources and estimation, Patenting and licensing situations, development cost, location, market situation, plant capacity, raw materials, waste disposals

Course of Process Development: Process development as an iterative process, Drawing up of an initial version of the process, checking the individual steps, Micro Plant: Link between the laboratory and the pilot plant, Testing the entire process on small scale.

Section C

Scaling up Process: Scaling up of process from laboratory to pilot plant and to industrial scale.

Process Evaluation: Batch Versus Continuous, Equilibrium Limitations, Process alternatives, Preparation of study report

Flow sheeting: Basic Flow Diagram, P&ID, Development of flow diagram.

Recommended Books:

1. Vogel, G. H. (2005). Process development: from the initial idea to the chemical production plant. John Wiley & Sons.
2. Perkins, J. D. (1989). Conceptual design of chemical processes JM Douglas. New York: McGraw Hill
3. Jordan, D. G. (1968). Chemical process development.
4. Seader, J. D., Seider, W. D., & Lewin, D. R. (2004). Product and process design principles: synthesis, analysis and evaluation. Wiley.
5. Turton, R., Bailie, R. C., Whiting, W. B., & Shaeiwitz, J. A. (2008). Analysis, synthesis and design of chemical processes. Pearson Education.

Advanced Simulation Lab

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

The students will be able to:

- Develop and implement dynamic models in simulation software
- Investigate effect of operating parameters using simulator
- Develop complex network of process flow diagram

Selected experiments are to be performed from the following list using available softwares (MATLAB, ASPEN, AFT Fathom, ProSimulator, OLI Analyzer, ANSYS CFD, K-SPICE).

1. To write a computer code of Newton-Raphson method and simulate it
2. To write a code of solution of linear and nonlinear algebraic equations and simulate it
3. To write a code of Runge-Kutta method and simulate it
4. Heat exchanger control
5. Distillation column control
6. Design and steady state solution of distillation column
7. Steady state and dynamic simulation
8. Simulation of flow through channels
9. VLE/LLE

Computational Fluid Dynamics

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Develop geometrical model of the flow
- To select appropriate boundary conditions
- Obtain solution of dynamic flows using different mathematical models

Section A

Introduction: What is CFD? How does a CFD code works?

Conservation laws of fluid motion and boundary conditions: Governing equations of fluid flow and heat transfer, Equations of state, Navier-Stokes equations for a Newtonian fluid, classification of physical behaviors, classification of fluid flow equations and Auxiliary conditions for viscous fluid flow equations.

Section B

Turbulence and its modeling: Transition from laminar to turbulent flow, Descriptors of turbulent flow, Characteristics of simple turbulent flows (Free turbulent flows , Flat plate boundary layer and pipe flow), Reynolds-averaged Navier–Stokes equations and classical turbulence models (Mixing length model, The k– model and Reynolds stress equation models).

Implementation of boundary conditions: Introduction, Inlet boundary conditions, Outlet boundary conditions, Wall boundary conditions and the constant pressure boundary condition.

Section C

The finite volume method for diffusion problems: Introduction, Finite volume method for one-dimensional steady state diffusion, Finite volume method for two-dimensional diffusion problems and Finite volume method for three-dimensional diffusion problems.

The finite volume method for convection-diffusion problems: Introduction, Steady one-dimensional convection and diffusion, the central differencing scheme, Properties of Discretization schemes (Conservativeness, Boundedness and Transportiveness).

The finite volume method for unsteady flows: Introduction, One-dimensional unsteady heat conduction and Discretization of transient convection–diffusion equation.

Recommended Books:

1. Versteeg H. K. & Malalasekera W. (2007). An introduction to computational fluid dynamics: the finite volume method. Longman scientific & technical publishers.
2. Ranade V. V. (2002). Computational flow modeling for chemical reactor engineering. San Diego: Academic Press.

E-resource(s): <https://nptel.ac.in>

Energy Conservation

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Carryout energy auditing, waste heat recovery and renewable energy resources.
- Carryout calculations related to pay-back, energy management, performs, energy conservation opportunities in various equipments, controllers and heat pumps.
- Understand concepts of non-conventional energy sources, designs and calculation will be explained.

Section-A

Introduction: Energy generation, utilization, economics and growth rates, ENCON: approach, modern techniques, benefits, trends, energy conservation in energy intensive industries: boilers, steam system, heating systems, furnaces.

Energy efficiency: Energy accounting; Overview of energy audit, monitoring and control.

Section-B

Waste heat recovery: benefits, measurement- classifying and storage of waste-heat, open and close waste-heat exchangers, the waste-heat exchanger equipment- heat exchangers, incinerators, regenerators and recuperators, economics of waste-heat recovery, various forms of energy storage- thermal, chemical, mechanical and electrical.

Section-C

Solar energy: Production and transfer of solar energy, general description and characteristics of solar collectors.

Energy from biomass: Sources of biomass, conversion of biomass into fuels- fermentation, pyrolysis, gasification, combustion, aerobic and anaerobic bio-conversion.

Wind energy: Principles of wind energy conversion, site selection considerations, types of wind power conversion systems.

Geothermal energy: Availability, system development and limitations, ocean thermal energy conversion.

Recommended Books:

1. Kreith F. & Goswami D. Y. (2003). Energy management and conservation handbook. CRC Press.
2. Turner W. C. & Doty S. (2005) Energy Management Handbook. The Fairmont Press Inc.
3. Rai G.D. (1997). Non-conventional Energy Sources. Khanna Publishers.
4. Smith Craig B. (2006). Energy Management Principles: Applications, Benefits, Savings. Pergamon.
5. Chakrabarti A. (2015). Energy Engineering And Management. Phi Learning Private Limited.

E-resource(s): <https://nptel.ac.in>

Advanced Transport Phenomena

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to

- Understand the fundamentals of transport process
- Pertain the isothermal, non isothermal and multi-component systems
- Analyze the transport equation and computational methods involving multiphase flow

SECTION A

Fundamentals of transport processes, basics of vector and tensor algebra, phenomenological equations and transport properties, analogies amongst momentum, heat, and mass transport; non-newtonian fluids and rheological behaviour. Basic transport equations for isothermal, non-isothermal and multicomponent systems; velocity, temperature and concentration distributions with more than one independent variables; velocity, temperature and concentration distributions in laminar and turbulent flow.

SECTION B

Macroscopic balances for isothermal, non-isothermal and multicomponent system and their applications in momentum, heat and mass transport problems; simultaneous momentum, heat and mass transfer with chemical reaction.

SECTION C

Analytical methods for solution of transport equations .Computational methods involve in multiphase flow, chemically reacting flows, turbulent mixing etc.

Recommended Books:

1. Bird, R. B., Stewart, W. E., & Lightfoot, E. N. (2002). Transport Phenomena 2nd Ed., John Wiley&Sons. Inc., Hoboken, NJ.
2. Deen, W. M. (1998). Analysis of transport phenomena (Vol. 2). New York: Oxford University Press.
3. Slattery, J. C. (1999). Advanced transport phenomena. Cambridge University Press.
4. Leal, L. G. (2007). Advanced transport phenomena: fluid mechanics and convective transport processes (Vol. 7). Cambridge University Press.
5. Geankoplis, C. J. (2003). Transport processes and separation process principles: (includes unit operations). Prentice Hall Professional Technical Reference.

E-resource(s): <https://nptel.ac.in>

Fluidization Technology

Max. Marks: 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand the fluidization phenomena and operational regimes
- Design various types of gas distributors for fluidized beds and determine effectiveness of gas mixing at the bottom region.
- Analyze fluidized bed behavior with respect to the gas velocity
- Develop and solve mathematical models of the fluidized bed

Section-A

Introduction: the phenomenon of fluidization, liquid like behavior of a fluidized bed, comparison with other contacting methods, advantages and disadvantages of fluidized beds, fluidization quality, selection of a contacting mode for a given application.

Industrial applications of fluidized beds: coal gasification, gasoline from other petroleum fractions, synthesis reactions, metallurgical and other processes, physical operations, synthetic reactions, cracking of hydrocarbons, biofluidization.

Mapping of regimes and dense bed: fixed bed of particles, fluidization without carryover of particles, mapping of regimes, distributor types, gas entry regions, gas jet region.

Section-B

Bubbles in the fluidized bed: single rising bubbles, coalescence and splitting of bubbles, flow model for bubbling bed, two phase hypothesis.

Entrainment and elutriation from fluidized beds: freeboard behavior, location of the gas outlet of a vessel, Entrainment of tall vessel: the elutriation constant approach, relationship between k and G_s , experimental findings of k and k^* , K-L approach.

High velocity fluidization: turbulent fluidized beds, fast fluidization.

Mixing, segregation and staging: vertical and horizontal movements of solids, segregation of particles.

Section-C

Mass and heat transfer in fluidized bed: dispersion of gas in beds, gas interchange between bubble and emulsion, mass transfer between particle and bed, heat transfer between fluidized bed and surfaces.

Circulation system: circuits for the circulation of solids, circulation rates, flow of gas-solid mixture in down-comers.

Fluidized bed reactor: reaction rates and reactor performance, reactor model for fine particle bubbling bed, intermediate and large size particle beds.

Recommended Books:

1. Kunii D. & Levenspiel O. (1991). Fluidization Engineering. Butterworth.
2. Gidaspow D. (1993). Multiphase Flow and Fluidization: Continuum and Kinetic Theory Description. Elsevier Science & Technology.
3. Gibilaro L.G. (2001). Fluidization dynamics. Butterworth Heinemann.

E-resource(s): <https://nptel.ac.in>

Natural and Synthetic Polymers

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Understand the basics of polymer
- Understand kinetics of polymerization
- Classify polymers, their reinforcement and additives

Section-A

Introduction To Polymer Science: history of polymers, types of polymers and polymerizations: polymer composition and structure, polymerization mechanism, nomenclature of polymers, nomenclature based on source, nomenclature based on structure, linear, branched, and crosslinked polymers, molecular weight, physical state, crystalline and amorphous behavior, determinants of polymer crystallinity, thermal transitions, applications of polymers, mechanical properties, elastomers, fibers, and plastics, surface characterization, stress-strain relationships, thermal analysis, particle size, rheology, chemical resistance.

Section-B

Kinetics of Polymerization: step-reaction polymerization or polycondensation reactions stepwise kinetics, general step-reaction polymerization, polycondensation mechanisms, ionic chain-reaction and complex coordinative, polymerization (addition polymerization), cationic polymerization, anionic polymerization, free radical chain polymerization (addition polymerization), initiators for free radical chain polymerization, mechanism for free radical, chain polymerization, chain transfer, kinetics of copolymerization, copolymerization.

Naturally Occurring Polymers: polysaccharides, cellulose, cellulose-regenerating processes, esters and ethers of cellulose, starch, other polysaccharides, proteins, nucleic acids, naturally occurring polyisoprenes, and polymer structure.

Section-C

Inorganic-Organic Polymers: sol-gel, addition polymers, coordination polymers, inorganic reaction mechanisms, condensation organometallic polymers. **Inorganic Polymers:** silicon dioxide (amorphous), silicates, high-temperature, superconductors, silicon dioxide in electronic chips, polymeric carbon—diamond, asbestos, polymeric carbon—graphite, ceramics, polysulfur, zeolites, silicon dioxide (crystalline forms)—quartz form. **Fillers and Reinforcements for Polymers:** Theory of the effect of fillers, fillers, reinforcements, coupling agents, composites, nanocomposites. **Plasticizers, Stabilizers, Flame Retardants and Other Additives:** plasticizers, antioxidants, heat stabilizers, ultraviolet stabilizers, flame retardants, microorganism inhibitors, colorants, curing agents, antistatic agents (antistats), chemical blowing agents, compatibilizers, impact modifiers, processing aids, lubricants, flame-retardant mechanisms.

Recommended Books:

1. Odian, G. (2004). Principles of polymerization. John Wiley & Sons.
2. Carraher Jr, C. E. (2007). Seymour/Carraher's polymer chemistry. CRC press.

E-resource(s): <https://nptel.ac.in>

Processing of Alternative Fuels

Max. Marks: 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Learning Outcomes:

The students will be able to:

- Predict the future of energy scenario and availability
- Understand basic characteristics of alternative fuels including alcohol, biodiesel and gaseous fuels
- Realize the importance of electric and solar power vehicles

Section A

Estimation of petroleum reserve, World Energy Scenario , Energy Survey of India; Oil industry background and history, Survey of oil consumption ;Availability of petroleum products – types – uses , Air craft fuels , Alternate fuels , list of alternate fuels, Need for alternate fuel – Availability of alternate fuels

Section B

Alternative fuels: Liquid and gaseous fuels, Physico-Chemical Characteristics.

alternative liquid fuels - alcohol fuels; Ethanol & Methanol. Fuel composition, Fuel Induction techniques, Fumigation, Emission of oxygenates, Applications to engines and automotive conversions. **Vegetable oil based fuels** Introduction, Various vegetable oils for engines, Biodiesel formulation techniques, trans-esterification, Application in diesel engines- Performance and Emission Characteristics. **Gaseous Fuels** Availability of CNG- automotive gasoline- composition- types- properties – additives-effect of emissions - modification required in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects. Biogas, Producer gas and natural gas; their characteristics, System development for engine application.

Section C

Electric and solar powered vehicles Layout of an electric vehicle – advantage and limitations, Specifications – System component, Electronic control system – High energy and power density batteries – Hybrid vehicle – Solar powered vehicles. Fuel cell vehicles.

Recommended Books:

1. Hordeski, M. F., & Pansini, A. J. (2007). Alternative fuels: the future of hydrogen. The Fairmont Press, Inc..
2. Thipse, S. S. (2010). Alternative fuels. Jaico, India.
3. Bechtold, R. (1997). Alternative fuels guidebook. SAE.
4. Maxwell, T. T., & Jones, J. C. (1994). Alternative fuels. Emissions, economics, and performance (Vol. 143).
5. Lee, S., Speight, J. G., & Loyalka, S. K. (2014). Handbook of alternative fuel technologies. CRC Press.

Green Energy

Max. Marks: 100

L	T	P	C
0	0	0	2

Note: The paper is divided into three sections. The candidates are required to attempt four questions in all.

Learning Outcomes:

The students will be able to:

- Identify the need of wind Energy and solar energy and the various components used in energy, generation and know the classifications.
- Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications.
- Compare Solar, Wind and bio energy systems, their prospects, advantages and limitations

Section-A

Green Chemistry: Introduction, Introduction to chemistry (atoms and elements), Chemical compounds and chemical bonds, Chemical reactions and equations, Physical properties and states of matter.

Green Science & Technology: Introduction, Definition, Concept, techniques involve and applications.

Introduction to Energy Sources: Petroleum in the World, Natural Gas as the Fastest Growing Primary energy, Source in the World, Coal as a Fuel and Chemical Feedstock, Introduction to Renewable and Bio-renewable Sources, Role of energy in economic development and social transformation.

Section-B

Biomass Energy: Introduction, Biomass Characterization, Biomass Fuel Analyses Biomass and its Conversion Technologies.

Fuel Cell Energy: Introduction, types of fuel cell system, Principle of working, construction and applications.

Solar Energy: Thermonuclear energy source, Planck's Law, Thermal radiation fundamentals,

Wind Energy: Introduction, Types of wind turbines, Power extraction by a turbine, Integration of wind energy converters to electrical networks -Applications of wind energy.

Section-C

Wave Energy: Concept of energy and power from waves, Wave characteristics (period and wave velocities), and Different wave energy conversion devices.

Tidal Energy: Principles of tidal power generation, components of power plant, Single and two basin systems, Estimation of energy.

Hydro-Energy: Introduction, types of hydro-energy systems, Overview of micro, mini and small hydro systems; Hydrology; Elements of pumps and turbine; Selection and design criteria of pumps and turbines.

Recommended Books:

1. Twidell, J., & Weir, T. (2006). Renewable energy resources. Routledge
2. Manahan, S. E. (2006). Environmental science and technology: a sustainable approach to green science and technology. CRC Press.
3. Sharpe, D., Burton, T., Jenkins, N., & Bossanyi, E. (2013). Wind energy handbook. Wiley.

E-resource(s): <https://nptel.ac.in>

ISO Practices in Industry

Max. Marks: 100

L	T	P	C
0	0	0	2

Note: The paper is divided into three sections. The candidates are required to attempt four questions in all.

Learning Outcomes:

The students will be able to:

- Differentiate various ISO standards
- Implement ISO practices in environmental management
- Apply ISO standards in energy management system

Section-A

ISO-Quality Management System: Introduction; Quality management system, management responsibilities, contributing approach to quality. the ISO 9000:2006 specific terminology, the concept of quality products, development of concept “quality” and related industrial practices, ISO 9000 family of standards, requirements of the quality management system according to ISO 9001 standard; quality management system documentation.

Section-B

ISO-Environmental Management System: Introduction; general approach to developing an environmental management system, summary of requirements of ISO-14001, other ISO -14000 standards. Design and implementation of ISO-14001 (environmental management system), costing, audits and registration of environmental management system. Measurements systems in environmental managements; choosing suitable measuring instruments, calibration of measuring instruments, documentation. Quantification and effects of air and water pollution. Waste management; waste reduction and disposal. Monitoring process parameters values to minimize pollution risk.

Section-C

ISO-Energy Management System: Introduction to ISO-50001Energy Management System, Phases and Elements, Stages, Requirements, Management responsibilities, Management, Representative, A best practice using OAR and/or PAL for energy team meeting, QVS corporation management, QVS corporation energy policy.

Recommended Books:

1. Singhal, D., & Singhal, K. R. (2012). Implement ISO9001: 2008 Quality Management System: A Reference Guide. PHI Learning Pvt. Ltd..
2. Morris, A. S. (2004). ISO 14000 environmental management standards: engineering and financial aspects. John Wiley & Sons.
3. Howell, M. T. (2014). Effective implementation of an ISO 50001 energy management system (EnMS). ASQ Quality Press.

Life Cycle Assessment

Max. Marks: 100

L	T	P	C
0	0	0	2

Note: The paper is divided into three sections. The candidates are required to attempt four questions in all.

Learning Outcomes:

The students will be able to:

- Get basic idea of life cycle assessment including its goal and scope
- Classify and implementation of LCA
- Interpret LCA, identify its significant issues, report preparation and review the LCA

Section-A

Introduction: Life cycle assessment, History, definition, standards, structure of LCA.

Goal and scope: System of a product, system boundary, unit process, functional unit.

Life cycle inventory: Data collection, databases, allocation, validation.

Section-B

Life cycle impact assessment: Impact categories, classification, normalization, weighting.

Life cycle impact assessment methodologies: Overview of methodologies, Eco-indicator99 method.

Section-C

Life cycle interpretation: limitation of LCA, Identification of significant issues, evaluation, reporting, critical review, LCA in practice, LCA and life cycle management, life cycle thinking, sustainability.

Recommended Books:

1. Scientific Applications International Corporation (SAIC), & Curran, M. A. (2006). Life-cycle assessment: principles and practice (pp. 1-80). Cincinnati, Ohio: National Risk Management Research Laboratory, Office of Research and Development, US Environmental Protection Agency.
2. Guinée, J. B. (2002). Handbook on life cycle assessment operational guide to the ISO standards. The international journal of life cycle assessment, 7(5), 311-313.
3. Zbicinski, I. (2006). Product design and life cycle assessment (Vol. 3). Baltic University Press.

E-resource(s): <https://nptel.ac.in>

Safety in Process Industry

Max. Marks: 100

L	T	P	C
0	0	0	2

Note: The paper is divided into three sections. The candidates are required to attempt four questions in all.

Learning Outcomes:

The students will be able to:

- Potential hazards and hazardous conditions in process industries
- Pay more attention on precaution to avoid accidents
- Make careful decisions during plant malfunction

Section-A

Introduction: Safety program, Accidents & loss statistics, risk perception, nature of the accident process, inherently safer design, safety and environment concern, major process hazards, accident model, personal safety, risk management.

Section-B

Pressure relief System: Source model, introduction, definition, relief concepts, types of relief systems, pressure relief devices and design.

Fire: The Fire triangle, flammability characteristics of liquids and vapors, combustion phenomena, ignition energy, MOC and inerting.

Explosions: Classification, explosion apparatus for vapor and dust, explosion characteristic, energy of chemical and mechanical explosion, TNO multi energy method.

Section-C

Hazard identification: Safety audit, hazard indices, hazard studies, HAZOP, scenario development.

Accident investigation: General investigation concept, cause of accident, evidence issues, evidence analysis, identification of root cause, management system for investigation.

Recommended Books:

1. Lees, F. (2012). Lees' Loss prevention in the process industries: Hazard identification, assessment and control. Butterworth-Heinemann.
2. Crowl, D. A., & Louvar, J. F. (2001). Chemical process safety: fundamentals with applications. Pearson Education.
3. Wentz, C. A. (1998). Safety, health, and environmental protection. McGraw-Hill Companies.
4. Sanders, R. E. (2015). Chemical process safety: learning from case histories. Butterworth-Heinemann.

E-resource(s): <https://nptel.ac.in>

Social Responsibilities of industries

Max. Marks: 100

L	T	P	C
0	0	0	2

Note: The paper is divided into three sections. The candidates are required to attempt four questions in all.

Learning Outcomes:

The students will be able to:

- Understand the scope, value and philosophies of CSR activities
- Develop labor communities, techniques and processes in CSR
- Work for the betterment of working culture and industrial environment

Section-A

Industrial Social Work: Meaning, definition, scope, values and philosophy, social responsibilities industry, various approaches to social welfare, recent development in social work practice in industry, future of industrial social work with special reference to India.

Section-B

Social Case Work: Meaning, principles, techniques and process of use in the area of industrial social work as a method of practice in the industrial setting.

Community Organization: meaning and its use in Industries, labor community development.

Section-C

Corporate Social Responsibility (CSR): Concept, objective and scope, integrated approach to social work methods in the field of industrial social work.

Industrial Environment: meaning and nature, roles, responsibilities of industrial social work in the growth and development of a balanced industrial environment, social service organizations for industrial workers.

Recommended Books:

Alao, K. A., Kobiowu, S. V., & Adebawale, O. F. (2010). Fundamentals of educational and counseling psychology. Strategic Insight Publishing.

E-resource(s): <https://nptel.ac.in>

Water and Land Pollution

Max. Marks: 100

L	T	P	C
0	0	0	2

Note: The paper is divided into three sections. The candidates are required to attempt four questions in all.

Learning Outcomes:

The students will be able to:

- Predict impact of pollution on future and can take appropriate action for prevention
- Identify causes of water and land pollution
- Recognize the conventional techniques which can help in reducing pollution

Section-A

Freshwater pollution: Types and sources; Sampling Methods; Water Quality Parameters.

Types and sources of water pollution: Biological pollutants; Inorganic; Organic; Heavy metals; Pesticides; Radioactive pollutants), Various sources Effluent standards, Drinking water standards, Characteristics of Domestic Waste and Characteristics of agricultural Waste.

Consequences of water pollution: Effect on health on biosphere and on economy.

Sampling methods: Purpose of sampling, different types of samples, collection methods and various instruments used, Methods involved in estimation of parameter for Pollution levels. Concept of dissolved O₂, BOD, COD; Prevention of water pollution (Water treatment processes & Sewage treatment

Section-B

Marine water pollution: Types, sources and consequences; Specifications for disposal of sewage and industrial waste into sea; Disposal of sewage & wash water from MV cargo & ships.

Soil pollution: Types, sources and consequences; Sampling Methods; Specifications for disposal of sewage & effluent on land for irrigation & ground water recharge. Methodology of wastewater disposal on land in India; Impact of usage of land for solid waste disposal both municipal solid waste & industrial solid wastes (fly ash from thermal power station, lime sludge from pulp & paper mills); Disposal of hazardous solid waste (heavy metals, toxic organic compounds) on land & its impact on soil pollution. Deterioration of soil due to mining activities Case study of restoration of land due to disposal to fly ash and dumping overburden & tailing in iron ore extraction.

Section-C

Solid waste pollution: Types, sources and consequences. Classification of wastes (Domestic, Industrial, Municipal, Hospital, Nuclear, Agriculture), Transfer and transport, Recycle, Reuse, Recovery, Conversion of solid wastes energy / Manure, Disposal methods (Generation, Sea disposal, Land disposal, Waste disposal on farm crops for irrigation purpose).

Radioactive pollution: Types, sources and consequences, Sampling methods; Models of radioactive decay.

Detection of nuclear radiations: G. M. Counter, Scintillation counter, semiconductor detector; Interaction of radiation's with matter: Biological effects of ionizing radiations: ICRP recommendations.

Recommended Books:

1. Eisenbud, M., & Gesell, T. F. (1997). Environmental radioactivity from natural, industrial and military sources: from natural, industrial and military sources. Elsevier.

2. Arnikaar, H. J. (1997). Essentials of Nuclear Chemistry: Critique of a review. Current science, 72(5).
3. Arnikaar, H. J. (1995). Essentials of nuclear chemistry (No. 1653). New Age International.
4. Enger, E. D., Smith, B. F., & Bockarie, A. T. (2000). Environmental science: A study of interrelationships. Boston: McGraw-Hill.

E-resource(s): <https://nptel.ac.in>

Advanced Synthesis Processes and Devices

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome

- Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical synthesis processes.
- Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
- Students will be able to clearly communicate the results of scientific work in oral, written and electronic formats to both scientists and the public at large.
- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

Section A

Approaches for nanomaterial fabrication: Top Down and Bottom up, Physical vapour deposition (PVD): Plasma Arc Discharge and Sputtering (DC, RF and RF Magnetron sputtering), Chemical vapour deposition (CVD): LPCVD, PECVD and MOCVD, Crystal Synthesis: Epitaxy and Epitaxial Growth techniques (Homoepitaxial and Heteroepitaxial growth mechanism), Molecular Beam Epitaxy (MBE), Variants: Gas source MBE, Phase locked Epitaxy, Atomic Layer Epitaxy. Lattice mismatched heteroepitaxy

Section B

Photolithography, E-beam lithography, X-ray and Ion-beam lithography: Resists and masks, process, types, problem, limitations and way out. Conventional and unconventional lithography,

Imprint or soft lithography: Printing/decal transfer, Molding/embossing, Phase-Shift Edge lithography and Nanoskiving (mechanical sectioning), Scanning probe lithography: Energy transfer: STM and AFM assisted lithography, local oxidation lithography, Replacement lithography (Nanoshaving, Nanografting and Nanopen reader and writer (NPRW)), and Passive technique: Dip-pen nanolithography, Nanolithography and nanomanipulation.

Section C

Metal-semiconductor junctions, Heterojunctions, High Speed electronic devices: FET, MESFET, HEMT, pHEMT and HBT, MESFET, HEMT and HBT equivalent circuits, Heterojunction Barrier varactor (HBV), Transferred electronic devices: Gunn diode, The SiGe and GaN systems: basic band structure and salient features.

Recommended Books

1. Gabor L. Hornyak, Dutta J. Tibbals H.F., Rao A. (2008) Introduction to Nanoscience (CRC Press)
2. Vajtai, R. (Ed.). (2013). Springer handbook of nanomaterials. Springer Science & Business Media.
3. Henini, M. (Ed.). (2012). Molecular beam epitaxy: from research to mass production. Newnes.
4. Jackson, M. J. (Ed.). (2005). Microfabrication and nanomanufacturing. CRC press..
5. Neamen, D. A. (2012). Semiconductor physics and devices: basic principles. New York, NY: McGraw-Hill,.
6. Manasreh, O. (2011). Introduction to nanomaterials and devices. John Wiley & Sons.

Suggested –web resources

<https://nptel.ac.in/courses/117106109/1>

<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-152j-micro-nano-processing-technology-fall-2005/lecture-notes/cvd.pdf>

Nano-Photonics and Optoelectronics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome

- Understand the fundamental operating principles of photodevices
- LED and heterojunction laser materials selection and design
- Fundamentals of organic electronics and liquid crystal displays
- An overview of photonic systems

Section A

III-V semiconductors; Absorption in Semiconductors: Indirect Intrinsic transitions, Exciton absorption, Donor acceptor and Impurity Band Absorption; Effect of electric field on absorption: Franz Keldysh and Stark effect; Quantum confinement; Quantum Dots; Quantum wells; Absorption in Quantum Wells and Quantum Confined Stark effect; Radiation in Semiconductors: Relation between absorption and emission spectra, Near Bandgap radiative transitions, Deep-level transitions, Auger recombination; Dielectric confinement effect; Superlattices; Core shell Quantum Dots; Quantum confined structures as lasing media

Section B

Introduction to Lasers; Gain in two level lasing medium; Lasing Condition and Gain in semiconductors; Selective Amplification and Coherence; Threshold condition for lasing; Lineshape function: Line broadening mechanisms: Natural Broadening, Collision Broadening, Doppler Broadening; Semiconductor Lasers: Basic principles; Heterojunction Lasers: Energy Band diagram and Power output; Quantum Well and Quantum Dot lasers; Multiple Quantum Well laser; Quantum Cascade laser: Structure and Principle of Operation

Section C

Photonic Crystals: 1D, 2D, 3D Photonic crystals, Photonic Bandgap and defects in photonic crystals, Features of photonic crystals, Optical microcavities, Methods of Fabrication, Nonlinear Photonic crystals, Photonic Crystal Fibre, Photonic Crystal Sensor;

Surface Plasmons: Drude-Sommerfeld theory, Surface plasmon polaritons at plane interfaces, Properties of surface plasmon polaritons, Surface plasmon sensors, Surface plasmons in nano-optics, Plasmons supported by wires and particles

Recommended Books :

1. Bhattacharya P. (2002) Semiconductor Optoelectronic Devices (Prentice Hall India, 11th edition)
2. Prasad P. N. (2004) Nanophotonics (Wiley Interscience, USA).
3. Silvfast W.T. (1998) Laser Fundamentals by, (Cambridge University Press, UK)
4. Ghatak A, Thyagarajan, K (2010) Lasers, Fundamentals and applications (Springer Science+Business Media, USA)
5. Novotny L., Hecht B. (2006) Principles of Nano-Optics (Cambridge University Press, UK)

Suggested web-Resources:

NPTEL : Semiconductor optoelectronics

<https://nptel.ac.in/courses/115102103/>

NPTEL : Nanophotonics

<https://nptel.ac.in/courses/118106021/1>

Fundamentals of Nano-Science and Nano-Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- The knowledge of the general principles of physics, chemistry, electronics and biology that play a role on the nanometer scale
- Insight into the materials, fabrication and other experimental techniques that can be used on the nanoscale, as well as their limitations
- Understanding of the formation of complex macro systems which are unique in their operations and possess new functionalities
- In-depth knowledge of at least one specialization area within the field of nanoscience and nanotechnology.

Section A

Nanostructures: Definition of nanoscience and nanotechnology, classification of the nano materials, zero dimensional nanostructures, one dimensional nanostructures-nanowires, nanorods and nanotubes, two dimensional nanostructures-graphene, Thinfilms.

Quantum Confinement: Quantum dots(QDs), Quantum wires (QWRs), Quantum wells (QWs). Density of states in QDs, QWRs, QWs.

Section B

Synthesis of Nanomaterials: Synthesis of nano-structured materials, sol-gel processing, microwave synthesis, self-assembly, Langmuir-Blodgett (LB) method, electrochemical deposition, chemical vapor deposition, Sputter deposition, pulsed laser deposition, magnetron sputtering, molecular beam epitaxy, lithography.

Section C

Properties of Nanomaterials. Shape and size dependant properties- electrical, linear and nonlinear optical properties, magnetic, thermal and mechanical properties of nanomaterials, melting point and lattice constants, surface plasma resonance.

Applications: Nano-Heterostructures and quantum dot (Photodetectors and lasers).

Recommended Books:

1. Sulabha, K., & Kulkarni, K. (2007). *Nanotechnology: principles and practices*.
2. Guozhong, C. (2004). *Nanostructures and Nanomaterials: synthesis, properties and applications*. World scientific..
3. Köhler, M., & Fritzsche, W. (2008). *Nanotechnology: an introduction to nanostructuring techniques*. John Wiley & Sons..
4. Roduner, E. (2015). *Nanosopic materials: Size-dependent phenomena and growth principles*. Royal Society of Chemistry.

Suggested –web resources:

<https://ocw.mit.edu/search/ocwsearch.htm?q=quantum%20dots>

<https://nptel.ac.in/courses/103103026/8>

Surface, Interfaces and Thin Films

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- Understand and describe properties of free liquid surfaces, such as surface tension, capillarity, wetting and spreading.
- Understand and describe electrical phenomena at surfaces, such as surface charge, surface potential, the electrical double layer, and basic electrochemical concepts.
- Describe the phase behavior and aggregation of amphiphiles in solution and at interfaces.
- Describe intermolecular forces, forces acting between molecules and surfaces, and surface forces.

Section A

Vacuum technologies: Introduction, Important areas of application basic definitions of vacuum technology, vacuum pumps: rotary Vane pumps, sorption pumps, Diffusion pumps, Turbo molecular pumps, Ion Pumps, cryogenic pumps, Vacuum gauges: Thermocouple gauge, McLeod gauge, Diaphragm gauge, Pirani gauge, Penning gauge

Section B

Growth and Analysis: Thin Film Deposition Mechanism: Homogeneous (Step propagation, Island growth) and heterogeneous (Frank-Vander Merwe Model, Volmer-Weber Model, Stanski-Krastanov model) film growth,

Analysis of surfaces: structure analysis using AFM (Principle, working and operational modes), STM: (Principle, working and operation modes), LEED, chemical analysis using XPS, AES, Capacitance-Voltage (C-V) measurement technique for the determination of interface quality.

Introduction to crystal lattice: Surface Energy, Wulff Construction and equilibrium shape for nanoparticles, Relaxation and reconstruction at surfaces, adsorption, physisorption and chemisorption, stepped and kinked surfaces.

Section C

Liquid surfaces and morphology: Roughness and its statistical description, height probability distribution, Gaussian probability distribution, correlation functions, transformation to reciprocal surface, Fractals, fractal dimension, self-similarity, self-affinity, self-affine surfaces, Principles of characterization techniques: Grazing incidence x-ray scattering techniques and surface sensitivity, x-ray and neutron reflectivity.

Recommended Books:

1. Prutton M. (1994) Introduction to surface science, (Cambridge University Press)
2. Daillant, J., & Gibaud, A. (Eds.). (2008). *X-ray and neutron reflectivity: principles and applications* (Vol. 770). Springer
3. Delchar, T. A. (1993). *Vacuum physics and techniques*. Chapman and Hall.

Suggested –web resources:

[https://nptel.ac.in/courses/112101004/downloads/\(36-8-1\)%20NPTEL%20-%20Vacuum%20Technology.pdf](https://nptel.ac.in/courses/112101004/downloads/(36-8-1)%20NPTEL%20-%20Vacuum%20Technology.pdf)
<https://ocw.mit.edu/search/ocwsearch.htm?q=stm>

Introduction to Material Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- Apply knowledge of mathematics, science, and engineering to solve problems related to materials science and engineering.
- Design new nanomaterials, as well as characterize the new material.
- Collaborate effectively on multidisciplinary teams.
- Communicate effectively in written and oral formats.

Section A

Need of material science and Engineering: Atomic bonding in solids, unit cells, primitive cell, crystal systems, Miller indices, crystallographic directions & planes, packing fraction, linear density, planar and theoretical densities of crystal structure, close-packed crystal structures, single crystal, polycrystals, amorphous structure, Introduction to XRD for the determination of crystal structure; Crystal imperfections: point defects, linear defects, surface defects, bulk and volume defects; Plastic deformation, plastic deformation by slip, shear strength, motion of dislocation: effect of stress, temperature, grain size, solute atoms, precipitate particles, multiplication of dislocations, basic concepts of creep and fracture.

Section B

Introduction to Phase diagrams: Phase rule, Unary phase diagram, binary phase diagram (Al₂O₃, PbSn, Ag-Pt), Hume-Rothery rules for solid solutions, the lever rule. The tie line rule, the iron-carbon system Development of Microstructure in Iron-Carbon Alloys.

Diffusion: Diffusion mechanism, Fick's law of diffusion, steady state and non-steady state, applications based on Fick's second law, Kirkendall effect; Phase Transformations: Nucleation, homogeneous, heterogeneous growth, Transformation kinetics, Time-temperature-transformation (TTT) curves, applications of nucleations & growth, glass transition.

Section C

Mechanical behavior: Elastic, anelastic, viscoelastic behavior of materials, Polymers: Introduction, classification, polymer structure, copolymers, tacticity, geometric isomerism, molecular weight, molecular weight distribution, molecular weight averages, polydispersity index; Ceramics: Introduction to ceramic structure and applications of ceramics.

Liquid Crystals and Quasi Crystals. Disposal of waste materials.

Composites: particle-reinforced composites, fiber-reinforced composites, structural composites

Recommended Books:

1. Callister, W. D., & Rethwisch, D. G. (2007). *Materials science and engineering: an introduction* (Vol. 7, pp. 665-715). New York: John Wiley & sons.
2. Jones, D. R., & Ashby, M. F. (2012). *Engineering materials 2: an introduction to microstructures and processing*. Butterworth-Heinemann.

Suggested –web resources:

<https://ocw.mit.edu/courses/materials-science-and-engineering/3-012-fundamentals-of-materials-science-fall-2005/lecture-notes/lec17b.pdf>
<https://nptel.ac.in/courses/112104039/53>

Advanced Nano-Electronics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- Cope up with certain nanoelectronic systems and building blocks such as: low-dimensional semiconductors, heterostructures, carbon nanotubes, quantum dots, nanowires etc.
- Set up and solve the Schrödinger equation for different types of potentials in one dimension as well as in 2 or 3 dimensions for specific cases.
- Use matrix methods for solving transport problems such as tunneling, resonant tunneling and know the concept of quantized conductance.
- Experimentally familiarized with AFM and PL methods and know their approximate performance as well as applications.
- Familiarized with searching for scientific information in their subject area, practice report writing and presenting their project in a seminar

Section A

MOS structure, subthreshold characteristics, Short channel effects, punch through, velocity saturation, hot electron effects, CMOS scaling, device variability, interconnects; Bulk CMOS improvements: strained Si, high-K dielectrics metal gates, SOI MOSFETs, Double gate MOSFETs, FinFET, Memory devices: Phase change RAM, ferroelectric RAM, magnetic RAM.

Section B

Important quantities in mesoscopic transport, ballistic electron transport, Magneto-transport properties of quantum films: Landau quantization, two-dimensional electron gases in perpendicular magnetic fields, The quantum Hall effect, conductance quantization in quantum point contacts, the Landauer-Büttiker formalism, Edge states and channels, Quantum point contact circuits, Electronic Phase Coherence: quantum interference and Aharonov-Bohm effect, weak localization, noise in nanostructures.

Section C

Limits of conventional microelectronics, Quantum tunneling, Resonant tunneling devices, hot-electron transistors, Coulomb-blockade effect and single-electron transistor, quantized conductance in CNTs, nanotubes, ballistic rectifiers, planar nano diode and nano MOSFET, Y-switches, molecular electronics: Introduction, Electrodes and Contacts, Functions and Devices-First Test Systems), carbon nanotube transistors, Organic Semiconductors devices: Organic Light Emitting Diodes and Organic Displays.

Recommended Books:

1. Hu, C. C. (2011). *Modern Semiconductor Devices for Integrated Circuits. Part I: Electrons and holes in a semiconductor*.
2. Taur, Y., & Ning, T. H. (2013). *Fundamentals of modern VLSI devices*. Cambridge university press.
3. Heinzel, T. (2008). *Mesoscopic electronics in solid state nanostructures*. John Wiley & Sons.
4. Waser, R. (Ed.). (2012). *Nanoelectronics and information technology*. John Wiley & Sons..
5. Lundstrom, M., & Guo, J. (2006). *Nanoscale transistors: device physics, modeling and simulation*. Springer Science & Business Media.
6. Hanson, G. W. (2008). *Fundamentals of nanoelectronics*. Upper Saddle River: Pearson/Prentice Hall.
7. Heikkilä, T. T. (2013). *The physics of nanoelectronics: transport and fluctuation phenomena at low temperatures* (Vol. 21). Oxford University Press.
8. Park, B. G., Hwang, S. W., & Park, Y. J. (2012). *Nanoelectronic devices*. CRC Press.
9. Mitin, V. V., Kochelap, V. A., & Strosio, M. A. (2008). *Introduction to nanoelectronics. Science, Nanotechnology, Engineering, and Applications* (Cambridge Univ. press, Cambridge, 2008).
10. Chang, C. Y. (2000). *ULSI devices*. John Wiley & Sons.
11. Datta, S. (1997). *Electronic transport in mesoscopic systems*. Cambridge university press.

Suggested –web resources

<https://nptel.ac.in/courses/113104004/>
<https://nptel.ac.in/courses/113104004/29>

Mathematical Modeling and Simulation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- Characterize engineering systems in terms of their essential elements, purpose, parameters, constraints, performance requirements, sub-systems, interconnections and environmental context.
- Model and solve the relationship between theoretical, mathematical, and computational modelling for predicting and optimizing performance and objective.
- Mathematical modelling real world situations related to engineering systems development, prediction and evaluation of outcomes against design criteria.
- Develop solutions and extract results from the information generated in the context of the engineering domain to assist engineering decision making.
- Interpret the model and apply the results to resolve critical issues in a real world environment.

Section A

Modeling: Scientific Modeling, Mathematical modeling, Numerical Algorithms, Fundamental principles of numerical methods (Programs and Software, Approximations in Mathematical model building, Numerical integration, Numerical differentiation, Finite element method and Finite difference method, Raleigh's method, Ritz method), physical simulation, process control, transport phenomena, concept of physical domain and computational domain.

Section B

Ab-Initio methods: Linear Combination of atomic orbitals method, Density function theory, Hartree and HartreeFock methods, mean field approximation, statistical methods for many body system, spin-polarized relativistic Korringa-Kohn-Rostoker Green's function, Augmented Plane Wave, Full Potential-APW, Projector Augmented Plane wave, linear muffin tin orbitals and k.p methods.

Section C

Simulation: Basic concepts of simulation, data manipulation, data exchange of the structure, properties and processing of materials, Three dimensional model for capillary nanobridges, Molecular dynamics simulation.

Monte Carlo methods: Basics of the Monte Carlo method, Algorithms for Monte Carlo simulation, Applications to systems of classical particles. Quantum Monte Carlo (Variation MC Diffusion MC : An Introduction only)

Recommended Books:

1. Chapra. S.C. and Canale R.P., Numerical methods for Engineers, Tata McGraw Hill, New Delhi, 2002.
2. Frenkel D. and Smith, B., Understanding molecular simulation from algorithm to applications, Kluwer Academic Press, 1999.
3. Ohno, K, Esfarjani. K. and Y. Kawazoe, Introduction to Computational Materials Science from ab-initio to Monte Carlo Methods, Springer-Verlag, 1999.

Suggested –web resources:

<https://nptel.ac.in/courses/103106119/>

<https://ocw.mit.edu/search/ocwsearch.htm?q=ab%20initio>

Quantum Computations and Information Processing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- The students are expected to understand basic principles of the techniques presented in the course, their advantages and limitations. Furthermore, the student should understand the requirements for samples suitable for each technique. They should also be able to perform simple and routine operations on the experimental setups.

Section A

Basics of Nanocomputing: Elements of Boolean Algebra and Binary System, Classical Logic Gates and Logic gate symbols (AND gate, OR gate, NOT gate, NAND gate, NOR gate, EXOR gate, EXNOR gate), Circuit Models. Linear Algebra and Dirac Notation : Hilbert Space, Operators, The Spectral theorem, Functions of Operators, Tensor Products, The Schmidt Decomposition Theorem.

Section B

Qubits and hypothesis of Quantum mechanics: The state of a quantum system, Time evolution postulate, Superposition and composite System, Measurement postulate, Mixed states and general quantum operation

Quantum model of computation: Quantum gates (one qubit gates and Controlled-U Gates), Universal set of quantum gates, Measurements with quantum circuits. Superdense coding, Quantum Teleportation and its application, Quantum Entanglement.

Section C

Introduction to Quantum algorithms: The Deutsch Algorithm, The Deutsch-Jozsa Algorithm, Quantum phase estimation and quantum Fourier Transformation, Eigenvalue Estimation and finding orders, Shor's algorithm, Grover's quantum Search algorithm,

Quantum Cryptography, Quantum Error Correction, Single-Qubit Measurement, Adiabatic Quantum Computation,

Physical realizations of logic quantum gates in Quantum System: Guiding Principles, Conditions for quantum computation, Harmonic oscillator quantum computer, Ion Trap Quantum Computer.

Recommended Books

1. Ajayan, P. M., Schadler, L. S., & Braun, P. V. (2006). *Nanocomposite science and technology*. John Wiley & Sons.
2. Wang Z.L (2000) Characterization of nanophase materials – (Wiley-VCH, New York).
3. Rao, C. N. R., Müller, A., & Cheetham, A. K. (Eds.). (2006). *The chemistry of nanomaterials: synthesis, properties and applications*. John Wiley & Sons.
4. Cullity, B. D. (1978). Elements of X-ray Diffraction.
5. Rose, R.M., Shepard L.A., and. Wulff, (1966) The Structure and Properties of Materials (Wiley Eastern Ltd.).

Suggested –web resources

<https://nptel.ac.in/courses/117106109/1>

<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-152j-micro-nano-processing-technology-fall-2005/lecture-notes/cvd.pdf>

Advanced Characterization Techniques

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- The students are expected to understand basic principles of the techniques presented in the course, their advantages and limitations. Furthermore, the student should understand the requirements for samples suitable for each technique. They should also be able to perform simple and routine operations on the experimental setups.

Section A

Diffraction techniques: Introduction to x-ray sources: sealed tube x-ray source, rotating anode x-ray source, synchrotron source, single crystal diffraction, powder diffraction, Low Energy electron diffraction (LEED), neutron diffraction: interaction of neutron with matter, scattering cross section, scattering length density, light scattering by colloidal dispersion, dynamic light scattering (DLS), static light scattering, hydrodynamic radius, zeta potential.

Section B

Microscopes: Optical microscopy, fluorescence and confocal microscopy, transmission electron microscopy (TEM), scanning electron microscopy (SEM), Thermal Analysis DTA, TGA, DSC techniques.

Section C

Spectroscopy Techniques: Ultraviolet (UV) and x-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), secondary ion mass spectroscopy (SIMS), Rutherford back scattering, FTIR, UV-VIS, cathode luminescence and photo luminescence.

Recommended Books

- Ajayan, P. M., Schadler, L. S., & Braun, P. V. (2006). *Nanocomposite science and technology*. John Wiley & Sons.
- Wang Z.L (2000) Characterization of nanophase materials – (Wiley-VCH, New York).
- Rao, C. N. R., Müller, A., & Cheetham, A. K. (Eds.). (2006). *The chemistry of nanomaterials: synthesis, properties and applications*. John Wiley & Sons.
- Cullity, B. D. (1978). *Elements of X-ray Diffraction*.
- Rose, R.M., Shepard L.A., and. Wulff, (1966) *The Structure and Properties of Materials* (Wiley Eastern Ltd.)

Suggested –web resources

<https://nptel.ac.in/courses/117106109/1>

<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-152j-micro-nano-processing-technology-fall-2005/lecture-notes/cvd.pdf>

MEMS and NEMS Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- Ability to understand the operation of micro devices, micro systems and their applications
- Ability to design the micro devices, micro systems using the MEMS fabrication process.
- Gain knowledge of basic approaches for various sensor designs
- Develop experience on micro/nano systems for photonics.
- Gain the technical knowledge required for computer-aided design, fabrication, analysis and characterization of nano-structured materials, micro- and nano-scale devices.
- Describe the transduction principles and scaling effects
- Design MEMS and NEMS and use multiphysics simulation softwares and tools

Section A

Introduction to MEMS and NEMS, MEMS Design, Scaling of Micromechanical Devices, Mechanical Properties of MEMS materials, Materials for MEMS, Micromachining Technologies: Bulk, Surface, LIGA, Microfabrication Techniques: Wafer level processes, Pattern Transfer, Process Integration: Developing a process. Transduction Mechanism, Energy conserving transducers: Parallel plate capacitors, two port capacitors, Electrostatic and Magnetic actuators.

Section B

Elasticity: Constitutive equations of linear elasticity, Thermal expansion and thin film stress, Material behavior at large strains.

Structures: Axially loaded beams, bending of beams, Anticlastic curvature, bending of plates, Effects of residual stresses and stress gradients, Plates with in plane stress.

Energy Methods: Elastic energy, the principle of virtual work, Variational methods, large deflections of elastic structures.

Section C

Applications of MEMS: Inertial sensors, Micromachined pressure and thermal sensors, Microbridge gas sensor, Microrobotics, Microscale vacuum pumps, DNA amplification, brief introduction to micro fluidics.

Fabrication Issues for NEMS and Their applications.

Recommended Books

1. Senturia, S. D. (2007). *Microsystem design*. Springer Science & Business Media.
2. Alvi, P. A. (2014). MEMS Pressure Sensors: Fabrication and Process Optimization.
3. Gad-el-Hak, M. (2001). *The MEMS handbook*. CRC press.
4. Sze, S. M. (2008). *Semiconductor devices: physics and technology*. John Wiley & Sons.

Suggested –web resources

<https://ocw.mit.edu/search/ocwsearch.htm?q=mems>
<https://nptel.ac.in/courses/105105108/24>

Organic and Polymer Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

- Isolate the key design features of a product which relate directly to the material(s) used in its construction
- Indicate how the properties of polymeric materials can be exploited by a product designer
- Describe the role of rubber-toughening in improving the mechanical properties of polymers
- Identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units
- Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerisation and mass fraction of chains present.

Section A

Introduction to polymers, Classification schemes, polymer structure and molecular weight and molecular averages. Polymer synthesis- Step growth, Chain Growth, Polymerization techniques, Synthetic polymers, Chemical structure determination. Ideal chain model, Random walk model, excluded volume effect. Self-avoiding random walk, radius of gyration.

Conformations - Single chain conformation, Thermodynamics of polymer solutions

Measurements of Molecular weight - Osmometry, Light scattering, Intrinsic Viscosity measurement, Gel - permeation Chromatography.

Solid State Properties - Amorphous state, crystalline state, Thermal transition and properties. Rouse Model, Reptation Model.

Section B

Mechanical Properties- Mechanism of deformation and method of testing, Viscoelasticity and rubber elasticity. Degradation. Blends and composites- Additives, Polymer blends, Interpenetrating network. Introduction to polymer composites, introduction to Biopolymers, natural polymers and fibers.

Special Polymers- Engineering thermoplastics, polyimides, ionic polymers, polyaryletherketones, polyolifins, Inorganic polymers, liquid crystal polymers, conducting polymers, dendritic polymers, high performance fibers

Non linear Mechanical behavior - Basic processing operations, Polymer rheology: Non Newtonian flow, Viscosity Equation, Elastic properties of polymeric fluids, Melt instabilities, Drag reduction, analysis of simple flows, Rheometry, Modelling of polymer processing operation- Extrusion, Wire coating.

Section C

Polymers for advanced technology- Membrane science and technology, Biomedical Engineering and drug delivery, applications in Electronics, photonic polymers.

Metal containing Polymers-Cryochemical synthesis, structure, physicochemical properties, Use of precursors in synthesis, optically anisotropic metal polymer nanocomposites, Plasmon absorption, Optical extinction by ion Implantation.

Recommended Books

1. Nicolais, L., & Carotenuto, G. (Eds.). (2004). *Metal-polymer nanocomposites*. John Wiley & Sons..
2. Strobl, G. R., & Strobl, G. R. (1997). *The physics of polymers* (Vol. 2). Berlin: Springer.
3. Fried, J. R. (2014). *Polymer science and technology*. Pearson Education.

Suggested –web resources

<https://nptel.ac.in/courses/113105028/>

<https://ocw.mit.edu/search/ocwsearch.htm?q=metal%20containing%20polymers>

Analytical Solid Geometry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Understand the basic applications of analytic and solid geometry.
- Understand geometrical terminology for planes, tetrahedron, spheres, paraboloids, hyperboloids and ellipsoids.
- Visualize and represent geometric figures and classify different geometric solids.

Unit 1 Plane, Straight line.

Unit 2 Equations of two skew lines in simplest form, Line intersecting two lines, Locus of a line intersecting three given lines, Intersection of three planes, Volume of a tetrahedron.

Unit 3 Sphere: Equation of Sphere through four given points, Plane Section of a sphere, Intersection of two spheres, Intersection of a sphere and line, Power of a point, Tangent plane, Plane of Contact, Pole and Polar, Condition for orthogonality, Radical- Plane, Line, center, Coaxial system of spheres. Cylinder.

Unit 4 Cone, Enveloping Cone, Enveloping Cylinder

Unit 5 The Central Conicoids (Referred to principal axes), Tangent plane, Polar plane, Equation of the normal to an ellipsoid, Number of normals from a given point to an ellipsoid, Cone through six normal.

Text Books:

1. Golas P. C., Tandon O. P., & Bhargava S. L. (1999). *Analytical Solid Geometry*. Jaipur Publishing House.

Reference Books:

1. Narayan, S. & Mittal, P. K. (2004). *Analytical Solid Geometry*. New Delhi, S. Chand.
2. Loney, S. L. (1962). *Co-ordinate Geometry*. London, MacMillan.
3. Chatterji, P. N. (2009). *Solid Geometry*. Meerut, Rajhans Agencies.
4. Sharma, B. D., Tyagi, B. S. & Brahma Nand (2016). *Co-ordinate Solid Geometry*. Meerut, Kedarnath Publishing House.

Suggested E-learning material:

1. Plane and solid Geometry:
<http://www.aproged.pt/biblioteca/planeandsolidgeometry.pdf>
2. Solid Geometry introduction:
http://altairuniversity.com/wp-content/uploads/2014/02/HM_SolidGeomintro.pdf
3. Math handbook of formulas, Process & Tricks: <http://www.mathguy.us/Handbooks/GeometryHandbook.pdf>

Differential Equations

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On completion of this course, the student will be able to:

- Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution.
- Student will be able to solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous, or Bernoulli cases.
- Create and analyze mathematical models using first order differential equations to solve application problems.
- Determine solutions to the linear and nonlinear ordinary differential equations of first and second order.
- Determine the complete solution of a differential equation with constant coefficients by variation of parameters
- Evaluate the Laplace and Inverse Laplace transform of functions of one variable

Unit 1 Solution of differential equations of first order and first degree, Solution of differential equations of first order and any degree, Applications of first order differential equations.

Unit 2 Singular solutions & extraneous loci, Trajectories of a family of curves, Orthogonaltrajectories.

Unit 3 Linear differential equations with constant coefficients, Homogeneous linear differential equations.

Unit 4 Linear differential equations of second order: The complete solution in terms of known integral, Method of removal of first derivative (or Reduction to normal form or Change of dependent variable), Transformation of equations by changing the independent variable, Method of variation of parameters.

Unit 5 Laplace transform: Definition, Laplace transform of certain elementary functions, Change of scale property, First and second translation properties, Laplace transform of derivatives, Inverse Laplace transform: Definition, Change of scale property, First and second translation properties, Inverse Laplace transform of derivatives.

Text Books:

1. Raisinghania, M. D. & Aggarwal, R. S. (1983). Ordinary and partial differential equations (2nd ed.). New Delhi, S. Chand.
2. Sneddon, I. N. (1979). The use of integral transforms. New Delhi, Tata Mac Graw-Hill.

Reference Books:

3. in SI metric units (1st ed.). Singapore, McGraw-Hill Book Company.

Suggested E-learning material:

1. Separable, homogeneous, exact, Linear differential equations, Laplace transform <https://nptel.ac.in/courses/122104018/7>
2. Open course in Differential Equations (All topics) <https://nptel.ac.in/courses/111106100/>
3. Open course in Differential Equations (All topics) <https://swayam.gov.in/course/3787-differential-equations>
4. Second order linear differential equation with constant coefficient <https://ocw.mit.edu/courses/mathematics/18-03sc-differential-equations-fall-2011/>
5. Laplace transform <https://www.math.ust.hk/~machas/differential-equations.pdf>

Introduction to Calculus

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On completion of the course, the student will be able to,

- Apply the concept and principles of differential and integral calculus to solve geometric and physical problems.
- Evaluate various limit problems both algebraically and graphically
- Differentiate and integrate the functions which are applicable in real life situations.
- Interpret the geometric meaning of differential and integral calculus
- Apply differentiation to find linear approximation, extrema, monotonicity, and concavity of functions.

Unit 1 Tangents and normals, Subtangent and sub-normal (Cartesian & polar forms), Derivative of an arc (Cartesian and polar), Pedal equations, Curvature.

Unit 2 Partial differentiation with Euler's theorem and its applications, Total derivative, Change of variables (polar to Cartesian and Cartesian to polar), Concept of tangent plane and normal to a surface. Maxima and minima of two variables including method of undetermined multipliers.

Unit 3 Asymptotes, Multiple points, Curve tracing (Cartesian, Parametric and Polar), Envelopes & Evolutes.

Unit 4 Reduction Formulae, Double and Triple Integrals, Change of order of integration in double integrals, Change of variables in multiple integration.

Unit 5 Quadrature, Rectification, Volume and Surface of solids formed by revolution.

Text Books:

1. Narayan S., & Mittal P. K. (2007). Differential Calculus (30th ed.). New Delhi, Sultan Chand & Sons.
2. Narayan S., & Mittal P. K. (2007). Integral Calculus (36th ed.). New Delhi, Sultan Chand & Sons.

Reference Books:

1. Kishan H. (2007). *Differential Calculus*, New Delhi , Atlantic Publishers.
2. Ram Babu (2010). *Engineering Mathematics*, Pearson Education.
3. Kreyszig E. (2007). *Advanced Engineering Mathematics* (9th ed.), John Wiley.

Suggested E-learning material:

1. Single Variable Calculus
<https://ocw.mit.edu/courses/mathematics/18-01sc-single-variable-calculus-fall-2010/>
2. Differentiation of two variables
<https://nptel.ac.in/courses/111104085/21>
3. Multiple Integral
<https://nptel.ac.in/courses/111104085/29>

Abstract Algebra

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- To demonstrate the mathematical maturity of understanding the proof.
- To understand the definition of a group and be able to test a set with binary operation to determine if it is a group.
- To find the order of elements of groups.
- To identify subgroups of a given group, cycle groups, normal groups.
- To understand permutation groups and be able to decompose permutations into 2-cycles.
- To grasp the significance of the concepts of homomorphism, isomorphism, and automorphism and be able to check a given function is one of these.
- To classify groups up to isomorphism.
- To identify a set with to binary operation forms a ring or not.
- To really understand the special types of rings and be able to construct new examples from the old ones.
- To check a subset of a ring is an ideal or not and be able to identify proper and maximal ideal.

Unit 1 Divisibility in $\mathbb{Z}$, division algorithm, greatest common divisor, Euclidean Algorithm, modular arithmetic, Binary Operations, Group: Definition, examples and properties of group.

Unit 2 Subgroups, Cyclic groups, Permutation group, symmetric and alternating groups of degree n , external direct products of groups.

Unit 3 Cosets, Lagrange's theorem, Homomorphism and Isomorphism of group, Cayley's theorem, Normal subgroups and Factor groups.

Unit 4 Fundamental theorem of homomorphism of group (First, Second and third theorem of isomorphism).

Rings: Definition and examples, Integral Domain, Division ring, fields

Unit 5 Ideal, Principal ideal, Principal ideal domain, Factor ring, Prime ideal, Maximal ideal, Ring homomorphism and ring isomorphism.

Text Books:

1. Gallian, J. A. (2013). *Contemporary Abstract Algebra* (8th Ed.). Cengage Learning.

Reference Books:

1. Hillman, A. P. & Alexanderson, G. L. (2015). *Abstract Algebra: A First Undergraduate Course* (5th Ed.) CBS Publishers & Distributors Pvt. Ltd.
2. Fraleigh, J. B. (2003). *A First Course in Abstract Algebra* (7th Ed.). Pearson.
3. Sen, M. K., Ghosh, S., Mukhopadhyay, P. & Maity, S. K. (2019). *Topics in Abstract Algebra* (3rd Ed.). University Press.
4. Khanna, V.K. & Bhambri, S. K. (2008). *A Course in Abstract Algebra* (3rd ed.). New Delhi: Vikas Publication House.
5. Herstein, I. N. (1991). *Topics in Algebra* (2nd ed.). New Delhi: Wiley Eastern

Suggested E-learning material:

1. <https://ocw.mit.edu/courses/mathematics/18-703-modern-algebra-spring-2013/related-resources/>
<https://www.extension.harvard.edu/open-learning-initiative/abstract-algebra>

Introduction to Linear Algebra

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Understand vector spaces over a field and subspaces and apply their properties.
- Understand linear independence and dependence.
- Find basis and dimension of a vector space, and understand change of basis.
- Compute linear transformations, kernel and range, and inverse linear transformations, and find matrices of general linear transformations.
- Find eigenvalues and eigenvectors of a matrix and of linear transformation.
- Understand inner product on a vector space.
- Understand the concept of orthogonality in inner product spaces.
- Create orthogonal and orthonormal bases: Gram-Schmidt process.

Unit 1 Vector space over a field, Vector subspaces, Algebra of vectors, Linear sum and direct sum of subspaces, Linear combination, Linear span, Linear dependence and independence of vectors and its properties.

Unit 2 Basis and dimension of vector space and subspace, Linear mappings, Kernel and Range of linear mapping, Singular and non-singular mappings, Linear operator, Algebra of linear operators, Invertible operators.

Unit 3 Matrix representation of a linear transformation, Change of basis, Range rank and Kernel nullity of a matrix, Elementary transformations, Matrix inversion with elementary transformations, Normal form of a matrix.

Unit 4 Matrix polynomials, Characteristics polynomial of a matrix, Characteristics values, Characteristics vector, Cayley-Hamilton theorem, system of linear equations.

Unit 5 Inner product spaces, Orthogonality, Orthogonal sets and bases, Projection of a vector, Gram-Schmidt orthogonalization process, Fourier coefficients, Introduction to Linear Functional with simple examples.

Text Books:

1. Sheldon, A. (1996). *Linear algebra done right* (2nd ed.). Springer.
2. Krishnamurthy, V., Mainra, V. P. & Arora, J. L. (1976). *An introduction to linear algebra*. New Delhi, East-West Press.

Reference Books:

1. Friedberg, S. H., Insel, A. & Spence, L. (2016). *Linear algebra*. (4th Ed.). Noida (U.P.), India Pearson
2. Halmos, P. R. (2013). *Finite dimensional vector spaces*. (2nd Ed.). S.I.: Literary Licensing, LLC
3. S. Kumaresam, S. (2000). *Linear algebra: A geometrical approach*, New Delhi: PHI Learning.
4. Hoffman, K. & Kunze, R. A. (2010). *Linear algebra*. New Delhi: PHI Learning.

Suggested E-learning Material:

1. Video Lectures: <https://www.edx.org/learn/linear-algebra>
2. Video Lectures: <https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/>
3. Video Lectures: https://onlinecourses.nptel.ac.in/noc17_ma04/preview

Introduction to Linear Algebra

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Understand vector spaces over a field and subspaces and apply their properties.
- Understand linear independence and dependence.
- Find basis and dimension of a vector space, and understand change of basis.
- Compute linear transformations, kernel and range, and inverse linear transformations, and find matrices of general linear transformations.
- Find eigenvalues and eigenvectors of a matrix and of linear transformation.
- Understand inner product on a vector space.
- Understand the concept of orthogonality in inner product spaces.
- Create orthogonal and orthonormal bases: Gram-Schmidt process.

Unit 1 Vector space over a field, Vector subspaces, Algebra of vectors, Linear sum and direct sum of subspaces, Linear combination, Linear span, Linear dependence and independence of vectors and its properties.

Unit 2 Basis and dimension of vector space and subspace, Linear mappings, Kernel and Range of linear mapping, Singular and non-singular mappings, Linear operator, Algebra of linear operators, Invertible operators.

Unit 3 Matrix representation of a linear transformation, Change of basis, Range rank and Kernel nullity of a matrix, Elementary transformations, Matrix inversion with elementary transformations, Normal form of a matrix.

Unit 4 Matrix polynomials, Characteristics polynomial of a matrix, Characteristics values, Characteristics vector, Cayley-Hamilton theorem, system of linear equations.

Unit 5 Inner product spaces, Orthogonality, Orthogonal sets and bases, Projection of a vector, Gram-Schmidt orthogonalization process, Fourier coefficients, Introduction to Linear Functional with simple examples.

Text Books:

3. Sheldon, A. (1996). *Linear algebra done right* (2nd ed.). Springer.
4. Krishnamurthy, V., Mainra, V. P. & Arora, J. L. (1976). *An introduction to linear algebra*. New Delhi, East-West Press.

Reference Books:

5. Friedberg, S. H., Insel, A. & Spence, L. (2016). *Linear algebra*. (4th Ed.). Noida (U.P.), India Pearson
6. Halmos, P. R. (2013). *Finite dimensional vector spaces*. (2nd Ed.). S.I.: Literary Licensing, LLC
7. S. Kumaresam, S. (2000). *Linear algebra: A geometrical approach*, New Delhi: PHI Learning.
8. Hoffman, K. & Kunze, R. A. (2010). *Linear algebra*. New Delhi: PHI Learning.

Suggested E-learning Material:

4. Video Lectures: <https://www.edx.org/learn/linear-algebra>
5. Video Lectures: <https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/>
6. Video Lectures: https://onlinecourses.nptel.ac.in/noc17_ma04/preview

Introduction to Mechanics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Explain the geometry of the motion of particle in plane curve, i.e. position, velocity, and acceleration, and how those quantities are related through calculus.
- Learn Newton's laws of motion and examines their application to a wide variety of problems.
- Learn the basic concept of composition and resolution of forces and friction.
- Understand and visualize the real physical problem in terms of Mathematics.
- Learn one-dimensional (SHM), multi-dimensional (Projectile motion), and constrained motion, motion of particle with or without connecting with string.

Unit 1 Motion in a Plane Curve: Velocity and acceleration (radial, transverse, tangential and normal), Motion of two particles connected by a string.

Unit 2 Projectile on a horizontal plane, Simple harmonic motion.

Unit 3 Constrained motion: Motion along a smooth vertical circle and smooth cycloid, Hooke's law, Motion of a particle attached to an elastic string.

Unit 4 Composition and resolution of forces, Equilibrium of forces acting at a point (Lami's theorem only), Parallel forces, Moments.

Unit 5 Friction-definition, Statical friction, Dynamical friction, Limiting equilibrium-an inclined plane, Common catenary.

Text Books:

1. Ray, M. & Sharma, G. C. (2006). *A Text Book on Dynamics* (13th revised ed.). New Delhi, S. Chand and Company.
2. Gokhroo, D. C. & Bhargava, S. L. (2009). *Elementary Mechanics*, Jaipur: Jaipur Publishing House (JPH).
3. Gokhroo, D. C., Saini, S. R. & Arora, R. K. (2017). *Elements of Dynamics*, Jaipur: Jaipur Publishing House (JPH).

Reference Books:

1. Ramsay, A. S. (2004). *Statics* (2nd ed.). CBS Publishers and Distributors.
2. Ramsay, A. S. (2002). *Dynamics* (2nd ed.). CBS Publishers and Distributors.
3. Gaur, Y. N., Mathur, A. K., Goyal, M. C. & Manohar, P. (2018-19). *Dynamics*, Jaipur & New Delhi: Ramesh Book Depot Publishing House.
4. Goyal, M. C., Sharma, O. P. & Goyal, M. (2018-19). *Statics*, Jaipur & New Delhi: Ramesh Book Depot Publishing House.
5. Sharma, K.C., Gokhroo, D. C. & Saini, S. R. (1996). *Elements of Statics*. Jaipur: Jaipur Publishing House (JPH).

Suggested E-learning material:

1. Engineering Mechanics: Statics & Dynamics; Platform: cosmolearning,
<https://cosmolearning.org/courses/engineering-mechanics-statics-dynamics/>
2. Engineering Mechanics: Statics & Dynamics; Platform: nptel
<https://nptel.ac.in/courses/112106180/>
3. Engineering Dynamics; Platform: MIT Open courseware,
<https://ocw.mit.edu/courses/mechanical-engineering/2-003sc-engineering-dynamics-fall-2011/>

Real Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Think about basic proof techniques and fundamental definitions related to the real number system.
- Understand the concept of real-valued functions, limit, continuity, and differentiability.
- Find expansions of real functions in series forms.
- Demonstrate some of the fundamental theorems of analysis.
- Develop the capacity to solve real integral while understanding of integrable functions.

Unit 1 Set, Function, Bounded and unbounded set, Supremum and Infimum of a set, Limit point, Closure of a set, Closed and Open set, Interior and boundary point. Description of the real number system as a complete ordered Field, Analytic properties of real number system.

Unit 2 Real sequences and their convergence, Cauchy sequence, Convergence of series: Comparison test, Root test, Ratio test, Raabe's test, De Morgan's and Bertrand's test, Gauss test, Logarithmic and Integral test, Leibniz test.

Unit 3 Real valued function, Limit of a function, Continuous function and their properties, Heine's theorem, Uniform continuity.

Unit 4 Derivability, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorem, Power series, Expansion of $\sin x$, $\cos x$, $\log(1+x)$, $(1+x)^n$ and e^x .

Unit 5 Riemann integration, Properties of Riemann integrals, Fundamental theorem of integral calculus, Pointwise and uniform convergence, M_n -test, Weierstrass M-test, Abel's test, Dirichlet's test, Uniform convergence and continuity, Term by term differentiation and integration.

Text Books:

1. Malik, S.C. (2004). Principles of Real Analysis. New Delhi, India: New Age International.

Reference Books:

1. Apostol, T.M. (1985). Real Analysis. New Delhi, India: Narosa Publishing House.
2. Royden, H.L. (1993). Real Analysis. New York: Macmillan.
3. Rudin, W. (1985). Principles of Mathematical Analysis. Auckland: McGraw Hill.

Suggested E-learning material

1. Real Analysis; NPTEL:<https://nptel.ac.in/courses/111106053/>

Complex Analysis

Max. Marks: 100
(CA: 40+ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Demonstrate understanding of the basic concepts and fundamental definitions underlying complex analysis.
- Investigate complex functions, concept of limit, continuity and differentiability of complex functions.
- Demonstrate capacity for mathematical reasoning through analyzing analytic functions.
- Prove and explain concepts of series and integration complex functions.
- Understand problem-solving using complex analysis techniques.
- Enjoy the roll of complex functions today's mathematics and applied contexts.

Unit 1 Complex Numbers, concept of limit, continuity and differentiability, Analytic Functions, Necessary and sufficient condition for a function to be analytic, Polar form of Cauchy-Riemann equations, Construction of an analytic functions.

Unit 2 Conformal Transformation and representation, Bilinear Transformation, Transformations

$$w = z^2, w = \sqrt{z}, w = e^z \text{ and } w = \log z.$$

Unit 3 Complex Integration - Definition, Cauchy's theorem, Cauchy's Goursat's Lemma, Cauchy's theorem, Cauchy's integral formula and its generalized form, Morera's theorem, Liouville's theorem, Taylor's and Laurent's expansion

Unit 4 Singularities: Zeros of an analytic function, Singular points, Different type of singularities, Residue at a pole, Residue at infinity, Cauchy's residue theorem, Computation of residue at a (i) simple pole, (ii) multiple pole.

Unit 5 Integration round the unit circle, Integration of $f(z)$ when it has no pole on the real line, Integration of $f(z)$ when it has poles on real line.

Suggested Reference Books:

1. Lang, S. (1999). *Complex Analysis*. New York : Springer.
2. Ahlfors, L. (1988). *Complex Analysis*. Auckland: McGraw-Hill.
3. Churchill, R.V. & Brown, J.W. (1995). *Complex Variables and Applications* (6th ed.). New York: McGraw-Hill.

Suggested E-learning material

1. Complex Analysis; NPTEL <https://nptel.ac.in/courses/111103070/>

Introduction to Discrete Mathematics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Write an argument using logical notation and determine if the argument is or is not valid.
- Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
- Understand the basic principles of sets and operations in sets.
- Prove basic set equalities.
- Apply counting principles to determine probabilities.
- Demonstrate an understanding of relations and functions and be able to determine their properties.
- Determine when a function is 1-1 and "onto".
- Demonstrate different traversal methods for trees and graphs.
- Model problems in Computer Science using graphs and trees.

Unit 1 Sets and Multisets, Relations and Functions, Equivalence relations, Partial order relations, Chains and Antichains. Permutations, Combinations, selection with & without replacement, Permutation and Combinations of multisets. Discrete probability. The rules of sum and product.

Unit 2 Basic concepts of graph theory, Multi-graphs, Paths & Circuits, Eulerian path and circuits, Hamiltonian path and circuits, weighted graphs, Shortest path in weighted graph, Planar graphs, Vertex connectivity and edge connectivity of graphs.

Unit 3 Vertex coloring and edge coloring of graphs, Vizing's theorem, Trees and cut sets- Trees, Rooted tree, Path lengths in rooted trees, Spanning tree and cut set, Minimum spanning tree, Matrix representation of graphs.

Unit 4 Pigeon hole principle, Inclusion-exclusion principle. Discrete numeric functions-manipulation of numeric functions. Asymptotic behavior of numeric functions. Generating functions and recurrence relations. Linear recurrence relation with constant coefficients and their solutions.

Unit 5 Mathematical logic: Basic Connectives, normal forms (CNF and DNF), proof of Validity, Predicate logic, Lattices and Boolean algebra. Uniqueness of finite Boolean algebra. Boolean functions and Boolean expressions. Propositional Calculus.

Text Books:

1. Rosen, K.H. (1999). Discrete Mathematics and its Applications. McGraw Hill.
2. Liu, C.L. & Mohapatra, D.P. (2008). Elements of Discrete Mathematics, Tata McGraw Hill.
3. Deo, N. (2004). Graph Theory. Prentice Hall of India, New Delhi.

Reference Books:

1. Biggs, N.L. (1985). Discrete Mathematics. Oxford Science Publication.
2. Koshy, T. (2005). Discrete Mathematics with Applications. Academic Press.

Suggested E-learning material:

1. <https://www.geeksforgeeks.org/engineering-mathematics-tutorials/>
<http://mathworld.wolfram.com/DiscreteMathematics.html>

Introduction to Numerical Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Solve the nonlinear equations, system of linear equations and interpolation problems using numerical methods.
- Examine the appropriate numerical differentiation and integration methods to solve problems.
- Apply the numerical methods to solve differential equations.

Unit 1 Error analysis: Exact and approximate numbers, rounding of numbers, Significant digits, various types of errors encountered in computations, error in function approximation, the general error formula, Taylor's series, error in series approximation. **Numerical solution of system of linear equations:** Direct methods: The matrix inversion method, Gauss elimination method with pivoting strategies, Gauss–Jordan method, Factorization methods (LU- Doolittle, Crout, LDL^T, Cholesky), computing inverse of a matrix. Iterative methods: Gauss-Jacobi Method, Gauss-Siedel method.

Unit 2 Finite differences: forward, backward, central and divided difference operators, their properties and difference tables, propagation of error in difference table, missing data calculation, Relation between difference and derivatives, differences of polynomials. **Polynomial interpolation:** Newton-Gregory forward and backward interpolation, Gauss's forward and backward, Stirling's, Bessel's interpolation, Lagrange's and Newton's divided differences interpolation, inverse interpolation, computation errors in these formulae and analysis of errors.

Unit 3 Numerical differentiation, Numerical integration: Newton's Cotes Quadrature formula, Simpson's, Weddle's and Trapezoidal rules, Gauss Quadrature formula.

Unit 4 Root finding for nonlinear equations (Transcendental and Algebraic equations), Iterative method, Bisection method, Regula-Falsi method, Newton Raphson's method, order of convergence.

Unit 5 Numerical solution of first and second order differential equations: Euler's Method, Picard's Method, Taylor's series approximation, Runge-Kutta's Method.

Text Books:

1. Sastry, S.S. (2012). *Introductory methods of numerical analysis*. New Delhi, ND: PHI Learning Private Limited.
2. Chauhan, D. S., Vyas, P. & Soni, V. (2005). *Studies in numerical analysis*. Jaipur, Jaipur Publishing House.

Reference Books:

1. Jain, M. K., Iyengar, S. R. K. & Jain, R. K. (2007). *Numerical methods for scientific and engineering computations*. New Delhi, ND: New Age International.
2. Rajaraman, V. (1984). *Computer oriented numerical methods*. New Delhi, ND: Prentice Hall of India.
3. Phillips, G.M. & Taylor, P.J. (1996). *Theory and applications of numerical analysis*. Academic Press, Elsevier.
4. Burden, R.L., Faires, D.J. & Burden, A.M. (2016). *Numerical Analysis*. Cengage learning.

Suggested E-learning material:

1. Elementary Numerical Analysis; Platform: Nptel <https://nptel.ac.in/courses/111101003/>
2. Numerical Differentiation and Numerical Integration; Platform: MIT open courseware https://ocw.mit.edu/courses/mechanical-engineering/2-993j-introduction-to-numerical-analysis-for-engineering-13-002j-spring-2005/lecture-notes/lect_9.pdf
3. Computational Error; Platform: Nptel <https://nptel.ac.in/courses/111107062/>

Linear Programing and Its Applications

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

- Formulate the LPP.
- Conceptualize the feasible region.
- Solve the LPP with two variables using graphical method.
- Solve the LPP using simplex method.
- Formulate the dual problem from primal.
- Solve Transportation and Assignment problems
- Solve the problems of competitive situations between two competitors.

Unit 1 Linear Programming Problem: Definition, Formulation of LPP, Graphical Method

Unit 2 Simplex Method, Big-M and Two-Phase Method, Degeneracy, Resolution of degeneracy. Limitation of LPP.

Unit 3 Duality in LPP, Important results in Duality, Dual Simplex Method.
Integer Programming: Definition, Gomory's Method.

Unit 4 Transportation: Definition, Solution by Simplex Method.
Assignment: Definition, Solution by Simplex Method.

Unit 5 Game Theory: Definition, 2 person zero-sum Game, Game with mixed strategies Solution by using Simplex Method.

Text Books :

1. Kambo, N. S. (1991). *Mathematical programming techniques*. New Delhi: East-West Press.
2. Chatterjee, D. (2005). *Linear programming and game theory*. New Delhi: Prentice-Hall of India Private Ltd.

Reference Book:

1. Swarup, K., Gupta, P. K. & Mohan, M. (1977). *Operations Research (Answers to problems)*. New Delhi: Sultan Chand & Sons.
2. Pant, J. C. (2004). *Introduction to optimization: Operations Research*. New Delhi: Jain Brothers.
3. Taha, H. A. & Pearson Education. (2017). *Operations research: An introduction*. Harlow [i 21 pozostałych: Pearson.
4. Hillier, F. S. & Lieberman, G. J. (1972). *Introduction to operation research*. San Francisco: Holden-Day.

Suggested E-learning material

1. Linear Programming, a CPLEX tutorial
https://ibmdecisionoptimization.github.io/tutorials/html/Linear_Programming.html
2. Linear Programming Tutorial | Sophia Learning <https://www.sophia.org/tutorials/linear-programming--5>
3. Lectures – nptel: <https://nptel.ac.in/courses/111102012/>

Introduction to Probability and Statistics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On completion of the course, the student will be able to:

- Compute numerical quantities that measure the central tendency and dispersion of a set of data.
- Understand basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
- Apply general properties of the expectation and variance operators.
- Understand the properties and fitting of the Normal, Binomial and Poisson distribution.
- Fit the straight line, second degree parabola and curves of type: ab^x and ax^b
- Understand the concept of Correlation (Karl Pearson) and Linear Regression.

Unit 1 Theory of probability, Law of total and compound probability, Conditional probability, Baye's theorem, Random variable, Discrete random variable, Continuous random variable, Distribution function.

Unit 2 Measures of central tendency, Measures of dispersion, Moments, Sheppard's correction (without proof), Skewness and Kurtosis.

Unit 3 Mathematical expectation, Addition and multiplication theorem of expectation, Moment generating functions, Cumulants and cumulant generating functions.

Unit 4 Discrete and continuous probability distributions: Binomial, Poisson and Normal distributions with important properties. Fitting of Binomial, Poisson and Normal distributions.

Unit 5 The principle of least squares and curve fitting, Fitting of straight line and second degree parabola, Fitting of the curves of type: ab^x and ax^b ; Correlation (Karl Pearson) and Linear regression.

Text Books:

1. Goon, A. M., Gupta, M. K. & Gupta, B. D. (1968). *Fundamental of Statistics*. (Volume I). Kolkata, The World Press Pvt. Ltd.
2. Rohtagi, V. K. (2008). *An Introduction to probability Theory and Mathematical Statistics*. (2nd ed.). John Wiley & Wiley Eastern.

Reference Books:

1. Mood, A. M., Graybill, F. A. & Boes, D. C. (1974). *Introduction to Theory of Statistics*. McGraw-Hill International.
2. Johnson. R. A., Miller, I. & Freund. J. (2011). *Probability and Statistics For Engineers*. Prentice Hall.
3. Feller, W. (1968). *An introduction to probability theory and its applications*. (Volume I) , (3rd ed.), John Wiley & Sons.
4. Gupta, S. C. & Kapoor, V. K. (2013). *Fundamental of Mathematical Statistics* (11th ed.). Sultan Chand Publication, New Delhi.
5. Gupta, S. P. (2017). *Statistical Methods* (17th ed.). Sultan Chand & Sons, New Delhi.

Suggested E-learning material:

1. Probability and Mathematical Statistics; Platform:

<http://www.math.louisville.edu/~pksaho01/teaching/Math662TB-09S.pdf>

Probability and Descriptive Statistics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, the students will be able to:

- differentiate between the two definitions of Statistics
- understand and differentiate between population and sample, variables and attributes in any survey
- choose between the type of survey, census or sample, and the method of data collection, primary and secondary methods for a study,
- represent the data using suitable tabular and/or graphical method
- identify and calculate appropriate summary statistics for the data
- understand the concept of various definitions of probability and calculate probability for any given problem.
- define a random variable for a study variable and obtain its properties.

Unit 1 Definition, Scope and limitations of Statistics, Concept of Statistical population. Attributes and variables. Types of data, Collection of primary and secondary data. Sample and census survey - their advantages and disadvantages. Types of Sampling and Non-Sampling errors. Classification and Tabulation of data.

Unit 2 Graphical and diagrammatic representation of data. Measures of central tendency. Measures of dispersion. Moments, Measures of skewness and kurtosis. Sheppard's correction (without proof) for moments. Charlier check.

Unit 3 Probability: Random experiment, Sample space, events, Combination of two or more events, Basic concept of probability. Classical, Empirical and Axiomatic approach to probability. Marginal, Joint and Conditional probability, Addition and Multiplication theorems of probability, Baye's theorem and its simple applications.

Unit 4 Random variable: Discrete, Continuous, Univariate and Bivariate. Probability mass function and Probability density functions, Distribution function, Conditional and Marginal distributions. Independence of random variables.

Unit 5 Mathematical Expectation: Expectation of sum and product of random variables. Variance and Covariance, Conditional expectation. Moments and Moment generating function, Characteristic function (definition and statement of properties only) Cumulant generating function, Relation between moments and cumulants.

Note: Use of scientific calculator is permissible

Text Books:

1. Goon, A. M., Gupta, M. K., & Dasgupta, B. (1968). *Fundamentals of Statistics: Vol.: 1*. Calcutta: The World Press Private Ltd.
2. Meyer, P. L. (1970). *Introductory probability and statistical applications*. Reading, Mass: Addison-Wesley Pub. Co.

Reference Books:

1. Mood, A. M., Boes, D. C. & Graybill, F. A. (1974). *Introduction to the theory of statistics*. East Windsor, NJ: McGraw-Hill, Inc.
2. Srinivasan, S. K. & Mehata, K. M. (1988). *Probability and random processes*. New Delhi: Tata McGraw-Hill.
3. Johnson, R. A., Miller, I. & Freund, J. E. (2011). *Miller & Freund's probability and statistics for engineers*. Boston: Prentice Hall.
4. Feller, W. (1968). *An introduction to probability theory and its applications: V. 1*. New York: Wiley.

5. Gupta, S. C. & Kapoor, V. K. (2000). *Fundamentals of mathematical statistics: A modern approach*. New Delhi: Sultan Chand.
6. Gupta, S. P. (2014). *Statistical Methods*. New Delhi: Sultan Chand and Sons.

Suggested E-learning material:

1. Video lectures on Probability and Statistics:
<https://nptel.ac.in/courses/111105090/>
2. Video lectures on Introduction to Data Analytics:
<https://nptel.ac.in/courses/110106072/>

Probability and Descriptive Statistics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, the students will be able to:

- Express raw data in terms of frequency table by using exclusive and inclusive method of classification for continuous/discrete variable.
 - Apply and justify the use of, various graphical representations such as Histogram, Frequency polygon etc.
 - Interpret and analyze the data using various averages such as arithmetic Mean, Median and Mode.
 - Compare different data sets using methods such as standard deviation, mean deviation, quartile deviation and coefficient of variation.
 - Employ and interpret the measures of Skewness and Kurtosis.
1. Preparation of frequency table by using exclusive and inclusive method of classification for continuous/discrete variable.
 2. Tabulation of data.
 3. Graphical representation of data by:
 - (i) Histogram
 - (ii) Frequency polygon
 - (iii) Frequency Curve
 - (iv) Ogives
 4. Diagrammatic representation of data by:
Simple Bar, Sub-divided Bar and Multiple Bar diagrams. Squares, Circles and Pie-diagrams.
 5. Determination of Mean, Median, Mode, G.M., H.M., Quartiles, Deciles and Percentiles.
 6. Computation of Range, Standard deviation, Mean deviation, Quartile deviation and Coefficient of variation.
 7. Combined mean and combined standard deviation.
 8. Computation of first four moments, Measures of Skewness and Kurtosis.

Note:(i) The above list is only for the guidance of the students. Any practical from the syllabus may be set in the practical examination.

(ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practicals.

(iii) Where it is feasible practical practice should be done through spreadsheet, package or programming.

Measures of Association and Probability Distributions

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, the students will be able to:

- Formulate the mathematical/statistical models for real data sets arising in various fields of the populations.
- Understand how to use probability distributions in real life problems.
- Understand how to check the independence of attributes.

Unit 1 Theory of Attributes: Classes and class frequencies, Consistency of data. Independence of attributes, Contingency table. Association of attributes, Measures of association. Curve fitting by the principle of least squares. Fitting of straight line, parabola, power curves and exponential curve.

Unit 2 Bivariate distributions, Correlation and Regression, Pearson's correlation coefficient, Lines of Regression and Regression coefficient, Rank Correlation and Spearman's rank Correlation coefficient. Partial and multiple Correlation for three variables only.

Unit 3 Binomial, Poisson, & Negative Binomial distributions, Limiting cases of Binomial and Poisson distributions, Fittings of Binomial and Poisson distributions.

Unit 4 Geometric, Multinomial and Hypergeometric distribution with simple properties and applications. Normal distribution with its properties & fitting.

Unit 5 Rectangular, Exponential, Gamma, Beta, Laplace and Cauchy with simple properties and applications.

NOTE: Use of scientific calculator is permissible.

Books Recommended:

1. Goon, A. M., Gupta, M. K., & Gupta, B.D. (2001). *Fundamental of Statistics*. (Volume I). Kolkata, The World Press Pvt. Ltd.
2. Gupta, S. C., & Kapoor, V. K. (2002). *Fundamental of Mathematical Statistics*. (11th ed.). Sultan Chand & Sons.
3. Gupta, S. P. (2010). *Statistical Methods* (39th ed.). New Delhi, Himalaya Publication.
4. Mood, A. M., Graybill, F. A., & Boes, D. C. (2001). *Introduction to the theory of Statistics*. (3rd ed.). Tata McGraw Hill.
5. Meyer, P. L. (1970). *Introductory probability and Statistical Applications*. (2nd ed.) Oxford & IBH Publishing Co. Pvt. Ltd.

Suggested E-learning material:

1. Probability and Random variables. MIT Open Course.
<https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/lecture-notes/>
2. Probability and Statistics, NPTEL.
<https://nptel.ac.in/courses/111105041/27>

Measures of Association and Probability Distributions Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, the students will be able to:

- Apply and use fitting of various curves such as Straight line, parabola, exponential curve etc.
 - Effectively distinguish between and compute, correlation and rank correlation, Partial and Multiple correlations.
 - Understand and perform the Fitting of Binomial, Poisson and Normal distribution
1. Fitting of the following curves by the method of least squares:
 - (i) Straight line
 - (ii) Parabola
 - (iii) Exponential Curve
 - (iv) Power Curve
 2. Computation of coefficients of correlation and rank correlation.
 3. Fitting of regression lines.
 4. Computation of Partial and Multiple Correlation
 5. Testing of independence of attributes.
 6. Yule's coefficient of association for attributes.
 7. Fitting of (i) Binomial, (ii) Poisson and (iii) Normal distribution.

Note: (i) The above list is only for the guidance of the students. Any practical from the syllabus may be set in the practical examination.

(ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practicals.

(iii) Where it is feasible practical practice should be done through spreadsheet.

Sampling Distributions

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, the students will be able to:

- Understand the difference between probability distribution and sampling distribution.
- Understand the sampling distribution of the mean of a sample from a Normal Population.
- Understand the properties of the sampling distribution of the sample mean in general situations, using the Central Limit Theorem.
- Understand the concepts of the t, F and χ^2 distributions.
- Apply t, F and χ^2 tests on real life data.

Unit 1 Limit laws: convergence in probability, almost sure convergence, convergence in mean square and convergence in distribution and their inter relations, Chebyshev's inequality, W.L.L.N., S.L.L.N. and their applications, De-Moivre Laplace theorem, Central Limit Theorem (C.L.T.) for i.i.d. variates, applications of C.L.T. and Liapunov Theorem (without proof).

Unit 2 Basic concept of Sampling and sampling distribution, sampling distribution of sample mean for Binomial, Poisson and Normal populations, standard errors of sample mean, sample variance and sample proportion. Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Concept of p-values.

Unit 3 Large sample tests of significance: Sampling for attributes and variables, Tests of significance and confidence intervals for proportion, difference of two proportions, single mean, difference of two means, standard deviation and difference of standard deviations.

Unit 4 Chi-square distribution with its moment generating function, moments and cumulant, Additive property of chi-square variates, Limiting case of chi-square distribution. Tests of significance and confidence intervals based on Chi-Square distribution. Yates Correction for 2x2 contingency table.

Unit 5 Students 't' and Fishers 't' statistics and their distributions Application of 't' test for one sample and two sample problems and for testing the significance of a sample, Correlation coefficient Paired 't' test, F-statistic and its distribution. Application of F-test for testing the equality of variance, Fisher's transformation and its uses. Relationship between 't' and 'F' statistics and F and Chi-square statistics

Note: Use of scientific calculator is permissible.

Text Books:

1. Hogg, R. V., & Tanis, E. (2009). *Probability and Statistical Inference*. Prentice Hall.
2. Goon, A. M., Gupta, B. D. & M. K. Gupta.(1968). *Fundamental of Statistics*. (Vol. I).The World Press Pvt. Ltd. Kolkata.

Reference Books:

1. Mood, A. M., Graybill, F. A., & Boes, D. C. (1974). *Introduction to Theory of Statistics*. McGraw- Hill International.
2. Gupta, S. C., & Kapoor, V. K. (2013). *Fundamental of Mathematical Statistics* (11thed.). New Delhi: Sultan Chand Publication.
3. Gupta, S.P. (2014). *Statistical Methods* (44th. ed.). Sultan Chand & Sons.
4. Freund, J. E. (2004). *Modern Elementary Statistics* (12th. ed.). New Jersey: Pearson Prentice Hall.

Suggested E-learning material:

1. Sampling distribution and central limit; Platform: Colorado State University
https://www.stat.colostate.edu/~vollmer/stat307pdfs/LN5_2017.pdf

Sampling Distributions Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, the students will be able to:

- Effectively compute and understand testing of significance and confidence intervals in various contexts such as, for single proportion, difference of two proportions for large sample, for single mean, difference of two means for large sample.
- Proficiently test for goodness of fit, independence of attributes.
- Understand how and when to use testing for equality of two population variances

List of Practicals

1. Testing of significance and confidence intervals for single proportion and difference of two proportions for large sample.
2. Testing of significance and confidence intervals for single mean and difference of two means for large sample.
3. Testing of significance and confidence for mean and difference of means (paired and unpaired cases) and for correlation coefficient
4. Testing of significance and confidence intervals for difference of two standard deviations.
5. Testing if the population variance has a specific value and its confidence intervals.
6. Testing of goodness of fit.
7. Testing of independence of attributes.
8. Testing based on 2 X 2 contingency table without and with Yates' corrections.
9. Testing of significance and confidence intervals of an observed sample correlation coefficient.
10. Testing and confidence intervals of equality of two population variances

Note: (i) The above list is only for the guidance of the students.

- (ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practical.

Where it is feasible practical practice should be done through spreadsheet, package or programming.

Statistical Inference and Quality Control

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, the students will be able to:

- Apply various basic parametric, non-parametric and sequential estimation techniques and testing procedures to deal with real life problems.
- Understand confidence interval in normal case, Neyman-Pearson fundamental lemma, UMP test.
- Understand SPRT, OC and ASN function.
- Understand some non-parametric techniques.

Unit 1 Theory of Estimation – Problems of point estimation, Properties of a good point estimator–Unbiasedness, Consistency, Efficiency & Sufficiency, Minimum variance unbiased estimator, Factorization theorems (without proof) and its applications. Confidence interval for normal case and Confidence coefficient.

Unit 2 Methods of Estimation: Method of maximum likelihood, Minimum variance, Moments, Least squares and minimum Chi-square with their properties (Statements only).

Unit 3 Testing of Hypothesis: Simple and Composite Hypothesis, Null and Alternative Hypothesis, First and Second types of errors, Power and size of the test, Level of significance, Critical region and best critical region, Neyman- Pearson lemma and its application for finding BCR.

Sequential test procedure, Sequential probability ratio test (Properties are excluded), OC and ASN functions (simple ideas only).

Unit 4 Order Statistics- Definition and their distribution, Distribution of sample range and sample median for continuous variable only (Confidence intervals and quartiles are excluded).

Non parametric tests; Sign Median and Run tests for small and large samples.

Unit 5 Statistical Quality Control: Process control, Control charts for $\bar{X}$, R, s, p and c and their uses. Sampling plan: Acceptance sampling for attributes, Single and Double sampling inspection plans, Concept of OC, ASN, AOQ and AOQL.

Note: Use of scientific calculator is permissible.

Suggested Text Books:

1. Mood, A. M., Graybill, F. A., & Boes, D. C. (1974). *Introduction to the Theory of Statistics*. Tata McGraw-Hill.
2. Goon, A. M., Gupta, M. K., & Gupta, B. D. (2001). *An Outline of Statistical Theory (Volume 2)*. The world Press Pvt. Ltd.

Suggested Reference Books:

1. Rohatgi, V. K., & Saleh, A. M. E. (2015). *An introduction to probability and statistics*. (2nd.ed.) John Wiley & Sons.
2. Lehmann, E. L., & Romano, J. P. (2006). *Testing statistical hypotheses*. Springer Science & Business Media.
3. Lehmann, E. L., & Casella, G. (2006). *Theory of point estimation*. Springer Science & Business Media.
4. Zacks, S. (1971). *The theory of statistical inference*. John Wiley & Sons.

Suggested E-learning material

1. Statistical Inference; Platform: MITOPENCOURSEWARE <https://ocw.mit.edu/index.htm>
2. Statistical Inference; Platform: Coursera <https://www.coursera.org>
3. Statistical Inference: Platform: e-PG Pathshala <https://epgp.inflibnet.ac.in>

Statistical Inference and Quality Control Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, the students will be able to:

- Understand when and how to use various control charts such as $\bar{X}$, R, and s charts.
- Effectively understand and determine the AOQ and AOQL plots.
- Understand when and how to use various non - parametric tests such as Sign test, Run test, Median test etc.

1. Controls Charts:

- $\bar{X}$, R, and s charts
- p and np charts for equal and unequal sample sizes.
- c-chart.
- Determination of AOQ & AOQL

2. Non Parametric Tests:

- Sign Test
- Run Test
- Median Test
- Mann Whitney U Test
- Five problems on primary data

Note: (i) The above list is only for the guidance of the students. Any practical from the syllabus of papers I & II may be set in the practical examination.

(ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practicals.

(iii) Where it is feasible practical practice should be done through spreadsheet, package or programming.

Applied Statistics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the concept of time series data and application in various fields.
- Identify principle sources of demographic data and assess their strengths and weaknesses.
- Understand the calculation and interpretation of the principal demographic measures, and standardize these measures for comparison and construct and interpret life tables.
- Understand the uses of index number with their construction methods.
- Understand the concept of demand and supply theory.
- Understand the concept of scaling of scores.

Unit 1 Time series analysis: Components of a time series, Additive and multiplicative models. Methods of determining trend and seasonal components.

Unit 2 Vital Statistics: Indices of mortality and fertility, Mortality- Crude and Standardized death rates. Fertility- Crude birth rate, general fertility rate, Gross and Net reproduction rates, Definition, evaluation and uses of above indices, Stable and stationary populations- concept, determination of the rate of increase in a stable populations, Life table: construction of life table from graduated rates of mortality and evaluation of probabilities of survival and death from a life table.

Unit 3 Economic statistics: Meaning and uses of Index Numbers, Problems in construction of Index Numbers, Prices and quantity indices, Fixed base and chain base Index numbers. Weighted and unweighted index numbers-Laspeyre's, Pasche's, Marshal-Edgeworth's and Fisher's ideal Index numbers, Time reversal, factor reversal and circular tests, Base shifting, splicing and deflating.
Construction of cost of living and wholesale price index numbers.

Unit 4 Educational Statistics: Statistics in Psychology and Education, Scaling of scores, Standard scores, Normalized scores, T scores, Reliability and validity of test scores, intelligence quotient.

Unit 5 Demand Analysis: Demand and supply, Law of Demand and Supply. Price elasticity of demand, Partial elasticity of demand. Engel's curve and Engel's law, Pareto's law of income distribution.

Note: Use of Scientific calculator is permissible.

Text Books:

1. Gupta, S. C. & Kapoor, V. K. (2000). Fundamentals of mathematical statistics. New Delhi, Sultan Chand & Sons. (for applications)
2. Goon, A.M., Gupta, M.K. & Dasgupta, B. *Fundamental of Statistics*. (Volume.2). The World Press Pvt. Ltd.

Reference Books:

1. Hooda, R.P. Introduction to Statistics. (7th ed.). Macmillan India Ltd.
2. Croxton, F.E. & Cowden, Dudley, J. (1955). Applied General Statistics. (2nd ed.). New York, Prentice-Hall.

Applied Statistics Lab

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

0 0 4 2

Learning Outcomes: On successful completion of the course, students will be able to,

- Find the trend and seasonal components in the given dataset and separate these components on excel.
 - Calculate and interpret the basic demographic measures and compare the measure for two different populations.
 - Construct the life table with the help of some given life table columns.
 - Calculate the index numbers for different commodities.
 - Scaling the scores, test the reliability of these scores and compute the IQ of any individual.
1.
 - (i) Measurement of trend by method of moving averages and curve fitting by least squares.
 - (ii) Measurement of seasonal fluctuations by-
 - (a) Ratio to trend
 - (b) Ratio to moving averages
 - (c) Link relative method.
 2. Vital Statistics:
 - (i) CDR, CBR, Age specific death rates, standardized with and death rates.
 - (ii) GFR, ASFR, TFR.
 - (iii) Crude rate of natural increase GRR, NRR.
 - (iv) Life table and finding out certain values with its help.
 3. Economic Statistics:
 - (i) Laspeyre's, Pasche's and Fisher's Index numbers.
 - (ii) Fixed base and chain base index numbers.
 - (iii) Wholesale price index numbers.
 - (iv) Cost of living index numbers.
 4. Educational Statistics: Computation of different scores, reliability of test scores and IQ

Sampling Techniques and Design of Experiments

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, the students will be able to:,

- Understand the Simple and Stratified random sampling techniques.
- Understand the ratio estimation procedure.
- Apply ANOVA for one-way and two-way classification, fixed effect models with equal number of observations per cell.

Unit 1 Sample survey procedures, Role of sampling theory, Probability and non-probability sampling. Mean square error. Accuracy and precision of an Estimator. SRSWR and SRSWOR. Variance of the estimate of population mean and population total. Estimation of standard error for sample mean. Sampling for proportions and percentages (with/without replacement). Variance of sample estimate, estimated variances of these estimates.

Unit 2 Stratified Random Sampling: Estimate of Population mean and its variance.

Allocation of sample size: Proportional allocation and optimum allocation (with/without varying cost). Comparison of simple random sampling with proportional and optimum allocation. Estimation of the sample size.

Unit 3 Systematic Sampling-Estimation of variance of the systematic sample mean. Comparison of systematic Sampling with simple random and stratified sampling. Estimation of the ratio and ratio estimates for population mean and population total. Approximate formula for variance and Bias of the ratio estimates.

Unit 4 Concept of Analysis of variance (i) One-way classification with equal/unequal observations per class. (ii) Two-way classification with one observation per cell. Fixed effect models of (i) and (ii) and the assumptions involved. Estimation of treatment effects, treatment differences and confidence limits for the same. Expectations of sum of squares, variances of the estimates.

Unit 5 Meaning of experiment, Experimental unit, Treatment, Field, Block, Experimental error, Precision, Uniformity trials, Principles of designs-replication, Randomization and Local Control, Efficiency of design choice of size and shape of plots and blocks. Completely Randomized design, Randomized Block design and Latin square Design-Analysis of these designs, standard error of treatment differences, comparison of their efficiencies.

Note: Use of Scientific calculator is permissible.

Text Books:

1. Sukhatme, P. V. & Sukhatme, B. V. (1970). *Sampling Theory of Survey with Applications*. (2nd ed.), Piyush Publication.
2. Goon, A. M., Gupta, M. K. & Gupta, B. D. (2001). *Fundamental of Statistics*. (Volume. II). The World Press pvt. ltd.

Reference Books:

1. Cochran, W. G. (1977). *Sampling Techniques*. (3rd ed.). Wiley Eastern Limited.
2. Singh, D. & Chaudhary, F. S. (2002). *Theory and Analysis of Sample survey Design*. New Age International Publisher.
3. Joshi, D. D. (2003). *Linear Estimation and Design of Experiments*. New Age International Publisher.
4. Das, M. N. & Giri, N. G. (2002). *Design and Analysis of Experiments*. New Age International Publisher.

Suggested E-learning material:

1. Sampling Theory, NPTEL. <https://nptel.ac.in/courses/111104073/>
2. Biostatistics and Design of Experiments, NPTEL, <https://nptel.ac.in/courses/102106051/>
3. Design of Experiments and sample Survey. ePATHSHALA. <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>

Basic Mathematics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basic rules of logic, including the role of axioms or assumptions.
- Appreciate the role of mathematical proof in formal deductive reasoning.
- Distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life.
- Understand the differences between inductive and deductive reasoning.
- Proficiently construct logical arguments and rigorous proofs.
- Formulate and solve abstract mathematical problems.

Unit 1 *Algebra*- Sequences and series, finite and infinite series, Arithmetic and geometrical progressions – Determination of n th term and sum to n terms, arithmetic and geometric means between two numbers, sum of an arithmetic- geometric progression, sum of an infinite G.P.

Unit 2 *Set Theory*: Sets, Operation on sets, union intersection complements Representation of Sets by Venn Diagrams De Morgan's Law, inclusion-exclusion principle & its applications, Logarithms- Definition and laws regarding product, quotient, power and change of base. Partial fractions (simple problems).

Unit 3 *Co-ordinate Geometry*: Rectangular co-ordinates, quadrants, Distance between two points. The section formula, Area of a triangle, Locus of a point, equation to the locus, graph of a linear function, Equations to straight lines- Parallel to axes, the slope form, the intercept form, normal form, general linear form, point slope form, two points form, Point of intersection of two straight lines, angle between two lines, relation between the slopes of two lines, which are (i) Parallel and (ii) Perpendicular, Line through the point of intersection of two given lines, concurrency of lines, co-linearity of points.

Unit 4 *Differential Calculus*: Functions, limit of function evaluation of limits of functions, derivative of a function, derivative of x^n , $\sin x$, $\cos x$, e^x , $\log_e x$ by ab-initio method, differentiation of algebraic, circular, exponential and logarithmic functions, differentiation of trigonometric functions sum, difference, product and quotient of two functions, differential coefficient of a function of a function. Derivative of second order, partial differentiation (simple problems) maxima and minima of functions of one independent variable.

Unit 5 *Integral Calculus*: Integration as inverse operation of differentiation, indefinite integral, integration of simple functions, integration by substitution, Integration by parts, Definite integral properties of definite integrals (without proof).

Differential Equations: Formation of differential equation order and degree of a differential equation, solution of a differential equation, General solution, particular solution and singular solution, Solution of differential equations of first order and first degree- variables separable from only.

Text Books:

1. Sharma, G. C. & Jain, M. (2001). *Essential Mathematics*. Galgotia Publication Pvt. Ltd.

Reference Books:

1. Sharma, G. C. & Jain, M. (2001). *Mathematics for B.C.A.* Galgotia Publication Pvt. Ltd.

Suggested E-learning material

1. Matrix <https://www.askiitians.com/iit-jee-algebra/matrices-and-determinants>.
2. Sequence and Series ncert.nic.in/ncerts/l/keep209.pdf
3. Set, Function, Relation ncert.nic.in/ncerts/l/keep201.pdf
4. LPP <https://www.analyticsvidhya.com/.../introductory-guide-on-linear-programming-explain>

Basic Statistics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On completion of the course, the student will be able to:

- Distinguish between qualitative variables and quantitative variables.
- Differentiate between discrete and continuous variables.
- Construct/draft questionnaire.
- Identify the need of Classification and Tabulation.
- Construct frequency tables, Interpret the data, identifies the importance of diagrammatic presentation of data.
- Explain and evaluate various measures of central tendency.
- Evaluate and interpret partition values – Quartiles, Deciles and Percentiles

Unit 1 Definition, scope and limitations of Statistics, Concept of Statistical population. Sample, Sample Unit & Sampling Units Attributes and variables. Types of data: Collection of primary and secondary data. Sample and census survey - their advantages and disadvantages. Types of Sampling and Non-Sampling errors.

Unit 2 Classification and Tabulation of data. Construction of frequency table. Frequency distribution. Diagrammatic representation of data: Bar diagrams & their types, Pie diagram. Graphical presentation of data: Histogram, Frequency polygon, Frequency Curve & O-gives.

Unit 3 Measures of central tendency: Arithmetic Mean, Geometric Mean, Harmonic Mean, Median & Mode. Quartiles, Deciles, Percentiles

Unit 4 *Permutation and combination*- simple problems under restrictions. Binomial theorem for positive integral index and for any index (without proof), application of binomial theorem in summation of infinite series. Application of exponential theorem and logarithmic series in summation of infinite series

Unit 5 *Matrices*- Definition, order of a matrix, types of matrices rectangular matrix, square matrix, row matrix, column matrix, triangular matrix, diagonal matrix, unit matrix, null matrix, transpose of a matrix, symmetric and skew-symmetric and subtraction of matrices, matrix multiplication commutative, associative and distributive laws for matrix addition and multiplication. Inverse of matrix, rank of matrices, determinant of a matrix, properties of determinants (without proof), evaluation of determinants up to third order

Text Books:

1. Gupta, S. C., & Kapoor, V. K. (2013). *Fundamental of Mathematical Statistics* (11th ed.). Sultan Chand Publication, New Delhi.
2. Sharma, G. C., & Jain, M. (2001). *Essential Mathematics*. Galgotia Publication Pvt. Ltd.

Reference Books:

1. Gupta, S. P. (2017). *Statistical Methods* (17th ed.). Sultan Chand & Sons, New Delhi. (for applications)
2. Freund, J. E. (2004). *Modern Elementary Statistics* (11th ed.). Pearson Education.

Suggested E-learning material

3. Probability and its concept- <https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/>
4. Elementary Statistics -<https://newonlinecourses.science.psu.edu/statprogram/stat200>
5. Probability and Statistics- <https://nptel.ac.in/courses/111105041/>
6. Permutation and Combination-<https://nptel.ac.in/courses/106106094/28>
7. Matrices- <https://nptel.ac.in/courses/122104018/>

Statistical Methods

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: On completion of the course, the student will be able to:

- Explain the purpose of measures of dispersion, and the information they convey.
- Select an appropriate measure of dispersion and correctly calculate and interpret the statistic.
- Describe and explain the mathematical characteristics of the standard deviation.
- Apply the definition of independence to attempt to determine whether an assumption of independence is justifiable in a given situation.
- Find probabilities of single events, complementary events and the unions and intersections of collections of events.
- Describe the main properties of probability distributions and random variables.
- Identify the random variable(s) of interest in a given scenario.

Unit 1 Measures of Dispersion: Absolute Measures & Relative Measures-Range, Quartile deviation Mean deviation, Standard Deviation & Coefficient of Variation, Moments, Measures of Skewness and Kurtosis.

Unit 2 Theory of Attributes: Classes and class frequencies, Consistency of data, Independence of Attributes, Contingency table, Association of Attributes, Measures of Association, Curve fitting by the principle of least squares, Fitting of straight line, Parabola, Power curves and exponential curves.

Unit 3 Bivariate distributions, Correlation and regression, Pearson's correlation coefficient, Lines of Regression and Regression coefficient, Rank correlation and Spearman's rank correlation coefficient, Partial and multiple correlation for three variables only.

Unit 4 Basic concept of probability, Random Experiment, Sample space, Events, Combination of two or more events Classical Empirical and Axiomatic approach to probability. Conditional probability with simple problems, Statistical independence of events, Addition and multiplication theorem of probability, Bayes' theorem without proof.

Unit 5 Random variable Discrete & continuous, Univariate & Bivariate, Marginal and Conditional distribution, Properties of distribution function (without proof) Independence of random variable, (Problems based on change of order of integration are excluded)

Note: Use of scientific calculator is permissible.

Text Books:

1. Goon, A.M., Gupta, M.K., & Gupta B. D. *Fundamental of Statistics*. Culcata, The World Press Pvt. Ltd.
2. Gupta, O.P. *Mathematical Statistics*. Meerut, Keddarnath Publication.

Reference Books:

1. Mood, M. A., Graybill, F. & Boes C. D. *Introduction to the theory of statistics* (3rd ed.). McGraw Hill and Co.
2. Paul, L. M. (1970). *Introductory probability and statistical applications* (2nd ed.). Oxford & IBM Publishing Co. Pvt.
3. Yule, G. U. & Kendall, M.G. (1999). *An Introduction to the theory of Statistics* (14th ed.).

Suggested E-learning material

1. [Introduction to Probability and Statistics-https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/](https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/)
2. [Elementary Statistics-https://newonlinecourses.science.psu.edu/statprogram/stat200](https://newonlinecourses.science.psu.edu/statprogram/stat200)
3. [Probability and Statistics-https://nptel.ac.in/courses/111105041/](https://nptel.ac.in/courses/111105041/)

Statistical Methods Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: On successful completion of the course, students will be able to:

- Make the frequency distribution for inclusive and exclusive type of class intervals on excel.
- Construct the table for given raw data.
- Draw the graphs for the given data like histogram, frequency polygon, frequency curve and ogives.
- Draw the diagrams like bar diagram and pie charts etc.
- Calculate the measures of central tendency and dispersion on excel for given set of observations.
- Fit the curves like straight line, parabola, exponential and power curve by using excel.

Course Content:

1. Preparation of frequency table by using exclusive and inclusive method of classification for continuous/discrete variable.
2. Tabulation of data.
3. Graphical representation of data by:
 - (i) Histogram
 - (ii) Frequency polygon
 - (iii) Frequency Curve
 - (iv) Ogives
4. Diagrammatic representation of data by:
 - (i) Simple Bar, Sub-divided Bar and Multiple Bar diagrams.
 - (ii) Squares, Circles and Pie-diagrams.
5. Determination of Mean, Median, Mode, G.M., H.M., Quartiles, Deciles and Percentiles.
6. Computation of:
 - (i) Range, Standard deviation, Mean deviation, Quartile deviation and Coefficient of variation.
 - (ii) Combined mean and combined standard deviation.
7. Computation of first four moments with Sheppard's correction, Measures of Skewness and kurtosis.
8. Fitting of the following curves by the method of least squares:
 - (i) Straight line
 - (ii) Parabola
 - (iii) Exponential Curve
 - (iv) Power Curve
9. Computation of coefficients of correlation and rank correlation.
10. Fitting of regression lines.
11. Testing of independence of attributes.
12. Yule's coefficient of association for attributes.

- Note:**
- (i) The above list is only for the guidance of the students. Any practical from the syllabus of paper may be set in the practical examination.
 - (ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practicals.
 - (iii) Where it is feasible practical practice should be done through spreadsheet, package or programming

Inferential Statistics and Quality Control

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: On successful completion of the course the students should be able to,

- Define estimator, its unbiasedness and efficiency.
- Obtain maximum likelihood estimates of parameters of some simple distributions.
- Perform testing of significance of single mean, proportion, s. d. and difference of two means, proportions, s. d, variances for small and large samples.
- Understand the concept of non-parametric testing.
- Apply the non-parametric methods to test for single population and two populations.
- Understand the concept of statistical quality control.
- Construct control charts for variables and attributes.

Unit 1 Concept of estimation, estimators and estimator, Unbiasedness and efficiency of estimators. Maximum likelihood estimator with simple problems, Properties of MLE (without proof), Testing of Hypothesis; Simple and composite hypothesis; one tail and two tail tests; two types of errors; Levels of significance and critical region.

Unit 2 Concept of sampling and sampling distribution, Standard error Meaning and role, Large sample tests of significance for single mean, standard deviation and proportion, Test of significance of difference between two means, standard deviations and proportions.

Unit 3 Definition of Chi-square, t and F statistics and their applications in test of significance, *Chi-square test*: For independence of attributes, variance of normal distribution & goodness of fit, *t-test*: For one sample, two sample, paired case and correlation coefficient, *F-test*: For testing the equality of two variances.

Unit 4 Non-parametric Methods- Need, meaning and assumptions; applications of Run, Sign, Median and Mann Whitney U-test for one sample and two sample problems based on small and large samples.

Unit 5 Statistical quality control-chance and assignable causes of variations. Concept of process control, control charts for mean, range, standard deviation and p, np & c charts & their uses; concept of product control, producer's risk and consumer's risk.

Note: Use of scientific calculator is permissible.

Text Books:

1. Gupta, S. C. & Kapoor, V. K. (2000). *Fundamentals of mathematical statistics*. New Delhi, Sultan Chand & Sons. (for applications)
2. Gupta, S. P. (2014). *Statistical Methods*. New Delhi, Sultan Chand and Sons.
3. Goon, A. M., Gupta, M. K. & Dasgupta, B. (1998). *An outline of statistical theory*. Calcutta, World Press Private.
4. Montgomery, D. C. (2001). *Introduction to statistical quality control*. New York, John Wiley and Sons.

Reference Books:

1. Mood, A. M., Boes, D. C. & Graybill, F. A. (1974). *Introduction to the theory of statistics*. East Windsor, NJ: McGraw-Hill, Inc.
2. Casella, G. & Berger, R.L. (1990) *Statistical Inference*. Duxbury Press, California.
3. Hogg, R. V. & Craig, A. T. (1959). *Introduction to mathematical statistics*. (5th ed.). Pearson Education.
4. Gibbons, J. D. & Chakraborti, S. (2011). *Nonparametric statistical inference*. (3rd ed.). Marcel Dekker Inc.

Suggested E-learning material:

1. Lecture notes and video on "Parameters, Statistics, and Sampling Error": <http://www.statisticslectures.com/topics/parametersstatistics/>
2. Video lectures on Introduction to Data Analytics: <https://nptel.ac.in/courses/110106064/>
3. Lecture notes and video on "Quality Control in Textile Industry": <https://nptel.ac.in/courses/116102019/>

Inferential Statistics and Quality Control Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: On successful completion of the course, students will be able to,

- Test the significance of single mean, proportion, s. d. and difference of two means, proportions, s. d. and variances for small and large samples.
- Understand when and how to use various non parametric tests such as Sign test, Run test, Median test etc. for single population and two populations.
- Plot various control charts for variables and attributes such as $\bar{X}$, R, and s charts and determine whether the given procedure is in statistical control or out of statistical control.

1. Test of significance:

- (i) Large sample tests for mean and proportions for one and two sample problems.
- (ii) Chi-square test for variance, goodness of fit and independence of attributes.
- (iii) Test for mean and difference of means (paired and unpaired cases) and for correlation coefficient.
- (iv) F test for equality of population variances.

2. Controls Charts:

- (i) $\bar{X}$, R, and s charts
- (ii) p and np charts for equal and unequal sample sizes.
- (iii) c-chart.

3. Non-parametric methods: Sign, Median, Run and Mann Whitney U-tests.

- Note:**
- (i) The above list is only for the guidance of the students. Any practical from the syllabus of may be set in the practical examination.
 - (ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practical.
 - (iv) Where it is feasible practical practice should be done through spreadsheet, package or programming.

Probability Distributions and Numerical Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: On successful completion of the course, the student will be able to:

- Understand the basic principles of Probability, sample space, conditional probability.
- Differentiate between basic discrete & continuous distributions & how to work with them.
- Understand cumulative distribution function, expectation and distributions for functions of random variables.
- Work with bivariate distributions & basic two variable statistics.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations and apply them to obtain approximate solutions to mathematical problems.

Unit 1 *Finite differences:* Meaning of interpolation and extrapolation, difference table and nth order difference of a polynomial, Operators Δ and ∇ and their inter relationships, Factorials, Newton's Forward and Backward Interpolation

Unit 2 Newton's and Lagrange's Divided Difference formulae, Gauss and Stirling's Interpolation Formulae, Numerical Differentiation, Numerical integration- Trapezoidal Rule and Simpson's 1/3 & 3/8 rule

Unit 3 Mathematical Expectation: Addition and Multiplication theorem, Variance and covariance, $V(X+Y)$ and $V(X-Y)$, Moment generating and cumulant generating functions with their properties, Relationship among central moments and cumulants.

Unit 4 Discrete probability distributions: Uniform, Binomial and Poisson distribution with their important properties and applications (Mode and Median are excluded), Fitting of Binomial and Poisson distributions, limiting case of Binomial and Poisson distributions (without proof).

Unit 5 Continuous probability distributions: Rectangular, Exponential and Normal distributions with their properties and applications, Fitting of Normal distribution.

Note: Use of scientific calculator is permissible.

Text Books:

1. Bansal, J.L., & Ojha, J.P.N. *Numerical Analysis*. Jaipur Publishing House.
2. Goon, A.M., Gupta, M.K., & Dasgupta, B. *Fundamental of Statistics*. (Volume.1). The World Press Pvt. Ltd.
3. Gupta, S.C., & Kapoor V.K. *Fundamental of Mathematical Statistics*. New Delhi, Sultan Chand & Sons.

Reference Books:

1. Mood, M. A., Boes, G. F., & Duane, C. *Introduction to the theory of Statistics* (3rd ed.). Mc Graw Hill and Co.
2. Meyer, P.L. (1970). *Introductory Probability and Statistical Applications* (2nd ed.). New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd.

Suggested E-learning material

1. *Introduction to Numerical Analysis » Lecture notes* .
<https://ocw.mit.edu/courses/mathematics/18-330-introduction-to-numerical-analysis-spring-2004/lecture-notes/>
2. Probability and Random Variables
<https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/>
3. Numerical Analysis- <https://nptel.ac.in/courses/111107062/>
4. Probability - <https://nptel.ac.in/courses/111104032/>
5. Probability distributions-<https://nptel.ac.in/courses/111105041/8>

Probability Distributions and Numerical Analysis Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: On successful completion of the course, students will be able to:

- Fit the probability distributions by using Excel.
- Find out the missing values using interpolation
- Get the approximate values of differentiation and integration by using excel.
- Obtain the solution of linear and nonlinear equations and the solution of differential equations and apply them to obtain approximate solutions to mathematical problems.

1. Fitting of

(i) Binomial (ii) Poisson and (iii) Normal distribution.

2. Estimation of missing values in case of equal intervals.

3. Interpolation for equal and unequal intervals by:

(i) Newton-Gregory formula

(ii) Newton's divided difference formula

(iii) Lagrange's formula

(iv) Gauss's Formula

(v) Stirling's Formula

4. Numerical Differentiation

5. Numerical integration by:

(i) Trapezoidal rule

(ii) Simpson's 1/3rd rule

(iii) Simpson's 3/8th rule.

- Note:**
- (i) The above list is only for the guidance of the students. Any practical from the syllabus of paper may be set in the practical examination.
 - (ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practicals.
 - (ii) Where it is feasible practical practice should be done through spreadsheet, package or programming.

Algebra-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completing the course, students will be able to

1. Analyze finite and infinite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector spaces.
2. Understand the properties of linear transformations, matrices of linear transformations and change of basis, including kernel, range and isomorphism.
3. Compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization.
4. Identify operators in inner product spaces.
5. Identify bilinear forms, canonical forms for symmetric and skew-symmetric forms.

Section A

Vector spaces, subspaces, linear span, bases, quotient spaces, coordinate vectors, change of basis, linear transformations, isomorphism, range and kernel of a linear transformation, matrix of a linear transformation, algebra of $L(U, V)$, invertible transformations and matrices, Linear functionals and dual spaces.

Section B

Linear operator, annihilating polynomials, invariant subspaces of linear operator, direct sum decomposition, cyclic operator, maximal vector, indecomposable linear operators, invariant factors, canonical forms, operators on real and complex vector spaces.

Section C

Inner Product Spaces, Orthonormal Sets, Gram–Schmidt Process, Orthogonal Complements and Projections, Adjoints, self-adjoints and normal operators, unitary and orthogonal operators, Forms on inner product spaces, Bilinear forms, symmetric bilinear forms and quadratic form.

Suggested Books:

1. Hoffman, K., & Kunze, R. A. (2010). *Linear algebra*. New Delhi: PHI Learning.
2. Cooperstein, B. N. (2015). *Advanced linear algebra*. (Advanced Linear Algebra, Second Edition.) Boca Raton: CRC Press.
3. Lang, S. (2011). *Linear algebra*. (3rd Ed.). New York: Springer.
4. Halmos, P. R. (2013). *Finite dimensional vector spaces*. (2nd Ed.). S.l.: Literary Licensing, LLC.
5. Yang, Y. (2015). *Advanced linear algebra*. Cambridge: Cambridge University Press.

Suggested E-learning Material:

1. Lecture Notes: <https://nptel.ac.in/downloads/111102011/#>

Video Lectures & Notes: https://onlinecourses.nptel.ac.in/noc17_ma04/preview

Algebra-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completing the course, students will be able

- To demonstrate the mathematical maturity of understanding the proof.
- To understand the algebraic structures groups, rings, modules.
- To grasp the significance of the concepts of homomorphism & isomorphism and be able to check a given function is one of these.
- To understand the class equation for a finite group and its applications in Sylow's theorems.
- To classify groups up to isomorphism.
- To really understand the special types of rings and be able to construct new examples from the old ones.
- To check a subset of a ring is an ideal or not and be able to identify proper and maximal ideal.
- To understand the concept of unique factorization domain and able to write a polynomial as the product of irreducible factors
- To describe as a generalization of vector space and able to understand types of modules.
- To grasp the concept of Artinian modules, Noetherian modules, Artinian rings and Noetherian rings.

Section A

Review of groups, direct product of groups, normal subgroups, quotient groups, isomorphism theorems, Conjugates, Conjugacy in S_n , Class equation for a Group, Sylow's Theorems, Applications of Sylow's theorem, Simplicity of Alternating Group A_n for $n > 5$.

Section B

Rings, Ring homomorphism and quotient rings, Ideals: Prime and Maximal, fields of fractions, Divisibility, Euclidean and Principal Ideal Domains, Unique Factorization Domains, Polynomial Rings over fields, irreducibility criteria.

Section C

Modules, Quotient modules, module homomorphisms, generation of modules, direct sums, free modules, modules over PID's, Chain conditions, Artinian modules, Noetherian modules, Composition series, Modules of finite length, Jordan Holder Theorem, Artinian rings, Noetherian rings, Hilbert Basis Theorem, I.S.Cohen's Theorem, Introduction of Nil radical and Jacobson radical.

Suggested Books:

1. Gallian, J. A. (2013). *Contemporary abstract algebra*. (8th Ed.). Boston, MA: Brooks/Cole Cengage Learning.
2. Dummit, D. S. & Foote, R. M. (2004). *Abstract algebra* (3rd Ed.). New Jersey: Wiley.
3. Musili, C. (1994) *Introduction to Rings and Modules* (2nd Ed.). New Delhi: Narosa Publishing House.
4. Hungerford, T. W. (2014) *Abstract algebra: An introduction* (3rd Ed.). Australia: Brooks/Cole Cengage Learning.
5. Hillman A. P. & Alexandersor, G. L. (2015) *Abstract algebra: A first undergraduate course* (5th Ed.). CBS Publishers & Distributors Pvt. Ltd.
6. Fraleigh, J. B. (2003). *A first course in abstract algebra* (7th Ed.). Harlow: Pearson.
7. Sen, M. K., Ghosh, S., Mukhopadhyay, P. & Maity, S. K. (2019) *Topics in abstract algebra* (3rd Ed.). University Press.
8. Herstein, I. N. (1991) *Topics in algebra* (2nd Ed.). New Delhi: Wiley Eastern.

Suggested E-learning Material:

1. Lecture Notes on Groups and Rings: <https://ocw.mit.edu/courses/mathematics/18-703-modern-algebra-spring-2013/related-resources/>
2. Video Lectures on Algebra: <https://www.extension.harvard.edu/open-learning-initiative/abstract-algebra>

Open Source Book Abstract algebra: Theory and applications by Thomas W. Judson

<http://abstract.ups.edu/download/aata-20110810.pdf>

Analysis-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

On completion of the course, the student will be able to,

- understand modern theory of set and real numbers.
- investigate different metric spaces and their properties.
- master the technique of calculating the Lebesgue integral and understand the applications measurable functions.
- explain construction and investigate properties of Lebesgue measure.
- derive the Fourier series of integrable functions.
- discuss the point-wise and uniform convergence of series.

Section A

Countable & Uncountable sets, well ordering principle, Field of real numbers as a complete ordered field, Metric space, Sequences in metric spaces, complete metric space, Compact set, Heine-Borel Theorem, Bolzano Weierstrass Theorem.

Section B

Construction & Properties of Lebesgue measure, Borel sets, Measurable sets, Measurable functions, Lebesgue integration & its properties, Dominated & Monotone convergence theorems, Fatou's Lemma.

Section C

Fourier series of integrable functions. Discussion of pointwise & uniform convergence of series, Fejer's Theorem for continuous periodic functions, Orthogonality, Parseval's Theorem, Riesz Fischer theorem.

Suggested Text Books:

1. Royden, H. L. (2011). *Real analysis*. (3rd Ed.). New Delhi: Prentice hall of India.
2. Barra, G. D. (2008). *Measure theory and integration*. New Delhi: New Age International.
3. Carslaw, H. S. (1959). *Introduction to the theory of Fourier's series and integrals*. New York: Dover Publications.

Suggested Reference Books:

1. Rudin, W. (2017). *Principles of mathematical analysis*. (3rd Ed.). Chennai: McGraw Education (India) Private Limited.
2. Apostol, T.M. (1974). *Mathematical analysis*. (2nd Ed.). New Delhi: Narosa Publishing House.
3. Titchmarsh, E. C. (1968). *The theory of functions*. London: Oxford Univ. Press.
4. Hewitt, E., & Stromberg, K. R. (2009). *Real and abstract analysis: A modern treatment of the theory of functions of a real variable*. New York: Springer.
5. Goldberg, R. R. (2019). *Methods of real analysis*. New Delhi: Blaisdell Pub. Co.; Oxford and IBH.

Suggested E-learning material

2. A Basic Course in Real Analysis; NPTEL: <https://nptel.ac.in/courses/111105069/>
3. Fourier Series Part-1; NPTEL: <https://nptel.ac.in/courses/122107037/24>

Analysis-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

On completion of the course, the student will be able to,

- demonstrate understanding of the basic and advanced concepts underlying complex analysis.
- demonstrate familiarity with a range of examples of these concepts.
- prove advanced results/theorems in complex analysis.
- apply the methods of complex function theory to evaluate integrals and infinite series of complex functions.
- demonstrate understanding and appreciation of a more deeper aspects of complex function theory.
- demonstrate skills in communicating mathematics orally and in writing.

Section A

The complex number systems, stereographic projection, Riemann sphere, review of basic analysis. Analytic (Holomorphic) functions, Cauchy-Riemann equations, harmonic functions, line integrals and Green's theorem. Independence of path, harmonic conjugates in star-shaped domain, complex line integrals. Fundamental theorem of calculus for analytic functions, Cauchy's theorem, Cauchy's integral formula and its generalized form, Cauchy's estimates, Liouville's theorem, Morera's theorem. Maximum and minimum modulus principle.

Section B

Power series, Abel's convergence lemma, Cauchy-Hadamard formula, power series expansion of an analytic function, zeros of an analytic function. Winding number, Laurent's expansions, isolated singularities, entire and meromorphic functions, Casorati and Weierstrass theorem. Residue at a singularity, residue theorem.

Section C

Argument principle, Rouché's theorem, residue and contour integration, Hurwitz theorem. Open mapping theorem. Inverse function theorem. Fundamental theorem of algebra. Gauss theorem, conformal mapping and fractional linear transformation, Transformations $w = z^2$, $w = e^z$, $w = e^{-z}$, $w = \log z$, $w = \sin z$, $w = \cos z$. Schwarz lemma, conformal self maps of the unit disk. Pick's lemma, Poisson integral formula, Analytic continuation.

Suggested Books:

1. Gamelin, T. W. (2004). *Complex analysis*. New Delhi: Springer.
2. Conway, J. B. (1995). *Functions of one complex variable*. New York: Springer-Verlag.
3. Ponnusamy, S. (2007). *Foundations of complex analysis*. (2nd Ed.). Oxford, UK: Alpha Science Internat.
4. Ahlfors, L. V. (2013). *Complex analysis: An introduction to the theory of analytic functions of one complex variable*. (3rd Ed.). India: McGraw Hill Education.

Suggested E-learning material

Complex Analysis; NPTEL: <https://nptel.ac.in/courses/111103070/>

Discrete Mathematics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completing the course, students will be able to

1. Understand logical arguments and logical constructs. Have a better understanding of sets, functions and relations.
2. Apply logical reasoning to solve a variety of mathematical problems.
3. Understand and apply the fundamental concepts in graph theory.
4. Acquire ability to apply graph theory-based tools in solving practical problems.
5. Improve the proof writing skills and able to develop mathematical maturity.

Section A

Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof, Multi-set, Relations and Functions, Introduction to Algorithms, The growth of functions, Complexity of Algorithms, Partially ordered sets, Chains and Anti-chains, Lattices, Complete lattices, Distributive lattices, Complements, Boolean Algebra, Uniqueness of Finite Boolean Algebras, Boolean expressions and Boolean functions, Normal forms.

Section B

Basic counting Principles, Permutations and Combinations, Permutations and Combinations on multi-sets, Generation of permutations and Combinations, Pigeon-hole principle, Principle of inclusion and exclusion. Discrete numeric functions, Generating Functions, Combinatorial problems. Recurrence relations, linear recurrence relation with constant coefficients and their solutions, Solution by the method of generating Functions.

Section C

Graphs, Vertices of graphs, degrees, Sub-graphs, Paths, Walks and cycles, Connected graphs, Connected components, Weighted graphs, Directed graphs. Matrix representations of graphs. Shortest path Problem Operations on graphs. Blocks, Cut-points, bridges Block graphs and Cut-point graphs. Euler tours, Euler graphs Hamiltonian paths, Hamiltonian graphs. Closure of a graph. Isomorphism in graphs. Euler's formula, Planar graphs, Vertex colouring Chromatic number, Chromatic polynomial, R - Critical graphs, Acyclic graphs- Trees , Elementary properties of trees Center, Connectivity, Connectivity and line connectivity, Partitions, Cut edges - Cut vertices, Spanning tree and minimum Spanning tree.

Suggested Text/Reference Books:

1. Liu, C. L. (1985). *Elements of discrete mathematics*. Mc-Graw Hill, International edition.
2. Deo, N. (2012). *Graph theory: With applications to engineering and computer science*. New Delhi: PHI Learning Private Limited.
3. Rosen, K. H. (2013). *Discrete mathematics and its applications: Seventh edition*. New York: McGraw-Hill.
4. Joshi, K. D. (1989). *Foundation of discrete mathematics*. Wiley Eastern Ltd.

Suggested E-learning Material:

1. Lecture notes: <https://nptel.ac.in/downloads/111104026/>
 2. Lecture notes: <http://home.iitk.ac.in/~aralal/book/mth202.pdf>
 3. Lecture notes: https://ocw.mit.edu/high-chool/mathematics/combinatorics-the-fine-art-of-counting/lecture-notes/MITHFH_lecturenotes_8.pdf
 4. Lecture notes: http://www.math.kit.edu/iag6/lehre/graphtheo2015w/media/lecture_notes.pdf
 5. Online Course: <https://swayam.gov.in/courses/4926-discrete-mathematics>
- Online Course: <https://swayam.gov.in/course/3795-graph-theory>

Numerical Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- Demonstrate numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of ordinary differential equations.
- Analyze the appropriate numerical method to find the Eigen values and corresponding eigenvectors of a system.
- Use rational approximation of a function like Padé approximant for power series.
- Solve the boundary value problems using shooting method and finite difference method.
- Define and use the concepts accuracy, consistence, stability and convergence.

Section A

Accuracy and approximate calculations: Different types of errors and their computations.

Numerical solution of system of linear equations: Direct methods: Gauss elimination method and Crout's (factorization) methods, Iterative methods: Jacobi method, Gauss-Seidel method, Vector and matrix norm, Condition number and ill-conditioning, condition of convergence in iterative methods.

Eigen values and Eigen vectors: Singular value decomposition, Power method, Aitken's acceleration, Inverse Power method.

Section B

Numerical solutions of algebraic and transcendental equations: Polynomial and transcendental equations, intermediate value theorem, Bisection method, Iterative method, Newton-Raphson method, Convergence analysis of these methods.

Interpolation: Newton-Gregory forward and backward interpolation, Lagrange's formula, inverse interpolation, computation errors in these formulae and analysis of errors, **Approximation of function:** Padé approximation.

Numerical Differentiation: Maximum and minimum value of a tabulated function, Solution of difference equations, **Numerical Integration:** Newton-cotes integration formula, Trapezoidal, Simpson's 1/3 and Simpson's 3/8 and Weddle's rules, Gaussian quadrature formula.

Section C

Numerical solution of ordinary differential equations: Initial value problems: Lipschitz condition for initial value problems, solution by Taylor's series method, Euler's method, Picard's method, Runge-Kutta methods, Runge-Kutta-Fehlberg method, Predictor corrector methods: Milne's method, estimation of errors, **Boundary value problems:** Shooting Method, Finite difference method, Rayleigh-Ritz method. Stability analysis of these numerical methods.

Suggested Text Books:

1. Cheney, E. W., & Kincaid, D. (2008). *Numerical mathematics and computing* (5th ed.). Thomson Brooks/Cole.

2. Jain, M. K., Iyengar, S. R. K., & Jain, R. K. (2007). *Numerical methods for scientific and engineering computation* (5th ed.). New Delhi: New Age International.
3. Sastry, S. S. (2012). *Introductory methods of numerical analysis* (5th ed.). New Delhi: Prentice-Hall of India.

Suggested Reference Books:

1. Burden, R. L., & Faires, J. D. (2005). *Numerical analysis* (7th ed.). Thomson Brooks/Cole.
2. Chauhan, D. S., Vyas, P., & Soni, V. (2014). *Studies in numerical analysis* (Reprint ed.), Jaipur Publishing House.
3. Rao, K. S. (2005), *Numerical methods for scientists and engineers* (2nd ed.). New Delhi: Prentice-Hall of India.
4. Phillips, G. M., & Taylor, P. J. (1996). *Theory and applications of numerical analysis* (2nd ed.). Elsevier.

Suggested E-learning material:

1. Introduction to Numerical Analysis for Engineering, Platform: MIT open courseware
<https://ocw.mit.edu/courses/mechanical-engineering/2-993j-introduction-to-numerical-analysis-for-engineering-13-002j-spring-2005/index.htm>
2. Numerical Analysis, Platform: nptel
<https://nptel.ac.in/courses/111107062/>
3. Elementary Numerical Analysis, Platform: nptel
<https://nptel.ac.in/courses/111101003/>

Numerical Analysis Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, the student will be able to,

- Implement numerical methods in MATLAB to solve systems of linear equations, compute quadrature, solve ordinary differential equations and various computational problems.
 - Write efficient, well-documented MATLAB code and present numerical results in an informative way.
 - Show logical thinking in coding a mathematical problem in algorithmic form.
 - Use their knowledge of a programming in MATLAB to learn more easily any other programming language like Mathematica, Python etc.
1. A review of basic MATLAB functions on command window.
 2. Writing Scripts and functions in MATLAB (m-files).
 3. Flow control commands (If-else, for, while, switch).
 4. An M-file to implement Gauss elimination method with partial pivoting for solving system of linear equations.
 5. An M-file to implement Gauss-Seidel method.
 6. An M-file to implement the bisection method.
 7. An M-file to implement Newton-Raphson method for nonlinear equations.
 8. An M-file to implement Newton's interpolation.
 9. An M-file to implement Lagrange's interpolation.
 10. Curve fitting: least-squares n^{th} order polynomial to data (linear and Quadratic).
 11. An M-file to implement the trapezoidal and Simpson's rules.
 12. An M-file to implement Euler's method for solving ordinary differential equations with a plot of exact and numerical solutions.
 13. An M-file to implement Runge-Kutta methods (ode23 and ode45) for solving ordinary differential equations with a plot of exact and numerical solutions.
 14. An M-file to implement finite difference method for solving ordinary differential equations with a plot of exact and numerical solutions.

Text Books/ Reference Books:

1. Fausett, L. V. (2008). *Applied numerical analysis using MATLAB* (2nd ed.). Pearson Education.
2. Chapra, S. (2006). *Applied numerical methods with MATLAB for engineers and scientists*, McGraw-Hill Higher Education.

Suggested E-learning material:

1. Introduction to Numerical Methods and MATLAB Programming for Engineers, Platform: Ohio University;
<http://www.ohiouniversityfaculty.com/youngt/IntNumMeth/>
2. Using numeric approximations to solve continuous problems, Platform: MathWorks;
<https://in.mathworks.com/discovery/numerical-analysis.html>

Probability and Statistics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the students will be able to:

- ũ Understand the meaning of probability and probabilistic experiment
- ũ Familiarize with the all approaches to probability theory and particularly, the axiomatic approach.
- ũ Understanding the meaning of conditional probability, conditioning, and reduced sample space.
- ũ Understand the concepts of random variables, sigma-fields generated by random variables, probability distributions and independence of random variables related to measurable functions.
- ũ Distinguish between independent and uncorrelated random variables.
- ũ Distinguish between discrete, continuous, and mixed random variables and be able to represent them using probability mass, probability density, and cumulative distribution function.
- ũ Derive the distribution of functions of random variable.
- ũ Understand the concepts of sampling distributions and use of sampling distribution in hypothesis testing.

Section A

Measures of Central Tendency: mathematical and positional. Measures of Dispersion, Review of probability, Random variable and functions of random variables: Probability density function, probability mass function, Distribution function and its properties. Mathematical expectation and its simple properties.

Section B

Moment generating function, characteristic function and their properties. Theoretical probability distributions with their simple properties, Discrete distribution: Bernoulli, Binomial, Poisson, Geometric distribution; Continuous distribution: Rectangular. Normal, Exponential and Cauchy distribution.

Section C

Sampling distribution of univariate normal, Chi square, t, F distribution with their simple properties and applications.

Bivariate data: simple, partial and multiple correlation (3 variables only), rank correlation and regression.

Suggested Text Books:

1. Goon, A. M., Gupta, M. K. and Gupta, B. D. (1968). *Fundamentals of Statistics* (Vol. I & Vol. II). World Press Pvt. Ltd., Kolkata.
2. Goon, A. M., Gupta, M. K. and Gupta, B. D. (1973). *An outline of Statistical Theory* (Vol. I & Vol. II). World Press Pvt. Ltd., Kolkata.
3. Srinivasan, S.K. & Mehta, K. M. (1978). *Probability and Random Process*. Tata Mc-Graw-Hill.
4. Kapoor, J. N. & Saxena, H.C. (2007). *Mathematical Statistics*. S. Chand & Company Ltd.
5. Rohtagi, V. K. (1976). *An Introduction to probability and Mathematical Statistics*. Wiley Eastern Publisher Ltd., New Delhi.

Suggested E-learning material:

1. Probability and Statistics; Platform: NPTEL [nptel.ac.in/courses/ 111105041/](https://nptel.ac.in/courses/111105041/).
2. Probability; Platform: e-PGPathshala <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>.
3. Introduction to Probability-<https://ocw.mit.edu/resources/res-6-012-introduction-to-probability-spring-2018/>.

Note: Use of Scientific Calculator of permissible.

1. MATHEMATICAL PROGRAMMING

SECTION – A

Introduction to Operations Research. Linear programming, principles of Simplex Method. Simplex method in tabular form. Duality and Dual simplex method. Degeneracy & Cycling.

SECTION – B

Special cases of Assignment and Transportation problems. Matrix game and its relation with linear programming. Fundamental theorem of matrix game theory. Game with mixed strategies.

SECTION – C

Nonlinear programming; the Kuhn - Tucker conditions, quadratic programming; method due to Beale's & Wolfe's Separable programming, Integer programming; Gomory's method for all integer and mixed integer programming, Branch and Bound Technique. Dynamic programming.

References :-

1. Pant, J.C. : Optimization Techniques
2. Taha : Operations Research, Macmillan & Co.
3. Kanti Swaroop : Operations Research
4. Sharma, S.D. : Operations Research
5. Gillette, B.E. : Introduction to Operation Research Talu MC Graw Hill
6. Kambo, N.S. : Mathematical programming Techniques Affiliated East-West Press Ref. Ltd.

Operations Research

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- Build a mathematical programming model of a real-life situation
- Write a report that describes the formulation of a linear programming problem, and able to presents and interprets the solutions.
- Understand the basic theory in linear programming.
- Apply a suitable method in research to develop the theories which will be applicable in the real-life problems.
- Understand the concepts of dynamic programming, job sequencing, network analysis.
- Understand the basic concepts and need of inventory theory and queueing theory.

Section A

Linear Programming: Simplex method, Theory of simplex method, Duality in linear programming. Dual simplex method. Assignment and Transportation Problem.

Section B

Dynamic Programming: Introduction, characteristics of dynamic programming, dynamic programming algorithm, solution of discrete dynamic programming problem.

Sequencing Problem: Introduction, processing n jobs through two machines, processing n jobs through k machines, processing two jobs through k machines.

Network Analysis, Introduction of Network analysis, shortest path problem PERT & CPM Updating of PERT charts.

Section C

Queueing Theory, Probability description of arrivals and service times, objectives and different characteristics of a queueing system, deterministic queueing system, steady-state behaviour of Markovian and Earlangian Models (M/M/1, M/M/C, M/Ek/1).

Inventory Theory, Deterministic economic lot size models and their extensions, models with lost sales and partially backlogged, continuous production with varying demand rates.

Suggested Books:

1. Swarup, K., Gupta, P. K., & Mohan, M. (1977). *Operations Research (Answers to problems)*. New Delhi: Sultan Chand & Sons.
2. Pant, J. C. (2004). *Introduction to optimization: Operations Research*. New Delhi: Jain Brothers.
3. Taha, H. A., & Pearson Education. (2017). *Operations research: An introduction*. Harlow [i 21 pozostałych: Pearson.
4. Hillier, F. S., & Lieberman, G. J. (1972). *Introduction to operation research*. San Francisco: Holden-Day.
5. Sinha, S. M. (2006). *Mathematical programming: Theory and methods*. New Delhi: Elsevier.

Suggested E-learning material:

1. Tutorial: https://ibmdecisionoptimization.github.io/tutorials/html/Linear_Programming.html
2. Tutorial: Sophia Learning: <https://www.sophia.org/tutorials/linear-programming--5>
3. Lectures – NPTEL: <https://nptel.ac.in/courses/111102012/>
4. Nonlinear Programming – MIT <http://web.mit.edu/6.252/>
5. Nonlinear Programming: <https://ocw.mit.edu/courses/sloan-school-of-management/15-084j-nonlinear-programming-spring-2004/lecture-notes/>

Ordinary Differential Equations

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, students will be able to

- Understand the existence and uniqueness of IVPs and their solution
- Understand method of successive approximations, variation of constants, annihilator method, and reduction of order of a homogeneous equation.
- Solve linear differential equations of higher order with variable coefficients.
- Solve boundary value problems for second order equations.
- Solve Boundary Value problems for second order equations by Green's function, Sturm-Liouville Boundary Value problem.
- Grasp the concept of the stability of system of differential equations
- Solve system of linear differential equations and study the qualitative behavior of these systems.

Sections A

Existence and Uniqueness of solutions: Introduction, Picard's Successive Approximations, Picard's theorem, Continuation and dependence of initial conditions, Existence of solutions in the large, Existence and Uniqueness for systems, fixed point technique for nonlinear differential equations.

Section B

Linear Differential equations of higher order with variable coefficients: Introduction, Existence and Uniqueness theorem, linear dependence and Wronskian. Solution Method of variation of parameters, Method of undetermined coefficients, Reduction of order.

Boundary Value Problems for second order equations: Introduction, Green's function, Sturm Liouville problem. Applications of BVPs.

Section C

System of linear differential equations: Introduction, Existence and Uniqueness theorem, Solution of the system; Eigenvalue–Eigenvector Method and Fundamental Matrix Method. Matrix Exponential Function, Non-homogeneous linear systems. Phase Portrait in $\mathbb{R}^2$. Plane Autonomous Systems: critical points and types of critical points and stability.

Text Books:

1. Deo, S. G., Raghavendra, V., Kar, R. & Lakshmikantham, V. (2015) *Textbook of ordinary differential equations*. (3rd Ed.). New Delhi: Mc Graw Hill Education.
2. Ahmad, S. & Ambrosetti, A. (2015). *A Textbook on Ordinary Differential Equations*. (2nd Ed.). Switzerland: Springer.

Reference Books:

1. Wirkus, S.A. & Swift, R.J. (2015). *Ordinary Differential Equations*. (2nd Ed.). USA: CRC Press.
2. Birkhoff, G. & Rot, G.C. (1989). *Ordinary Differential Equation*. (4th ed.), India: John Wiley.
3. Braun, M. (1975). *Differential Equations & their Applications*. New York: Springer Verlag.
4. Coddington, E.A. & Levinson, N. (1955). *Theory of ordinary differential equation*. New York: Mcgraw Hill.
5. Ross, S. L. (1984). *Differential Equations*. (3rd ed.). India: Wiley Publication.
6. William E. B., & Richard C. D. (2012). *Elementary Differential Equations and Boundary Value*. (10th Ed.). New York: Wiley Publication.

7. Coddington, E. A. (1961). *An Introduction to Ordinary differential equations*. New Jersey, USA: Dover Publication Inc.
8. Hartman, P. (1964). *Ordinary Differential Equations*. New York; John Wiley and sons.

Suggested E-learning material

1. Lecture notes: <http://www.math.ust.hk/~machas/differential-equations.pdf>
2. NPTEL: <https://nptel.ac.in/courses/111106100/>
3. Lecture Notes: <http://home.iitk.ac.in/~sghorai/TEACHING/MTH203/ode.html>

Topology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon successful completion of this course, student will be able to

- Define and illustrate the concept of topological spaces and continuous functions.
- Define and illustrate the concept of product topology and quotient topology.
- Calculate simple topological invariants, such as the number of path components.
- Define and illustrate the concepts separation axioms.
- Use continuous functions and homeomorphisms to understand structure of topological spaces.

Section A

Infinite sets and axiom of choice, Well-ordered sets, The maximum principle, Topological spaces, Bases for a topology, The order topology, The product topology, The subspace topology, Closed sets and limit points, Continuity of a function, Homeomorphism, Construction of continuous functions.

Section B

Metric topology, The quotient topology (Introduction only), Connected spaces, Path connected spaces, Connected sets in the real line, Components, Path components, Local connectedness, Local path connectedness, Compact spaces.

Section C

First countability axiom, Second countability axiom, Lindelof space, Regular space, Normal spaces, The Urysohn Lemma, Completely regular space. The Tietze extension theorem.

Suggested Books:

1. Munkres, J. R. (1975). *Topology: A first course*. New Delhi: Prentice Hall of India.
2. Singh, T. B. (2013). *Elements of topology*. CRC Press.
3. Joshi, K. D. (1986). *Introduction to general topology*. New Delhi: Wiley Eastern.
4. Murdeshwar, M. G. (1983). *General topology*. New Delhi: Wiley Eastern.
5. Simmons, G. F. (1963). *Introduction to topology & modern analysis*. Auckland: Mc Graw Hill.
6. Dugundji, J. (1990). *Topology*, New Delhi: Universal Book Stall.

Suggested E-learning Material:

Video Lectures: <https://nptel.ac.in/courses/111106054/>

Advanced Analysis (Analysis on Abstract Spaces)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of this course, students will be able to

- Explain when Normed space become Banach space.
- Define the Hilbert spaces.
- Define multi linear mappings.
- Check whether the function is bounded or not?
- What is directional derivative?
- Explain the difference between partial derivative and directional derivative.
- Tell about the Lipschitz's constant and conditions
- Related the analysis and differential equation

Section A

Normed Linear Spaces & Banach spaces. Bounded Linear transformations, multi linear mappings, inner product spaces, Hilbert spaces, orthonormal systems. The space of bounded functions, the space of continuous functions, Stone-Weierstrass Approximation Theorem equicontinuous sets.

Section B

The derivative, directional derivative, partial derivative, mean value theorem, continuously differentiable maps. Higher derivatives Taylor's Theorem, existence theorem on differentiable maps, fixed point theorem. Step functions, regulated functions.

Section C

Differential Equations: First order differential equations approximate solutions, Lipschitz's property, dependence on the initial value, dependence on a parameter, linear differential equations.

Suggested Text Book:

1. Dieudonne, Jean A. (1969). *Treatise on analysis: Foundations of modern analysis* (Vol. I). New York: Academic Press.

Suggested Reference Books:

1. Cartan, H. (1983). *Differential calculus*. London: Kershaw Publishing.
2. Hewitt, E. J., & Stromberg, K. R. (1975). *Real and abstract analysis: A modern treatment of the theory of functions of a real variable*. New York: Springer-Verlag.
3. Yosida, K. (1968). *Functional analysis*. (2nd Ed.). New York, N.Y: Springer-Verlag.

Suggested E-learning Material:

1. Normed space Banach space and Hilbert spaces and its properties; Platform:
<https://nptel.ac.in/courses/111105037/>

Advanced Calculus

Section A

Euclidean Space $\mathbb{R}^n$, Basic Topology on $\mathbb{R}^n$, Functions on Euclidean spaces, continuity Uniform Continuity, Differentiability; Partial and directional derivatives.

Affine functions, First order approximation of Real Valued functions, quadratic Functions Hessian Matrices, second order approximation and second derivative test.

Section B

Linear mappings and Matrices, The Derivative matrix, First order approximation Theorem for mappings, Chain Rule, Inverse Function Theorem, Implicit Function Theorem, Lagrange Multipliers.

Section C

Riemann Integral of real-valued functions on Euclidean spaces, Integration of functions on Jordan Domains, Fubini's Theorem, Change of Variables, Line and Surface Integrals, Green and Stokes Theorem.

Text Book :

1. Patrick M. Fitzpatrick, Advanced Calculus, Second edition, AMS.

Suggested Text/Reference Books:

1. J.R. Munkres, Analysis on Manifolds, Addison-Wesley, 1991.
2. GB Folland, Advanced Calculus, Pearson.
3. V. Guillemin and A. Pollack, Differential Topology, Prentice-Hall Inc., Englewood Cliffe, New Jersey, 1974.
4. W. Fleming, Functions of Several variables, 2nd Edition, Springer-Verlag, 1977.
5. W. Rudin, Principles of Mathematical Analysis, 3rd Edition, McGraw-Hill, 1984.
6. M. Spivak, Calculus on Manifolds, A Modern Approach to Classical Theorems of Advanced Calculus, W.A. Benjamin, Inc., 1965.

Advanced Functional Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of this course, students will be able to

- Check whether a sequence of operators convergence or divergences?
- Explain how continuous function on a closed and bounded interval can be uniformly approximated on that interval by polynomials to any degree of accuracy.
- Explain how you will apply the Banach fixed point theorem.
- Relate the fixed point with solution of differential and Integral equation.
- Check the spectral properties of bounded linear operators
- Check whether the operator is compact or not?
- Explain and use of the properties of compact linear operators.

Section A

Convergence of sequence of operators and functions, Toeplitz limit theorem, Weierstass approximation theorem for polynomials, Baire's Category theorem, Banach fixed point theorem, Application of Banach fixed point theorem on linear equations, Differential equations, Integral equations (Fredholms integral equation of second kind).

Section B

Spectral theory in finite dimensional normed spaces, Spectral properties of bounded linear operators, further properties of Resolvent & Spectral, Use of complex Analysis in Spectral theory, Banach Algebras.

Section C

Compact linear operators and their properties, Spectral properties of compact linear operation, further Spectral properties of compact linear operators, Operator equations involving compact linear operators, further theorem on Fredholm type, Fredholm Alternative.

Suggested Books:

1. Kreyszig, E. (2008). *Introductory functional analysis with applications*. New York: Wiley.
2. Bachman, G., & Narici, L. (2012). *Functional Analysis*. New York: Dover Publications.
3. Rudin, W. (2006). *Functional analysis*. New York: McGraw-Hill.
4. Limaye, B. V. (2014). *Functional analysis*. (3rd Ed.). New Delhi: New Age International (P) Limited.
5. Goffman, C., & Pedrick, G. (2002). *First course in functional analysis*. New Delhi: Prentice Hall of India.

Suggested E-learning material:

1. Lectures: Platform: NPTEL

<https://nptel.ac.in/courses/111105037/>

Analytic and Algebraic Number Theory

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of this course, students will be able to

- Demonstrate the knowledge of arithmetic functions and their property.
- Know the prime number theorem and its analytic proof.
- Understand basic concepts of algebraic number theory such as conjugates, discriminants, algebraic integers, integral basis, norms and traces.
- Understand prime factorization of ideal and unique factorization.
- Know some important theorem in algebraic number theory.

Section A

Arithmetic functions, Dirichlet product of arithmetical functions, Multiplicative functions, Bell series of an arithmetical function, The Selberg identity, Euler's summation formula, Chebyshev's functions, equivalent forms of the prime number theorem, Dirichlet Series, Euler Products, Analytic Proof of the Prime Number Theorem

Section B

Algebraic numbers, conjugates and discriminants, algebraic integers, integral basis, norms and traces, ring of integers, quadratic fields, cyclotomic fields, trivial factorization, factorization into irreducibles, Non-unique factorization, consequences of unique factorization, Ramanujan-Nagell Theorem

Section C

Prime factorization of ideal, norm of an ideal, non-unique factorization in cyclotomic fields, lattices, quotient torus, Minkowski's theorem, two square theorem, four square theorem, class-group, finiteness of the class-group, Unique factorization of elements in an extension ring.

Suggested Text Books:

1. Stewart, I., & Tall, D. O. (2000). *Algebraic number theory*. London: CRC Press.
2. Apostol, T. M. (1998). *Introduction to analytic number theory*. New York: Springer.

Suggested Reference Books:

1. Ireland, K. F., & Rosen, M. I. (2004). *A classical introduction to modern number theory*. (2nd Ed.). New Delhi: Springer India.
2. Lang, S. (1994). *Algebraic number theory*. New York: Springer-Verlag.
3. Marcus, D. A., & Springer Nature. (2018). *Number fields*. Cham: Springer.

Analytic and Algebraic Number Theory

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of this course, students will be able to

- Demonstrate the knowledge of arithmetic functions and their property.
- Know the prime number theorem and its analytic proof.
- Understand basic concepts of algebraic number theory such as conjugates, discriminants, algebraic integers, integral basis, norms and traces.
- Understand prime factorization of ideal and unique factorization.
- Know some important theorem in algebraic number theory.

Section A

Arithmetic functions, Dirichlet product of arithmetical functions, Multiplicative functions, Bell series of an arithmetical function, The Selberg identity, Euler's summation formula, Chebyshev's functions, equivalent forms of the prime number theorem, Dirichlet Series, Euler Products, Analytic Proof of the Prime Number Theorem

Section B

Algebraic numbers, conjugates and discriminants, algebraic integers, integral basis, norms and traces, ring of integers, quadratic fields, cyclotomic fields, trivial factorization, factorization into irreducibles, Non-unique factorization, consequences of unique factorization, Ramanujan-Nagell Theorem

Section C

Prime factorization of ideal, norm of an ideal, non-unique factorization in cyclotomic fields, lattices, quotient torus, Minkowski's theorem, two square theorem, four square theorem, class-group, finiteness of the class-group, Unique factorization of elements in an extension ring.

Suggested Text Books:

3. Stewart, I., & Tall, D. O. (2000). *Algebraic number theory*. London: CRC Press.
4. Apostol, T. M. (1998). *Introduction to analytic number theory*. New York: Springer.

Suggested Reference Books:

4. Ireland, K. F., & Rosen, M. I. (2004). *A classical introduction to modern number theory*. (2nd Ed.). New Delhi: Springer India.
5. Lang, S. (1994). *Algebraic number theory*. New York: Springer-Verlag.
6. Marcus, D. A., & Springer Nature. (2018). *Number fields*. Cham: Springer.

Differential Geometry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to

- Compute Reparameterization, Curvature and Torsion of smooth curves of curves.
- Discuss about Osculating circle, Osculating sphere, Involutives and Evolutes, Bertrand curves, and Helices.
- Compute quantities of geometric interest such as curvature, as well as develop a facility to compute in various specialized systems, such as semi geodesic coordinates or ones representing asymptotic lines or principal curvatures.
- Develop arguments in the geometric description of curves and surfaces in order to establish basic properties of geodesics.

Section A

Curves in Plane and Space: Parameterized curves, Tangent vector, Arc length, Reparametrization, Regular curves, Curvature and Torsion of smooth curves, Frenet-Serret formulae, Osculating circle, Osculating sphere, Involutives and Evolutes, Bertrand curves, Spherical indicatrices, Helices.

Section B

Surfaces in $\mathbb{R}^3$: Smooth surfaces, Tangent, Normal and Orientability. Examples of surfaces: Generalized cylinder and cone, ruled surfaces, Surface of revolution, First fundamental form, Isometries of surfaces, Conformal mapping of surfaces, Surface Area, Equiareal maps and Theorem of Archimedes, Second fundamental form, Curvature of curves on a surface, Normal and Principal curvatures, Meusnier's theorem, Euler's theorem, Classification of point on surface, Geometric interpretation of principal curvatures, Umbilical points.

Section C

Gaussian and Mean curvature, Pseudo sphere, Flat surfaces, Surfaces of constant mean curvature, Gaussian curvature of compact surfaces, Gauss map. Geodesics: Definition and basic properties, Geodesic equations, Geodesics on a surface of revolution, Clairaut's theorem, Geodesics as shortest paths, Geodesic coordinates, Geodesic curvature of a curve.

Suggested Text Book

1. Pressley, A. (2012). *Elementary differential geometry*. London: Springer.

Suggested Reference Books:

1. Carmo, M. P. (1980). *Differential geometry of curves and surfaces*. Englewood Cliffs, N.J: Prentice-Hall.
2. O'Neill, B. (2006). *Elementary differential geometry*. London: Elsevier/Academic Press.
3. Gray, A. (2000). *Modern differential geometry of curves and surfaces*. FL: CRC Press.
4. Somasundaram, D. (2010). *Differential geometry: A first course*. Harrow: Alpha Science International.

Suggested E-learning material:

1. NOC:Differential Calculus in Several Variables: <https://nptel.ac.in/courses/111104092/>
2. NOC:Curves and Surfaces: <https://nptel.ac.in/courses/111104095/>

Functional Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- explain the basic concepts of Functional Analysis, including the study of operator theory and the study of topological function spaces.
- describe how to illustrate the abstract notions in functional analysis via examples.
- apply Hilbert space-theory, including Riesz' representation theorem and weak convergence, and methods in problem solving.
- solve the problems appear in PDEs via the powerful tools from functional analysis,
- study in a range of other fields, e.g. Quantum Theory, Stochastic calculus and Harmonic analysis.

Section A

Normed spaces, Banach spaces, Further properties of Normed spaces, subspaces, Linear operators, linear functionals, Bounded and continuous linear operators, Normed spaces of operators, Dual spaces.

Section B

Hahn-Banach theorem (Extension of linear functionals) for normed spaces, application to bounded linear functionals on $C[a,b]$, adjoint operators, reflexive spaces, uniform boundedness theorem, convergence of sequence of operators and functionals, Open mapping theorem, closed linear operators, Closed Graph Theorem.

Section C

Inner product spaces, Hilbert spaces, further properties of inner product spaces, orthogonal complements and direct sums, orthonormal sets and sequences, total orthonormal sets and sequences, representation of functionals on Hilbert spaces, Hilbert adjoint operators, Self-adjoint, unitary and normal operators.

Suggested Text Books:

1. Kreyszig, E. (2008). *Introductory functional analysis with applications*. New York: Wiley.
2. Jain, P. & Ahuja, O. P. (2011). *Functional analysis*. New Delhi: New Age International.

Suggested References Books:

1. Bachman, G., & Narici, L. (2012). *Functional Analysis*. New York: Dover Publications.
2. Simmons, G. F. (2004). *Introduction to topology and modern analysis*. New Delhi: TATA McGraw-Hill.
3. Rudin, W. (2006). *Functional analysis*. New York: McGraw-Hill.

Suggested E-learning material

1. Introduction to Functional Analysis; Platform: MITOPENCOURSEWARE
<https://ocw.mit.edu/courses/mathematics/18-102-introduction-to-functional-analysis-spring-2009/>
2. Functional Analysis; Platform; NPTEL <https://nptel.ac.in/courses/111105037/>
3. Functional Analysis; Platform: Free video lectures <https://freevideolectures.com/course/3145/functional-analysis>

Integral Equations and Calculus of Variations

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- Acquire ability to recognize difference between Volterra and Fredholm Integral Equations, First kind and Second kind, homogeneous and inhomogeneous.
- Identify different types of integral equations and apply these methods to solve Integral Equations.
- Understand of the fundamental concepts of the space of admissible variations and concepts of a weak and a strong relative minimum of an integral.
- Solve isoperimetric problems of standard type.
- Solve simple initial and boundary value problems by using several variable calculus.

Section A

Linear Integral Equations: Definition and classification. Conversion of initial and boundary value problems to an integral equation, Eigenvalues and eigenfunctions. Solution of homogeneous and general Fredholm integral equations of second kind with separable kernels, Symmetric kernels, Resolvent kernel. Solution of Fredholm and Volterra integral equations of second kind by method of successive substitutions and successive approximations. Solution of Volterra integral equations with convolution type kernels by Laplace transform, Green's function, Construction of Green's function.

Section B

Conditions of uniform convergence and uniqueness of series solution, Complex Hilbert space, Orthogonal system of functions, Fundamental properties of eigen values and eigen functions for symmetric kernels, expansion in eigen functions and bilinear form, Hilbert Schmidt theorem, Solution of Fredholm integral equations of by using Hilbert Schmidt theorem, Classical Fredholm theory: Fredholm first fundamental theorem and its applications.

Section C

Variation of a functional, Fundamental lemma of calculus of variation, Euler-Lagrange equation, Necessary and Sufficient conditions for extrema., Variational problems for functional: Brachistochrone problem, problem of geodesics, Isoperimetric problem. Functionals dependent on higher order derivatives, Fields of Extremals: Proper field and Central field, Application of Euler-ostrogradsky equations, rayleigh - ritz method for solution of partial differential equations.

Suggested Text Books:

1. Gelfand, I. M., & Fomin, S. V. (1965). *Calculus of variations*. Englewood Cliffs, N.J: Prentice-Hall.
2. Gupta, A. S. (2015). *Calculus of variations with applications*. New Delhi : Prentice Hall India.
3. Raisinghania, M. D. (2007). *Integral Equations and boundary values problems*. New Delhi: S. Chand & Company.

Suggested Reference Books :

1. Corduneanu, C. (2008). *Integral equations and applications*. Cambridge: Cambridge University Press.
2. Hildebrand, F. B. (1992). *Methods of applied mathematics: Second edition*. New York, N.Y: Dover.
3. Tricomi, F.G. (1985). *Integral equations*, New York: Dover.

Suggested E-learning material

1. Open course in Integral equations, calculus of variation and its applications (all Topics)

<https://nptel.ac.in/courses/111107103/>

2. Volterra and Fredholm Integral Equations:

[http://staff.ul.ie/mitchells/Final notes.pdf](http://staff.ul.ie/mitchells/Final_notes.pdf)

3. Green's Functions

http://www.maths.manchester.ac.uk/~wparnell/MT34032/34032_IntEquns.pdf

4. Neumann series, resolvent kernels and variational problem

<https://swayam.gov.in/courses/4824-july-2018-integral-equations-calculus-of-variations-and-its-applicati>

5. Open course in integral equations:

<https://ocw.mit.edu/courses/mathematics/18-307-integral-equations-spring-2006/>

Integral Transforms and Special Functions

Contact Hours: 90

Section A

Laplace Transform : Laplace Transform of some elementary functions, properties, Laplace Transform of Derivatives. Laplace Transform of Bessel Function; Inverse Laplace Transform of Derivatives and Integrals, Convolution of Two functions, Convolution Theorem, Applications of Laplace Transform to solve ordinary differential equations with constant and Variable coefficients, Initial and boundary Value Problems, heat and wave equations. Fourier transforms, Fourier sine and Cosine transforms.

Section B

Convolution theorem, Relationship between Laplace and Fourier Transforms. Finite Fourier sine and Cosine transforms Inversion formula, Applications of Fourier transform in Initial and boundary value Problems. Mellin transform, Properties, Mellin transform, of derivatives and integrals, Mellin inversion Theorem, Convolution theorem, Hankel transform elementary Properties, Hankel Inversion theorem, Relation between Hankel and Laplace transform, Hankel Transform of derivatives.

Section C

Legendre polynomials : Solution of Legendre's Equation, generating Function, Rodrigue's Formula, Orthogonal Properties. Integrals Involving Legendre Polynomials, Fourier-Legendre Expansion, Recurrence Relations, Legendre's Function of Second kind $Q_n(x)$, Christoffel's summation formula. Bessel functions, solutions of Bessel's equation, Generating Function, Integral expressions. Recurrence relations, orthogonal properties, Fourier-Bessel Expansion.

Text Books:

1. Sneddon I.N.: The Use of Integral transforms, Tata McGraw Hill Publishing Co Ltd, New Delhi, 1974.
2. Earl D. Rainville : Special Functions, Chelsea Publishing Company, New York. 1960.
3. Vashishtha A.R. and Gupta R.K. : Integral Transforms : Transform calculus, 14thed., Krishna Prakashan Mandir, Meerut, 1995

References :-

1. Davies B.: Integral Transforms and their Applications, Springer, New York, 1978.
2. Goyal S.P. & Goyal A.K. : Integral transforms, JPH, 2005.
3. Goel J.K. & Gupta K.P.: Integral transforms, 4th ed., Pragati Prakashan Mandir, 1982.
4. L. J. Slater : Generalized Hypergeometric Functions, Cambridge University Press, 2008.
5. A.M. Mathai, H.J. Haubold : Special Functions for Applied Scientists, Springer, 2008.

Number Theory and Cryptography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- Understand the basic concepts of number theorem and their applications in cryptography.
- Know the need of security of digital data.
- Demonstrate the application of mathematics in computer science.
- Appreciate the historical cryptosystems and the development of modern cryptography.
- Demonstrate the knowledge of mathematics behind RSA cryptosystem, ElGamal Cryptosystem and secret sharing schemes.

Section A

Divisibility, greatest common divisor, Euclidean algorithm, Extended Euclid's algorithm, linear congruences, Chinese remainder theorem, prime numbers, Fermat's theorem, Euler's Theorem, primitive root and indices, quadratic residues, Legendre symbols, quadratic reciprocity law, Jacobi symbols, finite fields, arithmetic in finite fields, time estimates for basic arithmetic operations.

Section B

Introduction to cryptography, classical cryptosystems and their cryptanalysis, perfect secrecy, Stream cipher and Block cipher, LFSR, DES, pseudo random bit generators, public key cryptography, one way and trapdoor functions, discrete logarithm problem, Diffie-Hellman key exchange protocol, integer factorization problem and primality testing.

Section C

Public key encryption: RSA, Rabin, El-Gamal, knapsacks; hash functions, Digital signatures: RSA, El-Gamal, DSA, Entity Authentication, Zero knowledge protocols, Shamir secret sharing schemes.

Suggested Books:

1. Burton, D. M. (2012). *Elementary number theory*. (7th Ed.). New Delhi: McGraw-Hill Education.
2. Hoffstein, J., Pipher, J. C., & Silverman, J. H. (2014). *An introduction to mathematical cryptography*. (2nd Ed.). New York: Springer.
3. Trappe, W., & Washington, L. C. (2006). *Introduction to cryptography: With coding theory*. (2nd Ed.). Upper Saddle River, N.J: Pearson Prentice Hall.
4. Katz, J., & Lindell, Y. (2015). *Introduction to modern cryptography*. (2nd Ed.). Boca Raton: Taylor & Francis.
5. Forouzan, B. A., & Mukhopadhyay, D. (2011). *Cryptography and network security*. (2nd Ed.). New Delhi: Tata Mcgraw Hill Education Private Ltd.
6. Koblitz, N. (2006). *A course in number theory and cryptography*. (2nd Ed.). New York: Springer-Verlag.
7. Menezes, A., van, O. P., & Vanstone, S. (1996). *Handbook of Applied Cryptography*. CRC Press.

Suggested E-learning material:

1. Lecture Notes on Number Theory:
<https://nptel.ac.in/courses/111103020/>
2. Video Lecture on Number Theory:
<https://bit.ly/2ToTdJZ>
3. Video Lecture on Cryptography:
<https://nptel.ac.in/courses/106105031/>

Partial Differential Equations

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to

- apply the techniques for solving partial differential equations.
- describe the most common partial differential equations that appear in problems concerning e.g. heat conduction, flow, elasticity and wave propagation
- solve simple first order equations using the method of characteristics and classify second order equations.
- describe, compute and analyse wave propagation and heat conduction in mathematical terms
- formulate maximum principles for various equations and derive consequences.
- evaluate and assess the results of various problems in other subjects based on these concepts.

Section A

Mathematical classification and Formulation of partial differential equations, Partial Differential equation of the first order, Lagrange's linear equation, different forms of non-linear partial differential equations, Charpit's method. Linear partial differential equations with constant coefficients. Homogeneous equations, Non-homogeneous equation.

Section B

Partial Differential equations of second order with variable coefficients, Monge's Methods, Separation of variables, The Wave equation (one and two dimensional) Fourier series solutions of the Wave equations (homogeneous and non-homogeneous), Numerical solution of the wave equation.

Section C

Heat equations (homogeneous and non-homogeneous), Numerical approximation of solution of standard heat condition problem, Harmonic Functions and Dirichlet Problem, Green's Functions and Properties. Existence theorem by Perron's Method.

Suggested Text Books:

1. John, F. (1991). *Partial differential equations*. New York: Springer.
2. Bansal, J. L., & Dhami, H. S. (2004). *Differential equations Vol II*. Jaipur: JPH.
3. O'Neil, P. V. (2012). *Advanced engineering mathematics*. India: Cengage Learning.
4. Sneddon, I. N. (1981). *Elements of partial differential equations*. New York McGraw-Hill.

Suggested References Books:

1. Weinberger, H. F. (1995). *A first course in partial differential equations with complex variables and transform methods*. New York: Dover Publications.
2. Williams, W. E. (1980). *Partial differential equations*. Oxford [Eng.] : New York : Clarendon Press ; Oxford University Press
3. Folland, G. B. (2003). *Introduction to partial differential equations*. New Delhi: Prentice Hall of India.
4. Rao, K. S. (2010). *Introduction to Partial differential equations*. New Delhi: Prentice Hall of India.
5. Amaranath, T. (2009). *An elementary course in partial differential equations*. Sudbury, Mass: Jones and Bartlett Publishers.
6. Sharma, J. N., & Singh, K. (2009). *Partial differential equations for engineers and scientists*. Oxford: Alpha Science International Ltd.

Suggested E-learning material:

1. Partial Differential Equation; Platform: <https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/video-lectures/lecture-15-partial-differential-equations/>
2. Introduction to partial differential equation; Platform: NPTEL
<https://nptel.ac.in/courses/111103021/>

Video Lectures for Partial Differential Equations; Platform: LAMAR

<http://www.math.lamar.edu/faculty/maesumi/PDE1.html#pdeRESOURCES>

Rings and Modules

Section A

Rings, Matrix rings, Polynomial rings, Skew Polynomial rings, Laurant rings, Boolean rings, Opposite ring, Characteristic of a ring, Direct products.

Ideals, homomorphism of rings, Endomorphism rings. Field of fractions, Prime fields, PIDS and UFDS.

Section B

Modules Direct product, Direct sum of modules, Free modules, homomorphisms Maxima submodule, Minimal Submodule, Simple modules, Schur's lemma, Annihilator of a Subset of a module.

Modules over PID's, Torsion modules, Torsion free modules,

Section C

Chain conditions, Artinian modules, Northerian modules, Composition series, Modules of finite length, Jordan Holder Theorem.

Artinian rings, Northerian rings, Hilbert Basis Theorem, I.S.Cohen's Theorem, Introduction of Nil radical and Jacobson radical.

Sugessted Text/ Reference Books:

1. C. Musili, **Introduction to Rings and Modules**, Narosa Publishing House, ND, 1997.
2. K.R. Gooderal and R.B. Warfield, **An Introduction to Non-commutative Noetherian Rings**, Cambridge Univ. Press, London, 2004.
3. Neal H. McCoy, **The Theory of Rings**, Chelsea, New York, NY, 1973.
4. I.N. Herstein, **Non-commutative Rings**, Mathematical Association of America, Washington, DC, 1968.
5. L.W. Small, **Noetherian Rings and Their Applications**, American Mathematical Society, Providence, RI, 1987.
6. Louis Halle Rowen, **Ring Theory**, Academic Press, New York, 1988.

Tensor Analysis and Geometry of Manifolds

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- Discuss different kinds of surfaces, connection and covariant derivatives.
- Understand the concepts of manifold and illustrate some examples of manifolds.
- Understand the Ricci identity and enable to use it in proving different theorems.
- Define and illustrate some examples of Lie group.

Section A

Topological manifolds, Differentiable manifolds (Definition and examples), Differentiable Structures defined on sets, Smooth maps on a manifold, Smooth map between two manifolds, Smooth curves, Tangent vectors, Tangent space, Tangent bundle, Differentials of Smooth maps, Immersion and Embedding (Definition and examples only), Vector fields and Lie bracket.

Section B

Tensor Algebra : Tensor product of vector spaces, Contravariant and covariant vectors, Contravariant, covariant and mixed tensors of second order, Tensors of type (r, s) , Tensor product of tensors, Contraction, Symmetric and skew-symmetric tensors, Covariant differentiation of Tensors. Differential forms, Exterior derivative, Lie derivatives, Lie groups (Definition & Examples), Cartan's Structural Equation.

Section C

Linear connections: Affine connections, covariant derivative of a Connection, Torsion and Curvature tensors, Difference tensor of two connections, Riemannian metric, Riemannian connection, Riemann Curvature tensor, Some connections and transformations on a Riemannian manifold, Sectional curvature, and Shur's theorem.

Suggested Text Book:

1. De, U. C., & Shaikh, A. A. (2007). *Differential geometry of manifolds*. New Delhi: Narosa Publishing House.

Suggested References Books:

1. Boothby, W. M. (1986). *An introduction to differentiable manifolds and Riemannian geometry*. (2nd Ed.). Orlando, Fla: Academic Press.
2. Conlon, L. (2008). *Differentiable manifolds*. (2nd Ed.). Boston: Birkhauser.
3. Hicks, N. J. (1975). *Notes on differential geometry*. London: Van Nostrand Reinhold.
4. Mishra, R. S. (1965). *A course in tensors with applications to Riemannian geometry*. Allahabad, [India]: Pothishala Private Ltd.
5. Tu, L. W. (2011). *An Introduction to Manifolds*. New York, NY: Springer New York.
6. Willmore, T. (1972). *An introduction to differential geometry*. Oxford: Clarendon Press.

Suggested E-learning material:

1. NOC: Differential Calculus in Several Variables:

<https://nptel.ac.in/courses/111104092/>

2. NOC: Multivariable Calculus:

<https://nptel.ac.in/courses/111107108/>

3. NOC:Calculus of One Real Variable:

<https://nptel.ac.in/courses/109104124/>

Viscous Fluid Dynamics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- Understand the fundamental concepts of fluid dynamics.
- Derive the fundamental equations governing the flow of a viscous fluid.
- Demonstrate the analytical solutions of Navier-Stokes equations by making certain assumptions for certain geometries.
- Identify, formulate and solve engineering problems.

Section A

Viscosity, Analysis of stress and rate of strain, Stoke's law of friction, Thermal conductivity and generalized law of heat conduction, Equation of state and continuity, Navier-Stokes equations of motion, Vorticity and circulation, Dynamical similarity, Inspection and dimensional analysis, Non-dimensional parameters and their physical importance: Reynolds number, Froude number, Mach number, Prandtl number, Grashoff number, Brinkmann number, Non-dimensional coefficients: Lift and drag coefficients, skin friction, Nusselt number.

Section B

Exact solutions of Navier-Stokes equations, Velocity distribution for plane Couette flow, plane Poiseuille flow, Generalized plane Couette flow, Hagen - Poiseuille flow, Flow in tubes of uniform cross-sections, Flow between two concentric rotating cylinders.

Section C

Stagnation point flows- Hiemenz flow, Homann flow. Flow due to rotating disc. Concept of unsteady flow, Flow due to plane wall suddenly set in the motion. (Stoke's first problem), Flow due to an oscillating plane wall (Stoke's second problem), Starting flow in a plane Couette motion. Suction/injection through porous walls.

Suggested Books:

1. Bansal, J. L. (2005). *Viscous fluid dynamics* (2nd ed.). New Delhi: Oxford & IBH publishing Co.
2. Yuan, S.W. (1988). *Foundations of fluid mechanics*. New Delhi: Prentice-Hall of India.
3. Schlichting, H., & Gersten, K. (2000). *Boundary layer theory* (8th ed.). Springer, India.

Suggested E-learning material

1. Viscous Fluid Flow, Platform: The University of Manchester;
<http://www.maths.man.ac.uk/~mheil/Lectures/Fluids/index.html>
2. Fluid Mechanics, Platform: nptel;
<https://nptel.ac.in/courses/112105171/>
3. Introduction to Fluid Mechanics and Fluid Engineering, Platform: FreeVideoLectures;
<https://freevideolectures.com/course/3513/introduction-to-fluid-mechanics-and-fluid-engineering/28>

Measure Theory and Advanced Probability

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of this unit, students will be able to:

- Understand the basic concepts of measure and integration theory.
- Understand of the theory on the basis of examples of application.
- Use abstract methods to solve problems and to use a wide range of references and critical thinking.
- Use weak and strong law of large numbers in statistical theory.

Section A

Measure Theory-Fields, Sigma Fields, Monotone Classes, Set Functions, Measure, Outer Measure, Caratheodory's Extension Theorem. Probability Measure, Lebesgue Stieljes Measure. Measurable Functions, Monotone and Dominated Convergence Theorem. Product Spaces, Fubini's Theorem (without proof).

Section B

Sequences of Distribution Function, convergence: convergence in distribution, convergence in probability, almost sure convergence, convergence in Mean Square. Helly Bray theorem, Borel-Cantelli lemma and zero one law. Characteristics function, inversion and continuity theorem.

Section C

Inequalities: Cauchy-Schwartz inequality, Chebychev's inequality, Holder Inequality, Minkowski Inequality, Jensen Inequality. Weak and strong Law of Large Numbers-Khintchine, Kolmogorov theorem. One Dimensional Central Limit theorem- Lindeberg Levy, Lyapunov, Lindeberg Feller theorem.

Suggested Text/ Reference Books:

1. Feller, W. (2008). *An Introduction to probability theory and applications* (Vol.I& Vol.I). John Wiley & Sons.
2. Chung, K. L. (2011). *A Course in Probability Theory* (3rd ed.). San Diego, Academic Press.
3. Bhatt, B.R. (2019). *Modern Probability Theory* (4th ed.). London, UK : New Academic Science.
4. Rohatgi, V.K. (2000). *An Introduction to probability theory and mathematical statistics* (2nd ed.). Wiley series in probability and statistics.
5. Halmos, P.R. (2013). *Measure Theory* (Vol. 18). New York: Springer.
6. Bauer, H. (1981). *Probability theory and element of measure theory* (2nd ed.). London: Academic Press.

Suggested E-Learnings Material:

1. Measure Theory: www.math.tifr.res.in/~publ/ln/tifr12.pdf
2. Measure Theory and probability: https://www.math.ucdavis.edu/~hunter/measure_theory/
CLT and applications: <https://newonlinecourses.science.psu.edu/stat414/node/133/>

Statistical Inference

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After successful completion of this course, student will be able to:

- Apply various parametric, non-parametric and sequential estimation techniques and testing procedures to deal with real life problems.
- Understand confidence interval, Neyman-Pearson fundamental lemma, UMP test, Interval estimation.
- Understand SPRT, OC and ASN function.
- Understand non-parametric methods, U-statistic.

Section A

Properties of a good estimator: Unbiasedness, consistency, efficiency and sufficiency. Minimal sufficient statistics Complete sufficient statistics, Rao-Blackwell theorem, Lehmann Scheffe theorem, Cramer Rao lower bound for minimum variance unbiased estimator (MVUE).

Section B

Methods of estimation: Maximum likelihood estimator (MLE) and its small sample properties, Moment estimator. Interval estimation, Confidence interval for normal case, relation with testing of hypothesis, MP tests, NeymanPearson lemma, UMP tests.

Section C

Sequential test procedure, Sequential probability ratio test (SPRT), Operating characteristic (OC) and Average sample number (ASN) function.

Non-parametric tests: Tests of goodness of fit, Run test, Kolmogorov-Smirnov test, Sign test, Wilcoxon signed rank test, Mann-Whitney U test.

Text Books:

1. Zacks, S. (1971). *The theory of statistical inference*. John Wiley & Sons.
2. Rajagopalan, M. & Dhanavanthan, P.(2012). *Statistical Inference*. PHI learning privet Ltd.

Reference Books:

1. Casella, G. & Berger, R.L. (2002). *Statistical inference* (2nd. ed.). Duxbury Advanced Series.
2. Rohatgi, V. K., & Saleh, A. M. E. (2015). *An introduction to probability and statistics*. (2nd.ed.) John Wiley & Sons.
3. Kale, B. K. & Muralidharan, K. (2015). *A first course on parametric inference*. Alpha Science International Ltd.
4. Rao, C.R. (2010). *Linear Statistical Inference and Its Applications* (2nd. ed.). Wiley Eastern Ltd.
5. Goon, A.M. & Gupta, M.K. and Gupta, B.D.(2016). *An Outline of Statistical Theory* (Vol. II).The world Press Pvt.Ltd.
6. Lehmann, E. L., & Casella, G. (2006). *Theory of point estimation*. Springer Science & Business Media.
7. Lehmann, E. L., & Romano, J. P. (2006). *Testing statistical hypotheses*. Springer Science & Business Media.
8. Shao, J. (2010). *Mathematical Statistics* (2nd. ed.). Springer.

Suggested E-Learning Material:

4. Statistical Inference; Platform: MITOPENCOURSEWARE <https://ocw.mit.edu/index.htm>
5. Statistical Inference; Platform: Coursera <https://www.coursera.org>
6. Statistical Inference:Platform: e-PG Pathshala<https://epgp.inflibnet.ac.in>

Advanced Inference

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of this course, student will be able to

- Apply various estimation and testing procedures to deal with real life problems.
- Understand Fisher Information, Lower bounds to variance of estimators, MVUE.
- Understand consistency, CAN estimator, MLE.
- Understand Neyman-Pearson fundamental lemma, UMP test.
- Apply Likelihood Ratio test in real life testing problems.
- Understand invariant and similar test.

Section A

Consistency and asymptotic relative efficiency of estimators, Consistent asymptotic normal (CAN) estimator, Best asymptotic normal (BAN) for one parameter, Method of MLE and its large sample properties.

Section B

Generalized Neyman- Pearson lemma, UMP tests for distribution with monotone likelihood ratio (MLR), Unbiased tests, Similar regions and test of Neyman structure.

Section C

Invariance tests and UMP invariant tests, Likelihood ratio test. Consistency of Likelihood ratio test. Asymptotic properties of likelihood ratio test.

Text Books

1. Ferguson, T. S. (1996). *A course in large sample theory*. London, Chapman and Hill.
2. Goon, A. M., Gupta, M. K. & Gupta, B. D. (1973). *Fundamental of statistics* (vol. II), The World Press Pvt. Ltd.

Reference Books:

1. Gupta, A. D. (2008). *Asymptotic Theory of Statistics and Probability*. New York, Springer.
2. Kale, B. K. (1999). *A first course on parametric inference*. Narosa Publication.
3. Lehman, E. L. & Cesella, G. (1998). *Theory of Point estimation*. New York, Springer.
4. Rao, C. R. (1995). *Linear Statistical Inference and Its Applications*. Wiley Eastern Ltd.
5. Lehman, E. L. (1986). *Testing of point estimation*, John Wiley & Wiley Eastern.
6. Lehman, E. L. (1986). *Testing of Statistical Hypothesis*, John Wiley & Wiley eastern.

Suggested E-learning material

1. Statistical Inference, NPTEL
<https://nptel.ac.in/courses/111105043/>
2. Statistical Inference, ePATHSHALA
<https://epgp.inflibnet.ac.in/ahl.php?csrno=34>

Distribution Theory

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, the students will be able to:

- Formulate the statistical models for real data sets arising in various fields in order to analyze in respect of various useful characteristics of the populations
- Develop problem-solving techniques needed to accurately calculate probabilities.
- Identify the distribution of random variable under various discrete and continuous distributions.
- Calculate probabilities, moments and other related quantities based on given distributions.
- Determine the probability distribution after transformation.
- Understand how to use non-central distributions in real life problems.

Section A

Random Experiments and its sample space, random variables, cdf, pdf and pmf, absolutely continuous and discrete distributions, mixtures of probability distributions. Some common distributions like Bernoulli, Uniform, Binomial, Poisson, Geometric, Rectangular, Exponential, Normal, Cauchy, hypergeometric, multinomial, Laplace, Negative Binomial, Beta, Gamma, Lognormal and Compound Poisson distribution Weibull distribution.

Section B

Distributions of functions of random variables: Transformations, moments, m.g.f., p.g.f, Independence of random variables, Convolutions, Conditional expectations and variances.

Random vectors, joint distributions, joint m.g.f., mixed moments and variance- covariance matrix. Correlation and regression.

Section C

Sampling distributions of statistics from univariate normal random samples such as linear and quadratic forms. Fisher's Cochran theorem. Non central chi-square, t and F distributions.

Suggested Text/ Reference Books:

1. Mood, A. M. F., Graybill, F. A., & Boes, D. C. (2013). *Introduction to the theory of statistics*. New Delhi: McGraw-Hill Edition.
2. Johnson, N. L., Kotz, S., & Balakrishnan, N. (1995). *Continuous univariate distributions-Vol. 2*. Wiley & Sons.
3. Johnson, N. L., Kemp, A. W., & Kotz, S. (2005). *Univariate Discrete Distributions*. John Wiley & Sons.

Suggested E-learning material

1. [Probability Distribution- nptel.ac.in/courses/111105041/](https://nptel.ac.in/courses/111105041/)
2. [Distribution Functions-https://epgp.inflibnet.ac.in/ahl.php?csrno=34](https://epgp.inflibnet.ac.in/ahl.php?csrno=34)
3. Introduction to Probability- <https://ocw.mit.edu/resources/res-6-012-introduction-to-probability-spring-2018>

Design of Experiments and Linear Models

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of this course, student will be able to:

- Identify what design was followed and its features, describe what assumptions are appropriate in modelling the data.
- Analyse the results of a designed experiment in order to conduct the appropriate statistical analysis of the data.
- Interpret statistical results from an experiment and report them in non-technical language.
- Compare efficiency of the experimental designs.

Section A

Estimable functions, estimation and error space, linear models and regression, Standard Gauss Markov Models, Best linear unbiased estimate (BLUE), Method of least squares, Variance covariance matrix of BLUEs, uses of g-inverse.

Section B

Analysis of variance, Completely randomized design (CRD), Randomised block design (RBD), Analysis of Covariance in CRD and RBD, 2^n Factorial Experiments, Complete and partial confounding, Split and Strip plot designs.

Section C

Balanced Incomplete Block Design (BIBD), Construction of BIBD, Intra block analysis, BIBD with recovery of interblock information. Balanced Incomplete Block Design (PBIBD), Analysis with two associate classes only.

Text Books:

1. Joshi, D. D. (1987). *Linear estimation and design of experiments*. New York: John Wiley.
2. Das, M. N., Das, M. N., & Giri, N. C. (2003). *Design and Analysis of Experiments*. New Delhi: New Age International (P) Ltd. Publishers.

Reference Books:

1. Rao, C. R. (2010). *Linear statistical inference and its applications*. New York : Wiley
2. Dey, A. (1988). *Theory of block designs*. New York: Wiley.
3. Giri, N. (1986). *Analysis of variance*. New Delhi: South Asian Publ.

Suggested E-learning material:

1. Lecture notes on Design of Experiments
[http://www.iasri.res.in/ebook/EB SMAR/e-book pdf%20files/Manual%20III/2-Basic%20Experiments.pdf](http://www.iasri.res.in/ebook/EB%20SMAR/e-book%20pdf%20files/Manual%20III/2-Basic%20Experiments.pdf)
2. Lecture note on Split Plot Design http://www.iasri.res.in/design/analysis%20of%20data/split_plot_spss.html
3. Analysis of Data from Designed Experiments <http://www.iasri.res.in/design/Analysis%20of%20data/Analysis%20of%20Data.html>
4. [Lecture notes on ANOVA](http://home.iitk.ac.in/~shalab/anova/chapter4-anova-experimental-design-analysis.pdf)
home.iitk.ac.in/~shalab/anova/chapter4-anova-experimental-design-analysis.pdf

Econometric Models

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After a successful completion of this course students will be able to

- Construct econometric models from economic models.
- Detect influential observations and perform robust regression.
- Estimate regression models when the dependent variable is nominal, ordinal or a quantile.
- Fit distributed lag model when the data is time series.
- Diagnose the identifiability of a simultaneous equation model.
- Estimate a simultaneous equation system.

Section A

Nature of Econometrics, Review of linear regression models, polynomial regression model. Stepwise Regression, Lasso Regression, Model Selection Methods: AIC, BIC, Mallows's Cp, Cross-validation, Regression regularization methods.

Influential observations: Standardized and Studentized residuals, Cook's distance, DFFITS, DFBETAS, COVRATIO. Robust regression techniques: LAD and LMS regression.

Section B

Logit and Probit models: binary response model, multinomial choice models: ordered and unordered response models. Censored regression, truncated regression models.

Poisson regression: estimation and prediction. Introduction to Generalized linear model.

Introduction to quantile regression and non-parametric regression. General non-linear regression: Assumptions, Least squares estimation, Testing.

Section C

Distributed lag models: Finite polynomial lags, determination of the degree of polynomial. Infinite distributed lags, adaptive expectations and partial adjustment models, determination of lag length. Methods of estimation.

Simultaneous equation models: concept of structural and reduced forms, problem of identification, rank and order conditions of identifiability. Limited information and full information estimation methods.

Suggested Readings

1. Baltagi, B. H. (2007). *Econometrics*. Springer Science & Business Media.
2. Gujarati, D. N. (2003). *Basic econometrics*. McGraw Hill.
3. Johnston, J., & DiNardo, J. E. (2007). *Econometric Methods*. McGraw-Hill.
4. Montgomery, D. C., Peck, E. A., & Vining, G. G. (2006). *Introduction To Linear Regression Analysis, 3rd Ed.* Wiley India Pvt. Limited.
5. Rawlings, J. O., Pantula, S. G., & Dickey, D. A. (1998). *Applied Regression Analysis: A Research Tool* (2nd Ed.). New York: Springer-Verlag.
6. Wooldridge, J. M. (2008). *Introductory Econometrics: A Modern Approach*. Cengage Learning.
7. William H. Greene (2012). *Econometric Analysis* (7th Ed.). Pearson Education limited.

Suggested E-learning Material:

1. Lecture Notes on Regression Analysis by Shalabh, IITK: <http://home.iitk.ac.in/~shalab/course5.htm>
2. An article on "Understanding logistic regression analysis" by Sandro Sperandei : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3936971/>

Lecture Notes on "Econometrics": <https://ocw.mit.edu/courses/economics/14-382-econometrics-spring-2017/lecture-notes/>

Bayesian and Multivariate Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On the successful completion of the course, student will be able to,

- Find posterior distribution of a parameter.
- Identify the nature of the prior.
- Understand various types of loss functions and their nature.
- Use Bayesian theory to draw inferences in simple problems.
- Define multivariate normal distribution and understand its properties.
- Estimate the mean vector and covariance matrix of the multivariate normal population.
- Test the significance of single mean vector and difference in the two mean vectors.
- Perform PCA and factor analysis on real data set.
- Classify and discriminate the observations in two populations.
- Perform correlation analysis between two multivariate populations.

Section A

Bayes theorem for random variables. Prior and posterior distributions. Types of prior: non informative and improper priors for location, scale and location scale parameters.

Loss functions, decision rule and risk functions. Bayes estimation, Bayes principle, Bayes risk, Bayes test.

Section B

Multivariate Normal distribution marginal and conditional distributions, characteristics functions. Wishart distributions and its properties. Hotelling T^2 , Mahalanobis D^2 and their applications.

Section C

Classification and discriminate analysis. Principal Component analysis. Canonical correlations and variables. Factor analysis.

Text Books :-

1. Berger, J. O. (2010). *Statistical decision theory and Bayesian analysis*. Springer, New York.
2. Anderson, T. W. (1958). *An introduction to multivariate analysis*. John Wiley & Wiley eastern.

Reference Books :-

1. Bernardo, J. M., & Smith, A. F. M. (2009). *Bayesian Theory*. John Wiley & Sons, Ltd.
2. Johnson, R. A., & Wichern, D. W. (2014). *Applied multivariate statistical analysis*. Pearson.

Suggested E-learning material:

1. Video lecture on 'Bayesian statistics without tears'
<https://podcasts.ox.ac.uk/bayesian-statistics-without-tears>

Bayesian and Multivariate Analysis Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes

On completion of this course, the student will be able to

- Differentiate between the nature of prior and posterior densities by means of their plots
 - Find Bayes estimator, Bayes Risk and perform Bayes testing
 - Estimate mean vector and covariance matrix of given data set
 - Perform testing of significance of single mean vector and difference of two mean vectors
 - Reduce dimension of the data using principal component analysis and factor analysis
 - Classify and discriminate observations in two or more populations
 - Observe correlation between two sets of multivariate data sets.
1. Estimation of mean vector and co variance matrix.
 2. Estimation and testing of partial and multiple correlation coefficients.
 3. One sample and two sample problems using Hotelling T^2 statistics.
 4. Problems based on Wishart distribution.
 5. Exercise based on Mahalanobis- D^2 .
 6. Perform Principal Component Analysis, Factor Analysis
 7. Exercises based on classification and discrimination
 8. Finding Canonical Correlations between two data sets

Note :

- (i) The above list is only for the guidance of the students. Any practical from the syllabus may be set in the practical examination.
- (ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practicals.
- (iii) Where it is feasible practical practice should be done through spreadsheet, package or programming.

Suggested Books

1. Marin, Jean-michel, & Robert, Christian. (2016). *Bayesian Essentials With R*. Springer-Verlag New York Inc.
2. Schumacker, R. E. (2016). *Using R with multivariate statistics*. Thousand Oaks, California: SAGE Publications, Inc.

Suggested E-learning Material

1. Using R for Multivariate Analysis

<https://little-book-of-r-for-multivariate-analysis.readthedocs.io/en/latest/src/multivariateanalysis.html>

Clinical Trials

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After reviewing this paper, students should be able to:

- Identify and classify different types of trial designs when reading a trial report.
- Understand the essential design issues of randomized clinical trials.
- Appreciate three possible sources of errors that could lead to erroneous trial results.
- Understand the basic statistical principles, concepts, and methods for clinical data analysis and reporting; and
- Understand some frequently used terms in clinical trials.
- Understand the relative contributions of clinical judgment and clinical trials in evaluating new medical therapies.

Section A

Introduction to clinical trials. Overview of phase I-IV trials. Design consideration of clinical trials: Patient selection, selection of controls, statistical consideration. Randomization and blinding. Sample size estimation, recruitment of study participants.

Section B

Designs for clinical trials: Parallel, crossover, Cross-sectional, longitudinal, titration, enrichment designs. Classification of clinical trials: Multicentre, active control combination, equivalence trials. Concept of surrogate endpoints. An introduction to meta analysis of clinical trials.

Section C

Group sequential methods in clinical trials. Pollock's and O'Brien & Fleming's tests (with properties). Group sequential tests for binary data, survival data. Analysis for categorical data.

Text/ Reference Books:

1. Piantadosi, S. (1997). *Clinical trials. A methodological perspective*. New York: John Wiley and Sons, Inc.
2. Jennison, C., & Turnbull, B. W. (2000). *Group sequential methods with applications to clinical trials*. Boca Raton: Chapman & Hall.
3. Friedman, L. M., Demets, D. L., & Furberg, C. D. (1998). *Fundamentals of clinical trials*. New york: Springer.
4. Fleiss, J. L. (2011). *Design and Analysis of Clinical Experiments*. New York, NY: John Wiley & Sons.
5. Marubini, E., & Valsecchi, M. G. (2005). *Analysing survival data from clinical trials and observational studies*. Chichester, West Sussex: John Wiley & Sons.
6. Chow, S.-C., & Liu, J. (2014). *Design and analysis of clinical trials: Concepts and methodologies*. Hoboken, N.J: John Wiley & Sons.

Suggested E-learning material

1. Clinical Trials

<http://www.esourceresearch.org/eSourceBook/ClinicalTrials/1LearningObjectives/tabid/192/Default.aspx>

2. Clinical Trials as Research

<https://newonlinecourses.science.psu.edu/stat509/node/6/>

Demography and Advanced Sampling Theory

Contact Hours: 60

Section A

Different sources of demographic data, Demographic transition theory, Fertility and its measures, Mortality (child and Adult mortality) and its measures, Measures of Morbidity. Life table techniques: Type, methods of construction of abridged life tables and its applications. Model Life table.

Concept of Stable and stationary population theory. Migration theory: concept & its types and measures of internal migration, Intercensal and post censal method of population estimates and population projection, Push and pull theory, Urbanization causes, effects.

Section B

Post and deep stratification, Linear and circular systematic sampling cluster sampling with equal cluster size, Two phase sampling (double sampling) in Ratio and Regression estimation.

Ratio and Regression estimators with Combined and Separate type estimates, Quenouille's techniques of bias reduction, Hottel and Ross unbiased ratio type estimator.

Section C

Sampling with varying probability of selection with replacement and without replacement, Lahiri's method and cumulative total, Desraj ordered estimator Horwitz Thompson estimates, Midzuno sen and Narain methods of sampling, Yates and Grandy estimate of variance its non negativity.

Non-sampling error: Incomplete samples effect of non response, Hensen and Hurvitz technique, Interpenetrating samples.

Suggested Text/ Reference Books:

1. Ramkumar, **Technical Demography**, New Age international, 1986.
2. K.B. Pathak & F. Ram, **Techniques of Demographic Analysis**, Himalaya Publishing House, 1992.
3. P.V. Sukhatme, B.V. Sukhatme, C. Ashok, **Sampling Theory of Surveys with Applications**, The Indian Society of Agricultural Research, New Delhi.
4. M.N. Murthy, **Sampling Theory and Methods**, Statistical Publishing Society, 1967.
5. DesRaj, **Sampling Theory**, M c Graw Hill, 1986.
6. D. Singh & F.S. Chaudhary, **Theory and Analysis of Sample Survey Design**, New Age international Reprint 2013.
7. A.M. Goon, M.K. Gupta and B.Das Gupta, **Fundamental of Statistics Vol. II**, World Press, Kolkata, 2002.

Note: Use of scientific calculator is permissible

Practicals:

Contact Hour: 60

Demography and Advanced Sampling

1. Measures of Fertility and Mortality.
2. Life table techniques,(Abridged life table).
3. Methods of population projection (Component method).
4. Estimation of mean and variance of sampling mean in cluster sampling.
5. Estimation of mean and variance using combined and separate Ratio type of estimators.
6. Estimation of population mean and total by ratio and regression methods of estimation.
7. Double sampling for ratio and regression methods of estimation.
8. Narain, Horwitz-Thompson estimator and its variance
9. Des Raj's ordered estimator and the estimate of their variances.

Note:

- (i) The above list is only for the guidance of the students. Any practical from the syllabus of papers may be set in the practical examination.
- (ii) Whenever it is feasible, students should be asked to collect the required data themselves to use it in their practicals.
- (iii) Where it is feasible practical practice should be done through spreadsheet, package or programming.

Non Parametric Inference and Sequential Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of this course, student will be able to,

- Solve hypothesis testing problems where the conditions for the traditional parametric inferential tools to be applied are not fulfilled.
- Build non-parametric density estimates.
- The application of sequential statistical techniques.
- Critically examining sequential procedures for appropriate statistical analyses.

Section A

Distribution free and non-parametric methods, order statistics, joint distribution of order statistics, marginal distribution of order statistics, distribution of median and range, exact moments, confidence interval, estimates for population quantities. Exact null distribution of R moments of the null distribution of R, test based on total number of runs, chi-square goodness of fit test, empirical distribution function.

Section B

Ordinary sign test, Wilcoxon signed rank test, Kolmogorov Smirnov one sample & two sample test and their merits and demerits, Median test, Kruskal- Wallis one way analysis of variance by ranks, Mc Nemar change test.

Section C

Sequential analysis Wald's SPRT, properties of SPRT, OC and ASN functions of SPRT, Applications of SPRT, Testing of mean of a binomial distribution, Testing of mean of a normal distribution with known & unknown standard deviations.

Suggested Text/ Reference Books:

1. Siegel, S., & Castellan, N. J. (1988). *Non parametric statistics for the behavioral sciences*. New York, N.Y: McGraw-Hill.
2. Casella, G., & Berger, R. L. (2017). *Statistical inference*. Belmont, CA: Brooks/Cole Cengage Learning.
3. Wald, A. (2004). *Sequential analysis*. Mineola, N.Y: Dover Publications.
4. Gibbons, J. D., & Chakraborti, S. (2003). *Nonparametric Statistical Inference*. CRC Press.

Suggested E-learning Resources

7. Statistical Methods for Scientists and Engineers- Non Parametric Methods: <https://nptel.ac.in/courses/111105077/29>.
8. Statistics for Applications: <https://ocw.mit.edu/courses/mathematics/18-650-statistics-for-applications-fall-2016/>

Time Series and Stochastic Process

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

On the successful completion of the course the students should be able to

- Plot a time series and interpret the components.
- Identify and estimate cyclical fluctuations in the time series.
- Examine the relationship between the lagged values of the series.
- Test for the stationarity of the series.
- Estimate ARIMA(p,d,q) model for the series.
- Define stochastic process and identify its type .
- Understand the concept of Markov chain and its basic properties using some theorems.
- Define and understand the concept and application martingale.
- Define Poisson process and understand its properties with some applications.
- Apply gamblers ruin problem for some problems.
- Understand the basic concept and applications of Weiner process, Renewal theory and branching process.

Section A

Time series as a stationary or non stationary stochastic process, Time domain analysis based on correlogram, Sample autocovariance function and autocorrelation function at lag K, Lag correlation. Measurement of cyclic fluctuations: Periodogram and its relation with acvf, Harmonic analysis. Measurement of irregular component: Variate difference method.

AR(p) process, MA(q) process, mixed ARMA(p, q) process, Stationarity and inevitability conditions, ARIMA (p, d, q) model, Estimation of parameters, Tests for stationarity Stochastic – Process.

Section B

Markov Chain having two states, n-step transition probabilities, Classification of states, Recurrent and transient states, Chapman-Kolmogorov equations, Stationary probability theorems and limit theorem for ergodic chains, Martingales.

Section C

Poisson process, birth and death process, Random walk and Gambler's Ruin problem, Wiener process, Renewal theory and its application, Branching chains: Discrete Process (Galton-Watson).

Suggested Books

1. Hoel, P. G., Port, S. C., & Stone, C. J. (1971). *Introduction to probability theory*, Universal Book Store, New Delhi.
2. Srinivasan, S. K., & Mehata, K. M. (1988). *Stochastic Processes*. New Delhi: Tata McGraw Hill.
3. J. Medhi, J. (1994). *Stochastic processes*. New Age International Publications.
4. Box, G. E. P., Jenkins, G. M., & Reinsel, G. C. (2008). *Time series analysis: Forecasting and control*. Hoboken: Wiley.
5. Chatfield, C. (1975). *The Analysis of Time Series: Theory and Practice*. Boston, MA: Springer US.

Suggested E-learning material

1. Lecture Notes and Videos on "Stochastic Hydrology": <https://nptel.ac.in/courses/105108079/>
2. Course material on "Time Series Analysis": <http://hdl.handle.net/1721.1/46343>

3. Lecture Notes on “Introduction to Stochastic Processes”:
<https://ocw.mit.edu/courses/mathematics/18-445-introduction-to-stochastic-processes-spring-2015/lecture-notes/>
4. Lecture Notes on “Discrete Stochastic Processes”: <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-262-discrete-stochastic-processes-spring-2011/course-notes/>

Regression Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On the successful completion of the course the students should be able to

- Understand the concept of regression and the underlying assumptions.
- Estimate least squares estimate of regression coefficients.
- Perform testing of complete regression model and subset of regression model.
- Measure the goodness of the model.
- Check the validity of the assumptions for a real data.
- Find a suitable remedy to reduce the effect of violation of any assumption.
- Include a qualitative variable as regressors in a regression model using dummy variables.
- Check the model for specification errors and its testing.
- Understand the concept of outlier, leverages and influential observations.
- Understand the concept of a simple logistic regression and make interpretations.

Section A

Review of the two-variable linear model, p-variable linear model: underlying assumption, ordinary least squares estimators, set of linear hypothesis: Testing a single coefficient, testing the significance of a subset of coefficients, testing the significance of the complete regression. Confidence estimation, R^2 and adjusted R^2 . Residual Analysis.

Section B

Problems of multicollinearity: its detection and remedies, ridge estimator, PCR estimator, Use of extraneous information in terms of exact and stochastic linear restrictions. Estimation of parameters by generalized least squares in models with non spherical disturbances: heteroscedasticity of disturbances and the problem of autocorrelation.

Section C

Dummy Variables in Linear Regression Models, tests for structural break, Specification Errors, Nonlinear Associations and Interaction Terms, Influential Observations: Leverage Points and Outliers, A Brief Introduction to Logistic Regression.

Text Book:

1. Johnston, J. (1984). *Econometric Methods*, McGraw Hill Kogakusha Ltd.

Reference Books:

1. Hoffmann, J. P., & Shafer, K. (2015). *Linear regression analysis: Assumptions and applications*.
2. Draper, N. R., & Smith, H. (1998). *Applied regression analysis*. New York, N.Y: Wiley.

Suggested E-learning material:

1. The resources site for the book 'Introductory Econometrics for Finance, 3rd edition' by Chris Brooks <https://www.cambridge.org/us/academic/textbooks/introductory-econometrics>
2. Lecture Notes on "Econometric Theory": <https://nptel.ac.in/courses/111104072/>
3. Course material on "Econometrics": <https://ocw.mit.edu/courses/economics/14-32-econometrics-spring-2007>

Statistical Computing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of this course, student will be able to:

- Simulate and generate statistical data by different techniques.
- Understand the basic concepts of statistical theories besides developing their ability to handle real world problems with large scale data.

Section A

Review of R, Random numbers, Pseudo random number generation, Inverse transform method, Acceptance-rejection, Transformations. Tests for randomness. Multivariate probability calculation, Simulation and Monte Carlo integration, Variance reduction, Importance sampling.

Section B

Markov-Chain Monte Carlo: Metropolis-Hastings algorithm, Gibbs sampling, Jack-knife Method, Bootstrap method, Bootstrap confidence intervals, Likelihood estimation, Bootstrap of dependent data.

Section C

Bayesian posterior density estimation, Monte Carlo EM, Univariate Density estimation and smoothing: Histogram method, Kernel smoothing method. Multivariate density estimation, an introduction to functional data analysis.

Text Books:

1. Glvens, H.G. & Hoeting, J.A. (2013). *Computational Statistics*, (2nd Ed.), Wiley.
2. Robert, C. & Casella, G. (2004). *Monte Carlo Statistical Methods*, Springer Publication.

Reference Books:

1. Law, A. M. & Kelton, W.D. (2000). *Simulation, Modelling and Analysis* (3rd Ed). Tata McGraw Hill.
2. Thisted, R.A. (1988). *Elements of Statistical Computing*, Chapman and Hall.
3. Lee, P. M. (2004). *Bayesian Statistics: An Introduction*, 3rd ed. London: Arnold.
4. Robert, C. & Casella, G. (2009). *Introducing Monte Carlo Methods with R*, Springer Verlag.

Suggested E-learning material

1. Statistical computing Platform: MITOPENCOURSEWARE <https://ocw.mit.edu/index.htm>
2. Statistics: Platform: e-PG Pathshala

<https://epgp.inflibnet.ac.in>

3. Exploratory Data analysis ; Platform: Coursera <https://www.coursera.org>
<https://ocw.mit.edu/index.htm>

Inventory Theory

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of this course, students will be able to:

- Comprehend the dynamics of inventory management's principles, concepts, and techniques as they relate to the entire supply chain (customer demand, distribution, and product transformation processes),
- Understand the methods used by organizations to obtain the right quantities of stock or inventory,
- Familiarize themselves with inventory management practices.
- Optimize different case studies requires efficient methods and practices to address inventory management problems.
- Understand the behavior of the inventory parameters after some time using simulation techniques.

Section A

Concepts of Inventory, Classification of inventory models, EOQ model, EPQ model, EOQ model with shortages, EPQ model with shortages, EOQ model with constraints: Quantity discounts, Floor Constraints, Investment Constraint. Sensitivity analysis in inventory models.

Section B

Stochastic Inventory Models and Extensions without and with lead time. Power demand pattern inventory model, Introduction to Just In Time (JIT) and Vendor Managed Inventory (VMI).

Section C

Simulation in Inventory system, Classification of items viz: ABC, VED, FNSD, HML, SDE, XYZ, Case studies in inventory control.

Suggested Books:

1. Hadley, G., Whitin, T. M.. (1963). *Analysis of inventory systems*. Englewood Cliffs, N.J.: Prentice-Hall.
2. Naddor, E. (1984). *Inventory systems*. Malabar, Fla: R.E. Krieger.
3. Waters, D. (2008). *Inventory Control And Management, 2Nd Ed*. Wiley India Pvt. Limited.

Suggested E-learning material:

1. Inventory Models costs, EOQ model(Lecture PDF) <https://nptel.ac.in/courses/110106045/9>
2. Inventory management(PDF)

<https://ocw.mit.edu/courses/engineering-systems-division/esd-260j-logistics-systems-fall-2006/lecture-notes/>

Marketing Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- Understand the concept of marketing and its role in business and public organization.
- Understand the need for scientific marketing analysis.
- To use Mathematical models in Marketing and understand their limitations.
- Understand the concept of promotional decisions in the presence of competition.
- Use game theory models for promotional effort.
- Make channels of distribution and transportation decision.

Section A

Concept of Marketing and its role in Business and Public Organization, Marketing Decisions, Need for Scientific Marketing Analysis, uses and Limitations of Mathematical models in Marketing, Classification of Marketing Structure depending upon the nature of competitive conditions, Consumer behavior.

Demand elasticity's, Elasticity theorems, Joint optimization of price, quality and promotional effort Purchasing under Fluctuating prices.

Section B

Factors affecting Pricing decision, Pricing methods. Promotional decisions in the presence of competition, Game theory Models for Promotional Effort, Spatial Allocation of Promotional effort, media Allocation of advertisement, Brand Switching Analysis.

Section C

Sales response to Advertising in Presence of Competition. Channels of distribution, Transportation decision, Locating company's wholesale dealers and warehouses.

Case studies relating to marketing decisions.

Suggested Text Books:

1. Bass, F. M. (1964). *Mathematical models and methods in marketing*. Homewood, Ill: Irwin.
2. Kotler, P., & Keller, K. L. (2016). *A framework for marketing management*. Upper Saddle River, New Jersey: Pearson Education Inc.

Suggested Reference Books:

1. Lilien, G. L., Kotler, P., & Moorthy, K. S. (2009). *Marketing models*. Prentice Hall of India.
2. King, W. R. (1967). *Quantitative analysis for marketing management*. New York: McGraw-Hill.

Queuing Theory

Contact Hours: 90

Section A

Concept of stochastic processes. Markov Chains discrete and continuous time parameter. Objectives and different characteristics of a Queueing system. Performance measures. Steady state solution of Markovian Models (M/M/1, M/M/c, M/Ek/1, Ek/M/1).

Section B

Analytical method and use of randomization technique to find the transient solution of M/M/1, M/M/c and M/M/ μ queueing models including busy period distribution.

Section C

Imbedded markov chain technique and its use to the queueing models: M/G/1, GI/M/1 and M/D/c, Bulk queueing models. Different design and control policies ((O, N) and vacation policies) for Markovian Queueing models. Introduction to discrete time queueing system.

Simulation procedures: Data generation and Book- keeping aspects.

Sugessted Text Books:

1. D. Gross and C.M. Harris, **Fundamentals of Queueing Theory**, 2nd Ed., John Wiley, 1985.
2. Michel E. Woodward, **Communication and Computer Networks Modeling with Discrete Time Queues**, IEEE Computer Society Press, 1994. (Chapter 4)

Sugessted Reference Books:

1. R.B. Cooper, **Introduction to Queueing Theory**, 2nd Ed., North Holland, 1981
2. D.R. Cox and W.L. Smith, **Queues**, Mathuen, 1961.
3. L. Kleinrock, **Queueing Systems, Vol. I**, John Wiley, 1975.
4. J. Medhi, **Stochastic Model in Queueing theory**, Academic Press, 1991.
5. T.L. Satty, **Elements of Queueing Theory with Applications**, Mc-Graw Hill, 1961.

Theory of Games

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course, the student will be able to,

- understand all the basic concepts and results of game theory.
- understand terms like Nash equilibrium, the extensive form (which computer scientists call game trees), Bayesian games (modelling things like auctions), repeated and dynamic games.
- recognize and model strategic situations, to predict when and how your actions will influence the decisions of others and to exploit strategic situations for your own benefit.
- understand the game theoretic tools for modelling and solving problems in operations management.

Section A

Fundamental theorem of Rectangular Zero-sum games, Properties of Strategies, Relation of Dominance, Methods of solving Rectangular Zero-sum games.

Section B

Games with infinitely many strategies. The fundamental theorem of continuous games, differential Games, Separable games with convex pay-off function.

Section C

Solution of n-persons games with and without zero-sum restriction. Lanchester's equations and their application to games of strategy. Stochastic Games.

Suggested Books:

1. Myerson, R. B. (2013). *Game Theory: Analysis of Conflict*. Cumberland: Harvard University Press.
2. Levin, R. I., & Des Jardins, R. B. (1970). *Theory of games and strategies*. Scranton, Pa: International Textbook Co.
3. Luce, R. D., & Raiffa, H. (1989). *Games and decisions: Introduction and critical survey*. New York: Dover.
4. McKinsey, J. C. C. (2006). *Introduction to the theory of game*. Mineola, N.Y: Dover Publications.
5. William, J. D. (1966). *The complete strategist*, New York: McGraw Hill.

Suggested E-learning material:

1. Game Theory: Lecture notes(PDF)
<https://ocw.mit.edu/courses/economics/14-126-game-theory-spring-2016/>
2. Game Theory and Economics: Lecture notes(PDF)
<https://nptel.ac.in/courses/109103021/>

Decision Theory

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

On completion of the course, the student will be able to,

- Understand a decision theoretic approach to the problem, evaluate a utility function, propose a conjugate family of prior distributions, evaluate Bayes and posterior risks and find the optimal solution.
- Solve Multilevel Decision Problems, Decision Process with sampling information
- Understand Basic Concept of the sampling time Markov decision process, telecommunication and queuing theory.

Section A

Concepts of process, Bayesian Procedure, Decision Functions, Different Decision Criterion for Decision Problems under risk and Uncertainty. Regret versus Loss Function, Expected Value of perfect Information, Utility and its Application in Decision Problems.

Section B

Multilevel (Multi-Stage) Decision problem, Principles of Diagramming and Locating of Optimal Strategy. Decision Analysis with Continuous Distribution for the Events.

Decision Process with Sampling Information: Simple Sampling and Binomial Sampling and with Updating the Prior Distribution of the Events (Use of Posterior Distribution). Decision Process and Normal Distribution of Event.

Section C

Basic Concepts of the Sampling time Markov Decision process Examples, Stationary Policies, Average Cost Criterion, Policy- Iteration Algorithm, Linear Programming Formulation Procedure and Comparison of Linear Programming Formulation Procedure and Policy Iteration Algorithm for Solving an Infinite Stage Markov Decision Problem. Simple Concept of Semi Markov Decision Process. Application of Markov Decision Process to Inventory Management, Maintenance, Manufacturing Process, Telecommunication and Queuing theory.

Suggested Text/ Reference Books:

1. Baird, B. F. (1989). *Managerial decisions under uncertainty: An introduction to the analysis of decision making*. New York: J. Wiley. (chapters - 7,8,10,12).
2. Buchanan, J. T. (1982). *Discrete and dynamic decision analysis*. Chichester: Wiley.
3. Bunn, D. W., & Bunn, D. W. (1984). *Applied decision analysis*. New York: McGraw-Hill Book.
4. French, S. (1986). *Decision Theory: An Introduction to the Mathematics of Rationality*. Ellis Horwood.
5. Jones, J. M. (1977). *Introduction to decision theory*. Homewood, Illinois [etc.: Richard D. Irwin. (chapters -5,6,8,9,10,11).
6. Tijms, H. C. (1998). *Stochastic models: An algorithmic approach*. Chichester [u.a.: Wiley. (chapters - 2 & 3).

Suggested E-learning material:

1. Decision Theory; platform:
<http://www.utdallas.edu/~mbaron/7330/>

Theory of Reliability

Contact Hours: 90

Section A

Concept of Reliability. Classes of Life time distributions. Evaluation of Reliability function, Shape of Reliability function. System, Reliability Evaluation : Series & Parallel system, partially redundant system, standby system with perfect switching/imperfect switching, (k,n) system, Bridge Structure. Availability theory and its modeling for various configurations. Introduction to Software Reliability.

Section B

Reliability models of maintained systems. Reliability Allocation Problems, Discrete Replacement Policies : Age, Block, Policies, Preventive Maintenance Policies, Corrective Maintenance Policies, Concept of minimal repair, Notions of aging.

Section C

Renewal Theory, Distribution of number of renewals & moments, Recurrence time & its limiting distribution. Application of Renewal Theory, Solutions of Renewal type equations, Optimization problem with respect to system reliability.

Text Books (TB):

1. S. K. Sinha, **Reliability and Life Testing**, Wiley Eastern Limited, 1986.
2. I. Gertsbakh, **Reliability Theory**, Springer International Edition, 2009.
3. D. R. Cox, **Renewal Theory**, Matheun London, 1962.
4. E. E. Lewis, **Introduction to Reliability Engineering**, 2nd edition, John Wiley & Sons, 1994.

Reference Books (RB):

1. R. E. Barlow and F. Proschan, **Statistical Theory of Reliability and Life Testing**, Holt, Rinehart & Winston Inc. 1975.
2. A.K.S. Jardine, **Maintenance, Replacement and Reliability**, Pitman Publication (U.K.), 1973.
3. J. Medhi, **Stochastic Process**, 3rd Edition, New Age International, 2009.

Advanced Analysis (Analysis on Abstract Spaces)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of this course, students will be able to

- Explain when Normed space become Banach space.
- Define the Hilbert spaces.
- Define multi linear mappings.
- Check whether the function is bounded or not?
- What is directional derivative?
- Explain the difference between partial derivative and directional derivative.
- Tell about the Lipschitz's constant and conditions
- Related the analysis and differential equation

Section A

Normed Linear Spaces & Banach spaces. Bounded Linear transformations, multi linear mappings, inner product spaces, Hilbert spaces, orthonormal systems. The space of bounded functions, the space of continuous functions, Stone-Weierstrass Approximation Theorem equicontinuous sets.

Section B

The derivative, directional derivative, partial derivative, mean value theorem, continuously differentiable maps. Higher derivatives Taylor's Theorem, existence theorem on differentiable maps, fixed point theorem. Step functions, regulated functions.

Section C

Differential Equations: First order differential equations approximate solutions, Lipschitz's property, dependence on the initial value, dependence on a parameter, linear differential equations.

Suggested Text Book:

2. Dieudonne, Jean A. (1969). *Treatise on analysis: Foundations of modern analysis* (Vol. I). New York: Academic Press.

Suggested Reference Books:

4. Cartan, H. (1983). *Differential calculus*. London: Kershaw Publishing.
5. Hewitt, E. J., & Stromberg, K. R. (1975). *Real and abstract analysis: A modern treatment of the theory of functions of a real variable*. New York: Springer-Verlag.
6. Yosida, K. (1968). *Functional analysis*. (2nd Ed.). New York, N.Y: Springer-Verlag.

Suggested E-learning Material:

2. Normed space Banach space and Hilbert spaces and its properties; Platform:
<https://nptel.ac.in/courses/111105037/>

Measure Theory and Advanced Probability

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of this unit, students will be able to:

- Understand the basic concepts of measure and integration theory.
- Understand of the theory on the basis of examples of application.
- Use abstract methods to solve problems and to use a wide range of references and critical thinking.
- Use weak and strong law of large numbers in statistical theory.

Section A

Measure Theory-Fields, Sigma Fields, Monotone Classes, Set Functions, Measure, Outer Measure, Caratheodory's Extension Theorem. Probability Measure, Lebesgue Stieljes Measure. Measurable Functions, Monotone and Dominated Convergence Theorem. Product Spaces, Fubini's Theorem (without proof).

Section B

Sequences of Distribution Function, convergence: convergence in distribution, convergence in probability, almost sure convergence, convergence in Mean Square. Helly Bray theorem, Borel-Cantelli lemma and zero one law. Characteristics function, inversion and continuity theorem.

Section C

Inequalities: Cauchy-Schwartz inequality, Chebychev's inequality, Holder Inequality, Minkowski Inequality, Jensen Inequality. Weak and strong Law of Large Numbers-Khintchine, Kolmogorov theorem. One Dimensional Central Limit theorem- Lindeberg Levy, Lyapunov, Lindeberg Feller theorem.

Suggested Text/ Reference Books:

7. Feller, W. (2008). *An Introduction to probability theory and applications* (Vol.I& Vol.I). John Wiley & Sons.
8. Chung, K. L. (2011). *A Course in Probability Theory* (3rd ed.). San Diego, Academic Press.
9. Bhatt, B.R. (2019). *Modern Probability Theory* (4th ed.). London, UK : New Academic Science.
10. Rohatgi, V.K. (2000). *An Introduction to probability theory and mathematical statistics* (2nd ed.). Wiley series in probability and statistics.
11. Halmos, P.R. (2013). *Measure Theory* (Vol. 18). New York: Springer.
12. Bauer, H. (1981). *Probability theory and element of measure theory* (2nd ed.). London: Academic Press.

Suggested E-Learnings Material:

3. Measure Theory: www.math.tifr.res.in/~publ/ln/tifr12.pdf
4. Measure Theory and probability: https://www.math.ucdavis.edu/~hunter/measure_theory/
CLT and applications: <https://newonlinecourses.science.psu.edu/stat414/node/133/>

Mathematical Modelling

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Mathematical modelling: Need, techniques, classification, characteristics of mathematical models, limitations of mathematical modelling.

Mathematical modelling through ordinary differential equations of first order and system of ordinary differential equations of first order: Linear growth and decay models, Non-linear growth and decay models, Compartmental models

Section B

Mathematical modelling through ordinary differential equations of second order: Planetary motion, circular motions.

Mathematical modelling through difference equations: Basic theory of linear difference equations with constants coefficients, Models used in Economics, Finance, Population Dynamics, Genetics.

Mathematical modelling through partial differential equations: Methods to obtain PDE models.

Section C

Mathematical modelling through graphs: Modelling by directed graphs, signed graphs and weighted digraphs.

Mathematical modelling through differential difference equations, Linear programming, Nonlinear programming, Dynamic programming, Maximum principle, Principle of maximum entropy.

Suggested Text Books:

1. J.N. Kapur, **Matemactical Modelling**, Wiley Eastern Ltd., 1990.

Suggested Reference books :

1. J. Caldwell and Y.M. Ram, **Mathematical Modelling: Concepts and Case Studies**, Springer, 1999.
2. A.A. Samarskii and A.P. Mikhailov, **Principles of Mathematical Modelling, Ideas, Methods, Examples**, Taylor and Francis, 2002

Advanced Graph Theory

Contact Hours – 90

Section – A

Basic concepts of graph theory. Directed graph. Euler graph. Hamiltonian graph. Matrix representation of graphs. Shortest path in a weighted graph. K-connected and K-edge-connected graphs. Planar graphs. Coloring of graphs, Vertex colouring of graphs, Edge colouring of graphs, Vizing's theorem.

Trees: Rooted trees, Spanning tree and Cut set, Minimum-spanning tree. Flow network in a graph, max-flow- min cut theorem.

Section – B

Types of Enumeration, Counting Labeled Trees, Burnside's lemma, Polya's counting theorem, Graph enumeration with Polya's theorem. Graphs in Markov Process. Branching and Gossip, List colorings and Choosability, Partitions using path and cycles. Matchings in bipartite graphs, Hall's matching theorem, Min-Max theorem, Independent sets.

Section – C

Perfect graphs. Ramsey's theorem, Ramsey numbers, Graph Ramsey theory, Sperner's lemma and Bandwidth. Random graphs. Eigenvalues of graphs.

Text/Reference Books :

1. Graph Theory; Narsingh Deo; Prentice Hall of India, 2002
2. Introductions to Graph Theory; D.B. West, Prentice-Hall of India, 2001.
3. Graph Theory; Frank Harary, Addison-Wesley Publication

Finsler Geometry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course, student will be able to:

- use of purely metric methods in the investigation of various Finsler metrics that appear naturally in geometry, topology and convexity theory.

Section A

Minkowski norms, Finsler Metrics, Riemannian metrics, Product Finsler metric, Funk metric, Length Structure and Volume form, Zermelo Navigation Problem, Cartan Torsion, Matsumoto torsion.

Section B

Chern connections, Structural equations, Finsler metrics of Constant flag curvature, Bianchi Identities, Sprays, Shortest paths, projectively equivalent Finsler metrics, Projectively flat metrics.

Section C

Parallel vector fields, Parallel translations, Berwald metrics, Landsberg metrics, S-curvature, Distorsion and S-curvature, Randers metrics of Isotropic S-curvature, Riemannian Curvature, Flag curvature.

Text Books:

Chern, S. S., & Shen, Z. (2005). *Riemann Finsler Geometry, Nankai Tracts in Mathematics*, Vol. 6. World Scientific Publishing Co. Pte. Ltd.

Reference Books:

1. Bao, D., Chern, S.S., & Shen, Z. (2000). *An Introduction to Riemann Finsler Geometry, Graduate texts in Mathematics 200*, New York: Springer- Verlag.
2. Antonelli, P. L., Ingarden, R. S., & Matsumoto, M. (1993). *The theory of sprays and Finsler spaces with Applications in Physics and Biology*, FTPH 58, Kluwer Academic Publishers.
3. Matsumoto, M. (1986). *Foundations of Finsler geometry and Special Finsler Spaces*, Saikawa, Japan: Kaiseisha Press,.
4. Rund, H. (1959). *The Differential Geometry of Finsler spaces*, Berlin: Springer- Verlag.

Suggested E-learning material

1. Lectures on Differential Geometry: <https://www.math.iupui.edu/~zshen/Research/papers/lecture.pdf>
2. Lectures on Differential Geometry: <https://www.worldscientific.com/worldscibooks/10.1142/4619#t=toC>

Mathematical Cryptography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course, student will be able to:

- Understand the necessary concepts of number theory and complexity theory.
- Understand the need of cryptography and its impact on the society.
- Demonstrate the knowledge of one way functions and its concrete examples such as integer factorization and discrete logarithm.
- Understand the public key cryptosystems such as RSA and ElGamal.
- Know the concept of digital signature.

Section A

Basics of Number theory & Complexity theory, Introduction to cryptography, Classical cryptosystems and their cryptanalysis, Perfect Secrecy, One way and trapdoor functions, Discrete logarithm problem, Integer factorization problem, Pseudo random bit generators, Block ciphers; DES, Triple DES.

Section B

Deffie-Hellman key exchange protocol, Public key encryption, RSA cryptosystem, Rabin's public key cryptosystem, El-Gamal cryptosystem, Knapsacks cryptosystem, Attack Models, Hash functions, Message authentication Code.

Section C

Digital Signatures; RSA, El-Gamal, DSA, Rabin's signature schemes, Entity Authentication, Zero knowledge protocols, Secret Sharing Schemes, Digital Cash, Elliptic curves, Identity based encryption and signature.

Suggested Text/ Reference Books:

8. Burton, D. M. (2012). *Elementary number theory*. (7th Ed.). New Delhi: McGraw-Hill Education.
9. Hoffstein, J., Pipher, J. C., & Silverman, J. H. (2014). *An introduction to mathematical cryptography*. (2nd Ed.). New York: Springer.
10. Trappe, W., & Washington, L. C. (2006). *Introduction to cryptography: With coding theory*. (2nd Ed.). Upper Saddle River, N.J: Pearson Prentice Hall.
11. Katz, J., & Lindell, Y. (2015). *Introduction to modern cryptography*. (2nd Ed.). Boca Raton: Taylor & Francis.
12. Forouzan, B. A., & Mukhopadhyay, D. (2011). *Cryptography and network security*. (2nd Ed.). New Delhi: Tata Mcgraw Hill Education Private Ltd.
13. Koblitz, N. (2006). *A course in number theory and cryptography*. (2nd Ed.). New York: Springer-Verlag.
14. Menezes, A., Van, O. P., & Vanstone, S. (1996). *Handbook of Applied Cryptography*. CRC Press.

Basics of Network Analysis

L T P C

4 0 0 4

Max. Marks : 100

(CA:40 +ESA:60)

Section A

Flows in Network, Maximal Flow - Minimal Cut theorem using the concept of Duality, Maximal Flow Problem, Feasibility Theorems, General Minimal Cost Flow Problem, Hitchcock Problem, Bottleneck Assignment Problem, Out-of-Kilter Algorithm, Shortest Path Problem, Minimal Spanning Tree Problem.

Section B

PERT & CPM: Critical Path, Activity Floats, Project Crashing, Resource Leveling and Resource Scheduling.

Section C

Sequencing Problem; Finite sequencing for a single machine, Flow shop and Job-shop Problem, Sequencing with Stochastic processing times and parallel processing.

Suggested Text/ Reference Books :

1. R.K. Ahuja, T.L. Magnanti and B. Orlin, **Network Flows-Theory, Algorithm and Applications**, Prentice Hall, New Jersey, 1993.
2. M.S. Bazaraa and J.J. Jarvis, **H.D. Sherali Linear Programming and Network Flows**, 4th Ed, John Wiley, New Jersey, 2010.
3. S.D. Sharma, **Operations Research**, Kedarnath Ramnath & Company, Meerut, 2006.
4. L.R. Ford and D.R. Fulkerson, **Flows in Networks**, Princeton University press, 1962.
5. R.W. Conway, W.L. Maxwell and L.W. Miller, **Theory of Scheduling**, Addison Wesley, 1967.
6. S. French, **Sequencing and Scheduling**, Ellis Horwood Ltd., 1982.
7. J.J. Modder, and C.R. Philips, **Project Management with PERT and CPM**, VanNostrand Reinhold Co., 1970.
8. P.A. Jenson and J.W. Barmes, **Network Flow Programming**, John Wiley and Sons, 1980.
9. S.E. Elmaghraby, **Activity Network, Project Planning and Control**, John Wiley and Sons, NY, 1977.
10. R. Panneerselvam, **Operations Research**, PHI, New Delhi, 2003

Information Theory

L T P C

4 0 0 4

Max. Marks : 100

(CA:40 +ESA:60)

Section A

Information theory: Origin, concept and review of probability, Definition and implications of entropy, Shannon's entropy, Discrete information source: Discrete memoryless information source, Source coding, coding strategies, Most probable messages, Discrete information source with memory, Markov processes, coding aspect, Discrete communication channel: capacity of noiseless and noisy channels, error probability and equivocation, coding theorem.

Section B

Continuous information sources: stochastic signals, continuous information measures, Information power, Continuous communication channel: capacity, capacity in the case of additive gaussian white noise, capacity bound in the case of additive gaussian white noise, Channel coding theorem.

Section C

Rate distortion theory: Discrete rate distortion function and their properties, Source coding and information transmission theorems, The continuous rate distortion function, Network information theory: multi-access communication channel, Broadcast channels, Two-way channels.

Suggested Text/ Reference Books:

1. Van der Lubbe, J.C.A., **Information Theory**, Cambridge University Press, 1988.
2. T.M. Cover and J.A. Thomas, **Elements of Information Theory**, Wiley Interscience, 1991.
3. R.B. Ash, **Information Theory**, Dover Publications, 1990.
4. C.E. Shannon and W. Weaver, **The Mathematical Theory of Communication**, University of Illinois Press, 1963.
5. I. Csiszar and J. Koerner, **Information Theory: Coding Theorems** **for Discrete Memoryless Systems**, 2nd ed., Akademiai Kiado, Budapest, 1997.

Reliability and Renewal Theory

L T P C

4 0 0 4

Max. Marks : 100

(CA:40 +ESA:60)

Section A

Concept of reliability, classes of life time distributions, evaluation of reliability function, shape of reliability function, system reliability evaluation: series & parallel system, partially redundant system, standby system with perfect switching/ imperfect switching, (k, n) system, bridge structure. availability theory and its modeling for various configurations, introduction to software reliability.

Section B

Reliability models of maintained systems. Reliability Allocation Problems, Discrete Replacement Policies: Age, Block Policies, Preventive Maintenance Policies, Corrective Maintenance Policies, Concept of minimal repair, Notions of aging.

Section C

Renewal Theory, Distribution of number of renewals & moments, Recurrence time & its limiting distribution. Application of Renewal Theory, Solutions of Renewal type equations, Optimization problem with respect to system reliability.

Text Books:

1. Reliability and Life Testing:S. K. Sinha. Wiley Eastern Limited.
2. Reliability Theory. I. Gertsbakh. Springer International Edition 2009.
3. Renewal Theory.D. R. Cox.Matheun London, 1962.
4. Introduction to Reliability Engineering:E. E. Lewis: 2nd edition. John Wiley & Sons, 1994.

Reference Books:

1. R.E. Barlow and F. Proschan, **Mathematical Theory of Reliability**, John Wiley and Sons, New York, 1965.
2. John G. Rau, **Optimization and Probability in Systems Engineering**, Van Nostrand Reinhold Company, 1970.
3. E.E. Lewis, **Introduction to Reliability Engineering**, 2nd edition, John Wiley & Sons, 1994.
4. R.E. Barlow and F. Proschan, **Statistical Theory of Reliability and Life Testing**, Holt, Rinehart & Winston Inc., 1975.
5. D.R. Cox., **Renewal Theory**, Matheun London (Chapters 1-5), 1962.
6. A.K.S. Jardine, **Maintenance, Replacement and Reliability**, Pitman Publication (U.K.) (Chapter 6), 1973
7. P.M. Morse, **Queues, Inventories and Maintenance**, John Wiley and Sons, 1958.
8. Billinton Roy and W. Allan Ronald, **Reliability Evaluation of Engineering Systems**, Pitman Publication, 1983.
9. J.D. Musa, Antony Lannino, K. Okunoto, **Software Reliability Measurement, Prediction and Applications**, McGraw Hill, 1987.
10. P.K. Kapur, Santosh Kumar and R.B. Garg, **Contributions to Hardware and Software Reliability**, World Scientific, 1999.

Bayesian Inference

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course, student will be able to:

- Calculate simple likelihood function and use relative frequencies to estimate probabilities and conditional probabilities.
- Calculate posterior probabilities using Bayes' theorem
- Describe the role of the posterior distribution, the likelihood function and the posterior distribution in Bayesian inference about a parameter.
- Explain in detail the Bayesian framework for data analysis and its flexibility and be able to demonstrate when the Bayesian approach can be beneficial.
- Develop, analytically describe, and implement both single and multi parameter probability models in the Bayesian framework.
- Demonstrate the role of the prior distribution in Bayesian inference and be able to articulate the usage of non-informative priors and conjugate priors.
- Show high level Interpretation of Bayesian Analysis Results and be able to readily perform Bayesian model evaluation and assessment.

Section A

Bayes Theorem for random variables; non-informative and improper prior distributions for location, scale and location scale parameters; Jeffery's priors. Hartigan's priors, maximum entropy priors; Bayes sufficiency, Factorization theorem; natural conjugate priors; posteriors distribution and normal approximations to posterior distribution, Bayes principle and Bayes risk; generalized maximum likelihood estimation; Bayes point estimate; Credible regions; H.P.D. credible regions.

Section B

Finite action problem and hypothesis testing; prior and posterior odds ratio; Bayes factor; Lindley's paradox, two sample testing problems for the parameters of normal population; predictive density function; point and interval predictors.

Section C

Empirical Bayes estimation, determination of prior distribution from past data; linear Bayes estimate, hierarchical Bayes analysis (Normal context); Preposterior analysis and determination of optimal fixed sample size; general discussion on Bayes computation (without proof).

Suggested Text/ Reference Books:

1. Bansal, A.K. (2007). *Parametric Bayesian Inference*. New Delhi: Narosa Publishing House.

2. Aitchison, J. and Dunsmore, I.R. (2009). *Statistical Prediction Analysis*, Cambridge, GBR: Cambridge University Press.
3. Berger, J.O (2010). *Statistical Decision Theory and Bayesian Analysis*, New York, NY: Springer.
4. Box, G.E.P. and Tiao, G.C. (2011). *Bayesian Inference in Statistical Analysis*, New York: John Wiley & Sons.
5. Degroot, M.H. (2004). *Optimal Statistical Decisions*. New York, NY: McGraw-Hill.
6. Bernardo, J.M. and Smith, A.F.M. (2009). *Bayesian Theory*, Chichester: Wiley.
7. Ghosh, J. K., Delampady, M., & Samanta, T. (2007). *An introduction to Bayesian analysis: theory and methods*. Springer Science & Business Media.

Suggested E-learning material

1. Bayesian Statistics: From Concept to data analysis <https://www.coursera.org/learn/bayesian-statistics>
2. Introduction to Bayesian Statistics <https://www.statistics.com/bayesian-statistics/>

Population Sciences

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course, student will be able to:

- Identify principle sources of population data and assess their strengths and weaknesses.
- Able to evaluate of human development index.
- Construct and interpret life tables.
- Aware various population policies and programs.
- Calculation and interpretation of the principal demographic measures, and standardize these measures for comparison.
- Understand the significance of age- sex structures and their implications on population change, including the effects of changing birth, death and migration rates, and demonstrate their influences on age structure.
- Understand the concept of urbanization on the economic growth of the contrary.
- Estimate and project the population by different methods.

Section A

Definition of demography, Population Sciences, Source of population data, Census, Civil Registration System (CRS), Sample Registration Scheme (SRS), National Sample Survey (NSS), Demographic surveys and other sources (Nature and limitation of the data from each of the sources), Population Composition and change, Concept of aging, Population Theories- Theories of population growth-Malthus to Modern, theory of Demographic Transition, Theories related to fertility, migration and urbanization, Population, Development and Environment, Population and Gender,

Section B

Nuptiality& Fertility (Concepts, Measures Determinants of fertility). Mortality, Morbidity& Health (Concepts & Measures). Life Tables (Basic concepts, type and forms of life table),lexis diagram, Model life table. Reproductive Health, Migration and Urbanization (basic concepts, types, measures). Determinants and Consequences of migration, trends and pattern of urbanization in India, Issues in urbanization and urban problems in developing countries with focus on India.

Section C

Population estimation: Inter-Censual & Post Censual, Methods of population projection population policies and programmes. Population policies in the context of growth, structure, distribution and quality of life:policies related to medical termination of pregnancy (MTP), age at marriage, Sex Determination tests. National & state population policies in India. Evolution of family welfare programme in India. Programme Component and organization at different levels (National, State, District). Goals and achievements of the family welfare programme. Impact Assessment.

Suggested Text/ Reference Books:

1. Cox, P. R. (2009). *Demography* (6th. ed.). GBR Cambridge University Press.
2. Pathak, K.B.& Ram, F. (2019) *Techniques of Demographic Analysis* (2nd. ed.). Himalaya Publishing House.

3. Srinivasan, K., Saxena, P. C., & Kanitkar, T. (1979). *Demographic and Socio-economic Aspects of the Child in India*. Himalaya Publishing House.
4. Ramkumar, R. (2006). *Technical Demography*. New Age International.
5. Bhinde, A. A. & Kanitkar, T. (2018). *Principles of Population Studies* (19th. ed.). Himalaya Publishing House.
6. Sinha, V. C., & Zacharia, E. (1984). *Elements of demography*. Allied Publishers.

Suggested E-learning material

1. Demographic data; Platform: National Family Health Survey, India <http://rchiips.org>
2. Population Studies; Platform; e-PG Pathshala
<https://epgp.inflibnet.ac.in/loaddata.php?action=loadpaperlist1&maincat=453>
3. Demography ; Platform: University Library - The University of Adelaide
<https://www.adelaide.edu.au/library/>
4. Demography; Platform: MIT OPENCOURSEWARE <https://ocw.mit.edu/index.htm>

Time Series Modeling

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course, student will be able to:

- Estimate and eliminate trend and seasonality in a time series
- Fit stationary and non-stationary time series model to a series
- Understand the concept of testing for parameter stability of a time series model
- Demonstrate fitting of multivariate ARMA model to series
- Understand the concept of cointegration analysis and procedure for two variable models.
- Understand the concept of Vector autoregression and causality.
- Understand the concept of volatility in a series and related models.

Section A

Review of Time series analysis: Estimation and elimination of trend and Seasonal component. Simple time series models and their applications, Wald decomposition theorem, Estimation of AR/MA/ARMA models, Autocorrelation and partial autocorrelation functions. Diagnostic tests (AIC, BIC criterion), Forecasting ARMA processes.

Section B

Non stationary time series models (ARIMA): Estimation and forecasting. Testing of parameter stability, Multivariate time series models (ARMA), Cointegration: a general cointegrated system, two variable model: Engle-Granger method, Johansen procedure; error correction model and tests for cointegration.

Section C

Vector autoregression and Granger causality. Non-linear models: Volatility, Autoregressive conditional heteroscedastic (ARCH/GARCH) models, different interpretations, various generalizations, estimation and testing.

Suggested Text/ Reference Books:

1. Brockwell, Peter J., & Davis, Richard A. (2013). *Introduction to Time Series and Forecasting*. Springer Verlag.
2. Fuller, W. A. (2009). *Introduction to Statistical Time Series*. Hoboken: John Wiley & Sons, Inc.
3. Chatfield, C. (1999). *The analysis of time series: An introduction*. Boca Raton: Chapman & Hall/CRC.
4. Mills, T. C. (2001). *Time series techniques for economists*. Cambridge: Cambridge Univ. Press.

Suggested E-learning material

1. Econometric Modeling. Platform: <https://nptel.ac.in/courses/110105053/29>
2. Video lectures on Econometric Modeling: <https://nptel.ac.in/courses/110105030/37>
3. Video lectures on e-PG- Pathshala, Subject: Statistics, Paper Name: P-14. Econometrics and Financial Time Series <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>

Advanced Cryptography

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand digital signatures in detail.
- Understand the concept of signcryption and its security requirements.
- Understand the identity based cryptography.

Digital signatures: Definitions, formal definition of security, relations between security notions, strong unforgeability, one-time signature, signature from one-way function, hash-and-sign paradigm, security of RSA signature, Schnorr signature scheme, Certificates and public key infrastructure.

Signcryption: Definitions, security models for signcryption, signcryption scheme based on Diffie-Hellman Problem.

Identity Based Cryptography: Cocks, Boneh-Franklin, Boneh-Boyen, Sakai-Kasahara identity based encryption schemes.

Suggested Reading:

1. Katz, J. (2010). *Digital signatures*. New York: Springer. (Chapter 1, 3)
2. Katz, J., Lindell, Y.(2015). *Introduction to modern cryptography* (2nd Ed.). Boca Raton: CRC Press. (Chapter 12)
3. Dent, A. W. (2010). *Practical Signcryption*. Berlin: Springer Berlin. (Chapter 2, 3, 4)
4. Martin, L. (2008). *Introduction to identity-based encryption*. Boston: Artech House. (chapter 7, 8, 9, 10)

Advanced Queueing Models

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand the principles and objectives of model building based on Markov chains.
- Analyze the queueing situations.
- Understand the mathematical tools that are needed to solve queueing problems.
- Identify and develop queueing models from the verbal description of the real system.
- Understand the various Non-Markovian queueing models.

Time dependent solution of M/M/1 queueing model: Difference equation techniques, Probability generating function techniques, Pegden and Rosenshine technique, Catastrophized M/M/1 queue: Crescenzo et.al technique, Kumar B. K. et.al technique. Steady state solution of M/G/1 and M/G/1/N using supplementary variable technique; GI/M/1, Geo/M/1 using embedded Markov chain technique.

Suggested Reading:

1. Bunday B. D. (1996). *An Introduction to Queueing Theory*, Arnold Publisher.
2. Crescenzo, A. Di et. al. (2003). On the M/M/1 queue with catastrophes and its continuous approximation. *Queueing System*, 43, 329- 347.
3. Conolly B.W. (1957). A difference equation technique applied to the simple queue, *Journal of Royal Statistical Society, Series B*. 20. 165-167.
4. Gross, D., & Harris, C. M. (1985). *Fundamental of Queueing Theory*. (2nd ed.). John Wiley.
5. Takagi, H. (1993). *Queueing Analysis Vol. I, II and III*. Elsevier Sci. Publisher.
6. Kumar B.K. et.al. (2000). Transient solution of an M/M/1 queue with catastrophes. *Computer and mathematics with application*. 40. 1233-1244.
7. Pegden C. D. and Rosenshine. M. (1982). Some new results for the M/M/1 queue, *Management Science*. 28. 821-828.
8. Saaty T. L. (1983). *Elements of Queueing theory with Application*. McGraw Hill, New York .
9. Queueing Systems, NPTEL: <https://nptel.ac.in/courses/117103017/1>
10. Transient solution of an M/M/1 queue with catastrophe: <https://core.ac.uk/download/pdf/81115439.pdf>
11. On the M/M/1 queue with catastrophes and its continuous approximation. Source: Queueing Systems journal: <https://link.springer.com/article/10.1023/A:1023261830362>
12. Some new results for the M/M/1 queue, Source: Management Science journal: <https://pubsonline.informs.org/doi/10.1287/mnsc.28.7.821>

Algebraic Aspects of Cryptography

Max. Marks : 100

L T P C

(ESA: 100)

0 0 0 2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand the finite field arithmetic and what are the efficient algorithms for them
- Know the group law of elliptic curves and able to perform computation on the elliptic curves.
- Grasp the concepts of lattices and their applications in cryptography.

Finite field arithmetic: Introduction to finite fields, Prime field arithmetic, Binary field arithmetic, optimal extension field arithmetic.

Elliptic Curves: Group law, projective coordinate and Jacobian coordinates, Endomorphisms, Torsion points, Divisors and Tate pairings, Supersingular and singular elliptic curves Elliptic curves over finite field, Elliptic Curve Cryptography.

Lattices: Basic definitions and properties, Short vectors in lattices, Babai's Algorithm, NTRU public key cryptosystem, Lattice based digital signature algorithm, Lattice reduction algorithm.

Suggested Reading:

1. Hankerson, D. R., Vanstone, S. A., & Menezes, A. J. (2011). *Guide to elliptic curve cryptography*. New York: Springer. (Chapter 2)
2. Washington, L. C. (2008). *Elliptic Curves, Number Theory and Cryptography*. (2nd Ed.). Taylor & Francis. (Chapter 2, 3, 4, 6).
3. Martin, L. (2008). *Introduction to Identity based Encryption*. Artech House, London. (Chapter 3, 4, 6).
4. Hoffstein, J., Pipher, J. C., & Silverman, J. H. (2014). *An introduction to mathematical cryptography*. New York: Springer. (Chapter 7).

Algebraic Geometry

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- have knowledge of the basic affine and projective geometries.
- Be familiar with explicit examples including plane curves, quadrics, cubic surfaces, Segre and Veronese embedding.
- increased their knowledge of finitely generated commutative rings and their fields of fractions.
- learn how to formulate and prove basic statements about algebraic varieties. precise abstract algebraic language.

Algebraic curves in plane, closed subset of affine space, rational functions, projective and quasi projective varieties, projective spaces, hypersurfaces, product and maps of quasiprojective varieties, Normal varieties.

Dimension and degree, singular and non-singular points, singularities of a map, divisors, divisors on curves, plane cubic, algebraic group, differential forms, Riemann-Roch theorem on curves.

Suggested Readings:

1. Shafarevich, I.R. (1974). *Basic Algebraic Geometry*, Springer-Verlag, Berlin.
2. Robin, H. (1997) *Algebraic Geometry*. New-York: Springer.
3. Schenck, (2003). *Computational Algebraic Geometry*. Cambridge.
4. J. Harris. (1992). *Algebraic Geometry: A First Course*. Springer-Verlag.

Suggested E-learning Resources

1. Basic Algebraic Geometry : Varieties, Morphisms, Local Rings, Function Fields and Nonsingularity, NPTEL course: <https://nptel.ac.in/downloads/111106097>

Decision and Game Theory

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand and explain the framework of Decision Theory, its intrinsic limitations and broad goals, and how it leads to Game Theory.
- Demonstrate an understanding of games in pure and mixed strategies.
- Explain the game theoretic concepts of uncertainty, information and strategic moves.
- Explain the characteristics and application of repeated games and associated trigger strategies.
- Apply decision making models in interaction situations.
- Gain a proper understanding of game theoretic concepts and modeling: covering equilibrium in static and dynamic games, with varying information structures.

Finite Games, Equilibrium Points, Games with Infinitely many Strategies, Infinite Games, Concave-Convex Games, Multistages Games, Stochastic Games, Two Person General-Sum Games, Bimatrix Games, Non-Atomic Games.

Differential Games, Nash Equilibrium, Identifying Nash Equilibria, Solution of n-persons games with and without zero-sum restriction. Lanchester's equations and their application to games of strategy, Statistical Games, General Techniques for Solving Statistical Games.

Bayesian Decision Theory, Preposterior and Sequential Analysis, Group Decisions and Social Choice, Influence Diagrams, Multi Attribute Utility.

Suggested Readings:

1. Owen, G. (2008). *Game theory*. New York: Academic Press.
2. McKinsey, J. C. C. (2012). *Introduction to the Theory of Games*. Newburyport: Dover Publications.
3. Myerson, R. B. (2004). *Game theory: Analysis of conflict*. Cambridge, MA: Harvard University Press.
4. Jorgensen, S., & Zaccour, G. (2004). *Differential games in marketing*. Boston: Kluwer Academic Publishers.
5. Smith, J. Q. (1992). *Decision analysis: A bayesian approach*. London: Chapman & Hall.
6. Lindley, D. V. (2003). *Making decisions*. London: Wiley & Sons.
7. French, S. (1993). *Decision theory: An introduction to the mathematics of rationality*. Chichester: Ellis Horwood.
8. DeGroot, M. H. (2005). *Optimal statistical decisions*. Hoboken, N.J: Wiley-Interscience.
9. Clemen, R. T. (2001). *Making hard decisions with decision tools*. Pacific Grove, CA: Duxbury.

Suggested E-learning Resources

1. Economic Applications of Game Theory (Lecture notes PDF):

<https://ocw.mit.edu/courses/economics/14-12-economic-applications-of-game-theory-fall-2012/index.htm>

Finite Field Theory

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand finite fields and their extension in detail.
- Find primitive polynomial, factorization of polynomials.
- Understand Gauss, Jacobi, and Kloosterman sums, character sums and their applications.

Introduction to finite fields, extension fields, trace and norm function, bases linearized polynomial, irreducible polynomial, primitive polynomial, factorization of polynomials, normal bases, Completely normal bases, Gauss, Jacobi, and Kloosterman sums, exponential and character sums, Some applications of character sums.

Suggested Reading:

1. Mullen, G. L., & Panario, D. (2013). *Handbook of finite fields*. Boca Raton: CRC Press.
2. Lidl, R., & Niederreiter, H. (2002). *Introduction to finite fields and their applications*. Cambridge: Cambridge University Press.
3. Menezes, A. J. (2011). *Applications of finite fields*. New York: Springer.

Operator Theory

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Tell what is operators
- Define several standard examples of linear operators, self-adjoint operators and prove simple results related to them.
- Spectral representation of compact self-adjoint operators in Hilbert spaces.
- Applications of spectral Theorem for compact operators.
- Some recent results and open problems in operator theory

Dual space considerations: Representation of duals of the spaces with p-norms, and c with supremum-norm, $C[a,b]$ and . Reflexivity, Weak and weak* convergences. Best Approximation in Reflexive spaces.

Operators on Banach and Hilbert spaces: Compact operators and its properties; Integral operators as compact operators; Adjoint of operators between Hilbert spaces; Self-adjoint, Normal and unitary operators; Numerical range and numerical radius; Hilbert--Schmidt operators.

Spectral results for Banach and Hilbert space operators: Eigen spectrum, Approximate eigen spectrum, Spectrum and resolvent; Spectral radius formula, Spectral mapping theorem; Riesz-Schauder theory, Spectral results for normal, Self-adjoint and unitary operators; Functions of self-adjoint operators.

Suggested Readings:

1. Nair, M. T. (2008). *Functional analysis: A first course* (6th Ed.). New Delhi: Prentice Hall of India.
2. B.V. Limaye(2014). *Functional Analysis*(3th. ed.). New Age Internationals.
3. Conway, J. B. (2013). *A course in functional analysis* (Vol. 96). Springer Science & Business Media.
4. Goffman, C., & Pedrick, G. (2017). *A first course in functional analysis* (Vol. 319). American Mathematical Soc.
5. Gohberg, I., & Goldberg, S. (2013). *Basic operator theory*. Birkhauser.
6. Kreyzig E. (1989) . *Introduction to Functional Analysis with Applications*. Wiley
7. Bachman, G. & Narici L. (1964). *Functional analysis*. Academic Press.

Special Functions

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- understand various types of special functions, and their conditions of existence.
- carry out relations between different special functions, including some of the most useful special functions.
- demonstrate understanding of the concepts of recurrence relations, generating functions, series representations pertaining to different special functions and polynomials.
- determine some significant properties of special functions and their integral forms.
- discuss the nature of various special functions in different domains.

The Gamma and Beta Functions: Euler's integral for $\Gamma(z)$, the beta function, factorial function, Legendre's duplication formula, Gauss's multiplication theorem, summation formula due to Euler, behavior of $\log \Gamma(z)$ for large $|z|$. The Hypergeometric function: An integral representation, differential equation and solutions. $F(a,b,c;1)$ as a function of the parameters, evaluation of $F(a,b,c;1)$, contiguous function relations

The hypergeometric differential equation, logarithmic solutions of the hypergeometric equation, $F(a,b,c;z)$ as a function of its parameters, Elementary series manipulations, simple transformations, relation between functions of $\Gamma(z)$ and $\Gamma(1-z)$ quadratic transformations, theorem due to Kummer, additional properties. The Confluent Hypergeometric function: Basic properties of ${}_1F_1$, Kummer's first formula. Kummer's second formula, Generalized Hypergeometric Series: The function ${}_pF_q$, the exponential and binomial functions, differential equation, contiguous function relations, integral representation ${}_pF_q$, with unit argument, Saalschutz' theorem, Whipple's theorem, Dixon's theorem, Contour integrals of Barnes' type.

Bessel Functions: Definition, Differential equation, differential recurrence relations, pure recurrence relation, generating function, Bessel's Integral, index half an odd integer, modified Bessel functions,

Introduction to Legendre function, Meijer G-function and some basic properties, Fox's H-Function.

Suggested Readings:

1. Ranvillie, E.D. (1960). *Special Functions*. Macmillan.
2. Andrews, L. C. (1992). *Special Functions of Mathematics for Engineers*. SPIE Press.
3. Szego, G. (1939). *Orthogonal Polynomials*. American mathematical society.
4. Slater, L.J. (2008). *Generalized Hypergeometric Functions*. Cambridge University Press.
5. Mathai, A. M. & Haubold H. J. (2008). *Special Functions for Applied Scientists*. Springer.

Suggested E-learning Resources

1. Special Functions and Their Symmetries: www1.maths.leeds.ac.uk/~kisilv/courses/special.html

Finite Element Methods

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand global, local, and natural coordinates.
- Understand the significance of shape functions (linear, quadratic, cubic) in finite element formulations and can formulate one and two-dimensional elements like triangular and rectangular elements.
- Understand the concepts behind variational methods and weighted residual methods in FEM
- be able to implement the Galerkin residual weak formulation into the Finite Element Method for the solution of Ordinary and Partial Differential Equations.

The fundamentals of finite element methods, Discretization of the bounded area, stiffness matrix, assembly of stiffness matrices, Global stiffness matrix.

Shape function: Linear and higher order shape functions for linear, triangular and rectangular elements, Variational Formulation, Rayleigh-Ritz method and Weighted residue method, Galerkin's method

Finite Element formulation for PDE, Laplace equation, wave equation and diffusion equation.

Suggested Readings:

1. Reddy, J. N. (1993). Introduction to the finite element methods (2nd ed.). McGraw-Hill Education.
2. Norrie, D. H., & DeVries. Introduction to finite element methods. New York: Academic Press.
3. Brenner, S. C., & Scott, L. R. (2008). The mathematical theory of finite element methods. New York, NY: Springer -Verlag.
4. Ciarlet, P. G. (2002). The finite element method for elliptic problems. Philadelphia: SIAM.
5. Johnson, C. (1987). Numerical solution of partial differential equations by the finite element methods. Cambridge: Cambridge University Press.
6. Mercier, C. (1979). Lectures on topics in finite element solution of elliptic problems, TIFR Lectures on Mathematics and Physics, Vol. 63, Narosa Publ. House, New Delhi,.

Suggested E-learning Resources

PDF of Lectures on Finite Element Method by C. Mercier; Platform: The Tata Institute of Fundamental Research, Bombay 1975: <http://www.math.tifr.res.in/~publ/ln/tifr49.pdf>

Intelligent Transport System

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- understand the sensor and communication technologies.
- differentiate different ITS user services
- define the significance of ITS under Indian conditions
- select appropriate ITS technology depending upon site specific conditions.
- design and implement ITS components

Definition of ITS, historical context of ITS from both public policy and market economic perspectives, Types of ITS; Benefits of ITS.

Importance of telecommunications in the ITS. Information Management, Traffic Management Centers (TMC). Application of sensors to Traffic management; ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection.

ITS User Needs and Services and Functional areas: Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), ITS and safety, ITS and security, ITS planning.

ITS applications: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; public transportation applications; ITS and regional strategic transportation planning, ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

Suggested Readings:

1. Sussman, J. (2010). *Perspectives on Intelligent Transportation Systems (ITS)*. New York: Springer.
2. Mashrur A. C. and Adel W. S.(2003). *Fundamentals of Intelligent Transportation Systems Planning*, Artech House, Inc., 2003.
3. Lawrence A. Klein, *Sensor Technologies and Data requirements of ITS*.
4. Kan Paul Chen and John Miles; *ITS Hand Book 2000: Recommendations for World Road Association (PIARC)*.
5. *National ITS Architecture Documentation*, US Department of Transportation, 2007

Suggested E-learning Resources

1. Benefits of Intelligent Transportation System; Platform: https://www.its.dot.gov/factsheets/benefits_factsheet.htm
2. Intelligent Transportation System; Platform NPTEL: <https://nptel.ac.in/courses/105101008/48>
3. Intelligent Transportation System: <https://www.wsp.com/en-US/services/intelligent-transportation-systems-its>

Inventory and Production Management

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Demonstrate what inventory is and where we find it within the supply chain.
- Demonstrate the types of demand patterns common in real inventory problems.
- Prepare appropriate inventory planning models for differing demand patterns.
- Recognize the importance of inventory management.
- Understand Production management basics and its history.
- Formulation of aggregate planning problems; their objectives, constraints and applicable solution techniques.
- Understand the terms Trade credit, Inflation, VMI etc. and learn how to use these policies in inventory modeling.

Deterministic Inventory Lot-Size Model with Time proportional demand. Deterministic joint replenishment policy. Inventory Control of deteriorating items (discrete and Continuous). Inventory control under inflationary conditions. Inventory models with stock dependent demand. Interaction of inventory and trade credit policies. Impact with marketing policies on inventory decisions. Joint buyer-seller inventory model. The distribution free newsboy problem and its extensions.

Introduction to VMI and Supply chain. Interaction of Inventory, Queues and Reliability. Aggregate Production Planning Fixed and Variable Work Force Model. Inventory Location Model. Production Planning with Time Varying Demand.

Suggested Readings:

1. Waters, D. (2009). *Inventory control and management*. Chichester: Wiley.
2. Heizer, J., & Render, B. (2001). *Principles of operations management*. Upper Saddle River, N.J: Prentice Hall.
3. Zipkin, P. H. (2000). *Foundations of inventory management*. Boston, MA: McGraw-Hill.
4. Bernard, P. (1999). *Integrated inventory management*. New York: Wiley.
5. Silver, E. A., Pyke, D. F., & Peterson, R. (2006). *Inventory management and production planning and scheduling*. New York: John Wiley & Sons.
6. Wild, T. (2002). *Best practice in inventory management*. Oxford: Butterworth Heinemann.
7. Bedworth, D. D. (1998). *Integrated production control systems*. New York: John Wiley & Sons, Inc. wen jing.
8. Plossl, G. W. (1986). *Production and inventory control: Principles and techniques*. New Delhi: Prentice-Hall.

Suggested E-learning Resources

1. Basic Inventory Principles (PDF): <https://nptel.ac.in/courses/112102106/38>
2. Supply Chain Management & Vendor-managed Inventory (PDF):
<https://ocw.mit.edu/courses/sloan-school-of-management/15-760a-operations-management-spring-2002/lecture-notes/>

Marketing Management

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand the concept of marketing and its role in business and public organization.
- Understand the need for scientific marketing analysis.
- To uses Mathematical models in Marketing and understand their limitations.

Consumer Behavior, Contribution of Consumer Behavior in Marketing Management; Market Segmentation; Purchasing Decision with Market price Increase Anticipated; Purchasing under Varying marketing Parameters viz: Price, Quality, Promotional Effort and Distribution Expenses; Promotional and Pricing Decisions under Competition; Planning Suitable Channels of Distribution appropriate to various Classes of Goods and Customers; Media Planning and Media Allocation Models Determining the Optimal Return on Investment for an Advertising Campaign.

Diffusion of Products with Limited Supply and Known Expiration Date. Diffusion of Innovation under Supply Constraints.

Suggested Readings:

1. Bass, F. M. (1964). *Mathematical models and methods in marketing*. Homewood, Ill: Irwin.
2. Kotler, P., & Keller, K. L. (2016). *A framework for marketing management*. Upper Saddle River, New Jersey: Pearson Education Inc.
3. Lilien, G. L., Kotler, P., & Moorthy, K. S. (2009). *Marketing models*. Prentice Hall of India.
4. King, W. R. (1967). *Quantitative analysis for marketing management*. New York: McGraw-Hill.

Numerical Solutions of Partial Differential Equations

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Solve mathematical models represented by initial or boundary value problems involving partial differential equations that cannot be solved directly using standard mathematical techniques but are amenable to a computational approach.
- Select appropriate numerical methods based on the characteristics of a PDE problem.
- Introduce the discretization methodologies, with particular emphasis on the finite difference method that allows the construction of accurate and stable numerical schemes.
- Discuss about the stability and convergence of the numerical methods.

Numerical solutions of parabolic PDE in one space: two and three levels explicit and implicit difference scheme.

Numerical solution of parabolic PDE of second order in two dimensional space implicit methods, alternating direction implicit (ADI) methods, Non-linear initial BVP.

Difference schemes for parabolic PDE in spherical and cylindrical coordinate systems in one dimension. Numerical solution of hyperbolic PDE in one and two space dimension: explicit and implicit schemes. Lax's equivalence theorem, Finite difference schemes for initial and boundary value problems - FTCS, backward Euler and Crank-Nicolson schemes, Difference schemes for first order equations.

Numerical solutions of elliptic equations, approximations of Laplace and biharmonic operators. Solutions of Dirichlet, Neuman and mixed type problems.

Suggested Readings:

1. Jain, M. K., Iyenger, S. R. K., & Jain, R. K. (1994). Computational methods for partial differential equations. Wiley Eastern.
2. Jain, M. K. Numerical solution of differential equations (2nd ed.). Wiley Eastern.
3. Sastry, S. S. (2002). Introductory methods of numerical analysis, Prentice-Hall of India.
4. Griffiths, D. V., & Smith, I. M. (1993). Numerical methods of engineers, Oxford University Press.
5. General, C. F., & Wheatley, P. O. (1998). Applied numerical analysis, Addison-Wesley.
6. Smith, G. D. (1986). Numerical solutions to partial differential equations (3rd ed.). Oxford University Press.

Suggested E-learning Resources

1. Lecture notes on Numerical Methods for Partial Differential Equations; Platform: MIT open course ware;
<https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-920j-numerical-methods-for-partial-differential-equations-sma-5212-spring-2003/lecture-notes/>
2. Lecture notes on Numerical Solution of Partial Differential Equations; Platform: nptel;
<https://nptel.ac.in/courses/111107063/21>

Advanced Reliability Theory

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Estimate the reliability function and mean time to failure for different types of systems.
- Understand major concepts of reliability prediction.
- Analyze statistical experiments leading to reliability modeling.
- Estimate life length distributions, using complete or censored data.
- Identify reliability testing components.
- Apply reliability theory to assessment of reliability in engineering design.
- Know Bayesian reliability concept.
- Determine Life table and Kaplan- Meier approach.
- Understand MCMC technique for simulation.

Concept of Reliability: Definition of reliability and its measures, Importance of reliability, Concept of failure, Fault tree analysis.

Lifetime Models: Notion of aging, concept of hazard rate for life time distributions (exponential, Weibull, Log-Normal, Gamma, Inverse Gaussian) , Increasing failure rate (IFR) and Decreasing failure rate (DFR) class of life distributions, Bath-tub failure curve.

Life Testing and inference: Life testing, Complete data and censored data, Type-I, Type-II, hybrid and random censoring schemes. Parametric inference based on complete and censored data, Nonparametric estimate (Life table and Kaplan-Meier) of reliability, Graphical methods (PP, QQ and TTT plots) and standard statistical tests for model validation.

Bayesian Reliability: Bayesian approximations and Reliability estimation, Bayesian intervals for parameters and Reliability functions.

Suggested Readings:

1. Sinha, S. K. (1986). *Reliability and life testing*. John Wiley & Sons, Inc..
2. Nelson, W. B. (2005). *Applied life data analysis* (Vol. 577). John Wiley & Sons.
3. Meeker, W. Q., & Escobar, L. A. (2014). *Statistical methods for reliability data*. John Wiley & Sons.
4. Deshpande, J. V., & Purohit, S. G. (2006). *Lifetime Data: Statistical Models and Methods* (Vol. 11). World Scientific Publishing Company.
5. Lawless, J. F. (2011). *Statistical models and methods for lifetime data* (Vol. 362). John Wiley & Sons.
6. Kapur, K. C., & Lamberson, L. R. (1977). *Reliability in engineering design*. New York: Wiley.
9. Høyland, A., & Rausand, M. (2009). *System reliability theory: models and statistical methods* (Vol. 420). John Wiley & Sons.
10. Barlow, R. E., & Proschan, F. (1996). *Mathematical theory of reliability* (Vol. 17). John Wiley, New York..

11. Barlow, R. E., & Proschan, F. (1975). *Statistical theory of reliability and life testing: probability models*. Rinehart and Winston, New York..

Suggested E-learning Resources

1. Reliability Theory, Platform: NPTEL <https://nptel.ac.in/courses/114106041/15>.
2. MLE and Bayesian Estimation-1, Platform: NPTEL
https://nptel.ac.in/courses/pdf_link/103106123/lec109.pdf
3. Module, Systems and Reliability; Platform: MIT Open Course ware:
<https://ocw.mit.edu/courses/mechanical-engineering/2-627-fundamentals-of-photovoltaics-fall-2013/lecture-videos-slides/2011-lecture-17-modules-systems-and-reliability/>

Demographic Models

L T P C

0 0 4 2

Max. Marks : 100

(CA:40 +ESA:60)

Preliminaries: Introduction to matrix algebra, Review of unstructured population models and life table analysis. Demography: Measures of mortality, description of life table, construction of complete and abridged life tables, maximum likelihood, MVU and CAN estimators of life table parameters.

Age-structured (leslie matrix) models: model formulation and parameterization, population growth rate, stable age distribution, reproductive values, sensitivity analysis, Measures of fertility: models for population growth, intrinsic growth rate, stable population analysis, population projection by component method and using Leslie matrix.

Parameter estimation: estimation of survival and transition probabilities, estimation of reproductive parameters. Stochastic models.

Text Book:

1. Caswell, Hal. 2001. Matrix population models: Construction, analysis and interpretation. 2d ed. Sunderland, MA: Sinauer Associates.

Reference books:

1. DeAngelis, Donald L., and Loui J. Gross. 1992. Individual-based models and approaches in ecology: Populations, communities and ecosystems. New York: Chapman and Hall.
2. Murdoch, William W., Cheryl J. Briggs, and Roger M. Nisbet. 2003. Consumer-resource dynamics. Population Monographs Series 36. Princeton, NJ: Princeton Univ. Press.
3. Daley, D.J. and Gani, J. 1999. Epidemic Modelling. Cambridge Univ. Press.
4. Tuljapurkar, S. and Caswell, H. (Ed.). Structured-Population Models in Marine, Terrestrial, and Freshwater Systems. Chapman and Hall, New York.

Generalised Linear Models

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand the concept of logistic regression, its estimation and testing.
- Understand the procedure to regression analysis for dependent count variable using Poisson regression.
- Broaden their understanding of regression model to generalized linear models and their application.

Logistic Regression: Logit transform. ML estimation. Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis.

Poisson Regression: Introduction to Poisson regression, MLE for Poisson regression, Applications in Poisson regressions.

Family of Generalized Linear Models: Exponential family of distributions, Formal structure for the class of GLMs, Likelihood equations, Quasi likelihood, Link functions, Important distributions for GLMs, Power class link function.

Suggested Readings:

1. Christensen, R. (1997). *Log-linear Models and Logistic Regression* (2nd. Ed.) Springer.
2. Dobson, A.J. and Barnett, A.G. (2008). *Introduction to Generalized Linear Models*(3ed ed.). Chapman and Hall/CRC. London.
3. Hastie, T.J. and Tibshirani, R.J. (1990). *Generalized Additive Models*. (2nd. ed.). Chapman and Hall, New York.
4. Hosmer, D.W. and Lemeshow, S. (2000). *Applied Logistic Regression* (2nd ed.). Wiley, New York.
5. Lindsey, J. K. (1997). *Applying generalized linear models*. Springer-Verlag, New York.
6. McCullagh, P. and Nelder, J.A. (1989). *Generalized Linear Models*(2nd. ed.). Chapman and Hall.
7. McCulloch, C.E. and Searle, S.R. (2001). *Generalized, Linear and Mixed Models*. John Wiley & Sons, Inc. New York.
7. Myers, R.H., Montgomery, D.C and Vining, G.G. (2002). *Generalized Linear Models with Applications in Engineering and the Sciences*. John Wiley & Sons.

Statistical Computing

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Simulate and generate statistical data by different techniques.
- Estimate the unknown parameter of population via different methods.
- Understand the basic concepts of statistical theories besides developing their ability to handle real world problems with large scale data.

Random numbers, Pseudo random number generation: Inverse transform method, Acceptance-rejection, Transformations. Tests for randomness. Multivariate probability calculation, Simulation and Monte Carlo integration, Variance reduction, Importance sampling.

Markov-Chain Monte Carlo: Metropolis-Hastings algorithm, Gibbs sampling, Jack-knife method, Bootstrap method, Bootstrap confidence intervals, Likelihood estimation, Bootstrap of dependent data.

Density estimation: Univariate and Multivariate estimation, Bayesian posterior density estimation, EM algorithm.

Suggested Reading:

1. Givens, G. H. and Hoeting, J.A. (2013). *Computational Statistics* (2nd. Ed.). Wiley.
2. Law, A. M., Kelton, W. D., & Kelton, W. D. (1991). *Simulation modeling and analysis* (Vol. 2). Tata McGraw-Hill.
3. Thisted, R. A.(1988). *Elements of Statistical Computing*. Chapman and Hall.
4. Robert, C. P, & Casella, G. (2010). *Introducing Monte Carlo methods with R*. Springer Verlag.

Suggested E-learning Resources

1. Statistical computing Platform: MITOPENCOURSEWARE <https://ocw.mit.edu/index.htm>
2. Statistics: Platform: e-PG Pathshala <https://epgp.inflibnet.ac.in>

Supply Chain Management

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Understand the structure of supply chains and the different ways through which supply chains can become competitive in the realistic problems.
- Understand fundamental supply chain management concepts.
- Apply knowledge to evaluate and manage an effective supply chain.
- How to align the management of a supply chain with corporate goals and strategies.
- Analyze and improve supply chain processes.
- Identify the principles of customer and supplier relationship management in supply chains.

Building Blocks of a Supply Chain Network, Business Process in Supply Chains, Types of Supply Chains and Examples, Strategic, Tactical, and Operational Decisions in Supply Chains, Supply Chain Performance Measures.

Supply Chain Inventory Management: Newsboy, Base-stock, and (Q,r) Models, Multi-Echelon Supply Chains, Performance of Supply Chains using Markov Chains and Queueing Networks.

Mathematical Programming Models for Supply Chain Planning, Design and Optimization, Internet- Enabled Supply Chains ERP and Supply Chains, Customer Relationship Management.

Suggested Readings:

1. Chopra, S., & Meindl, P. (2007). *Supply chain management: Strategy, planning, and operation*. Upper Saddle River, N.J: Pearson Prentice Hall.
2. Shapiro, J. F. (2007). *Modeling the supply chain*. Australia: Thomson Brooks/Cole.
3. Viswanadham, N. (2000). *Analysis of manufacturing enterprises: An approach to leveraging value delivery processes for competitive advantage*. Boston: Kluwer Academic.
4. Ganeshan, R., Magazine, M. J., & Tayur, S. R. (2003). *Quantitative models for supply chain management*. Boston, Mass: Kluwer Acad.
5. Handfield, R. B. (2012). *Introduction to Supply Chain Management*. Pearson Education.
6. Viswanadham, N., & Narahari, Y. (2005). *Performance modeling of automated manufacturing systems*. New Delhi: Prentice-Hall of India.

Suggested E-learning Resources

1. Introduction to Supply chain management (PDF): <https://nptel.ac.in/courses/110106045/35>

Survival Analysis

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Learning Outcomes:

After completion of the course, student will be able to:

- Identify characteristics of survival data and problems in their correct analysis
- Define and understand the relationship between the survival function, distribution function,
- Hazard function, relative hazard, and cumulative hazard
- Perform and interpret analyses of survival data using common statistical procedures
- Fit the proportional hazards regression model to survival data and assess the scientific
- significance, precision, and interpretation of regression coefficients
- Fit parametric regression model to survival data and assess the scientific significance,
- precision, and interpretation of regression coefficients
- Use graphical and other methods to assess the adequacy of fitted models and propose
- Alternate solutions when common assumptions are violated
- Use time-dependent covariates in the proportional hazards model and interpret the coefficients

Concepts of time, order and random censoring. Life distributions - exponential gamma, Lognormal, Pareto, linear failure rate. Life tables, failure rate, mean residual life and their elementary properties. Ageing classes - IFR, IFRA, NBU, NBUE, HNBUE and their duals, Bathtub failure rate.

Estimation of survival function - Actuarial estimator, Kaplan - Meier estimator. Estimation under the assumption of IFR/DFR.

Semi-parametric regression for failure rate - Cox's proportional hazards model. Competing risk models. Repair models. Probabilistic models. Joint distribution of failure times. Unconditional tests for the time truncated case. Tests for exponentiality, two sample non-parametric problem.

Suggested Readings:

1. Collet, D. (2003). *Modeling Survival Data in Medical Research*. London: Chapman and Hall.
2. Hosmer, D. and Lemeshow S. (1999). *Applied Survival Analysis: Regression Modeling of Time to Event Data*. New York: Wiley.
3. Breslow, N. and Day, N. (1987). *Statistical Methods in Cancer Research: The Design and Analysis of Cohort Studies*. Lyon: IARC.
4. Therneau T, and Grambsch, P. (2000). *Modeling Survival Data: Extending the Cox Model*. New York: Springer
5. Kalbfleish, JD. and Prentice, RL. (2002). *The Statistical Analysis of Failure Time Data*. New York: Wiley.

Suggested E-learning Resources

1. <http://www.stat.columbia.edu/~madigan/W2025/notes/survival.pdf>

Financial and Cost Accounting

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives

1. To understand the fundamental concepts and processes of Accounting.
2. To analyze the Cost Accounting methods and to identify profitable products and services.
3. To be able to interpret cost accounting statements for cost ascertainment, planning, control.
4. To analyze accounting reports to make sound managerial decisions.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction to Accounting: Evolution, Significance & Accounting Cycle, Basic Terms in Accounting, accounting principles, concepts & conventions, GAAP, Overview of International Accounting Standards, Accounting Equation, Overview: International Financial Reporting Standards. Recording of Transactions - Journal: Types of Accounts, Rules of Debit and Credit, Ledger, Cash book and Trial Balance. Depreciation: Overview of SLM & WDV; Preparation of financial statement - Trading and P & L Account and Balance Sheet- Concepts, Format of P&L A/C and Balance Sheet (vertical & horizontal), numerical

Section B

Introduction to Cost Accounting: Understanding and Classifying Cost, Elements of cost, Component of total cost, Classification of Costs and Format & Preparation of Cost Sheet, Numerical.

Standard Costing and Variance Analysis: Meaning of Standard Cost & Variance, Cost Variance, Direct Material Variance, Direct Labour Variance, Sales Variance and Control of Variance, Numerical, Overview of Zero Based Budgeting

Section C

Marginal Costing and CVP analysis -Meaning and Difference between Absorption Costing and Marginal Costing, Marginal Cost, Utility of Marginal Costing and its Limitations, Segregation of Semi Variable Cost, B.E.P. Profit, Volume, Numerical. An overview of following: Nature of Managerial Decision Making -Decisions regarding make or buy, Accept a special order, Drop a product line, Replacement of assets.

Learning Outcomes

Upon completion of the course the student will be able to:

- Understand terminology, fundamental principles, classifications, generalizations and methods of accounting.
- Solve cost related problems and make decisions based on the effective cost system.
- Apply management decision on business situations with the help of real life examples and cases studies.

Suggested Readings:

1. Maheshwari, S. N., Maheshwari, S. K., & Maheshwari, S. K. (2013). *An Introduction to Accountancy*. New Delhi. Vikas Publishing House.
2. Goel D. K., Goel Rajesh, GoelShally (2017): *Accountancy*. (15 ed.) New Delhi. Arya Publications.
3. Horngren, C. T., Bhimani, A., Datar, S. M., Foster, G., & Horngren, C. T. (2002). *Management and cost accounting*. (4 ed.) New York. Harlow: Financial Times/Prentice Hall.

4. Banerjee, B. (2012). *Financial policy and management accounting*. (2 ed.)New Delhi. PHI Learning Pvt. Ltd.

Suggested E Learning Materials:

1. Hooper, C. (2013). New Approach to Accounting. Retrieved From <https://www.youtube.com/watch?v=IXxgl8Rqd74>
2. Mattison, R. (2016) Can a new way of accounting save our planet. Retrieved From <https://www.youtube.com/watch?v=G5M3kYAtYaI>
3. Aggarwal, N. (2017). Basics of Financial Accounting. Retrieved From <https://www.youtube.com/watch?v=mq6KNVeTE3A>

People Management

Max. Marks : 100 L T P C
(CA: 40 + ESA: 60) 4 0 0 4

Course Objectives:

1. To help students to develop their managerial competencies by understanding the issues related to human behavior.
2. To understand why people behave as they do and gain insight into management of human behavior for organizational effectiveness.
3. To acquaint the students with the theory and practice of Human Resource Management systems of contemporary organizations.
4. To help students become better leaders by enhancing their effectiveness in managing human resources.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Personality - Definition, determinants of personality, Big Five Model, introduction to MBTI, Major personality attributes influencing organizational behavior, Personality-job fit theory, Person-organization fit, Perception - Meaning: process of perception, perception distortion, application of perception in organization.

Learning- Definition, classical conditioning, instrumental conditioning, social learning, role of punishment and rewards in shaping behavior. Attitudes- Meaning, types of attitudes, cognitive dissonance theory. Values- Meaning, value system, types of values, values across cultures.

Section B

Motivation- Definition, motivation cycle, Theories of motivation: Maslow's Hierarchy of Need's Theory, Herzberg's Two Factor Theory, Theory X and Y, ERG Theory, Mc Clelland's Achievement Theory, Equity Theory.

Leadership- Definition, Theories of Leadership: Trait approach, behavioral theories (Ohio State Studies, Michigan Studies, Scandinavian Studies, Blake and Mouton's Managerial grid), Contingency theories: (Fiedler's contingency theory, path-goal theory, LMX theory, Hersey and Blanchard's situational theory, Leader-Participation Model), Overview of Charismatic and transformational Leadership.

Section C

Groups- Formal and Informal groups, reasons for group formation, Stages of group development- Five stages development model, Punctuated-Equilibrium Model, Group Processes-social loafing, Social facilitation effect, Group vs. Individual decision making, Group think, Group shift.

Power- Meaning; Bases of power, Power and politics.

HRM Concept, difference between HRM and Personnel Management. Human resource Planning- Process of HRP, techniques of demand forecasting and supply forecasting.

Job Analysis- Process and methods of Job Analysis. Procurement- Recruitment: Process and sources of recruitment, Selection: Process and tools of selection

Learning Outcomes:

Upon completion of the course the student will be able to:

- Develop the skills to analyze the organizational behavioral issues in the context of organizational theories, models, and concepts.

- Analyze the behavior of individuals and groups within organizations in terms of key factors that influence organizational behavior.
- Prepare for leadership roles in modern organizations.
- Demonstrate the skills and knowledge needed to effectively manage human resource.
- Administer and contribute to the design and evaluation of the performance management programs.

Suggested Readings:

1. Robbins, Stephen P., and Sanghi, Seema (2007). *Organizational Behavior* (11 ed), Delhi, Pearson Education.
2. Luthans, Fred (2016). *Organizational Behavior* (12 ed), New York, McGraw-Hill Companies, Inc.
3. Pareek, Udai (2016). *Understanding Organizational Behaviour* (4 ed), New Delhi, Oxford University Press.
4. Dcenzo, David A., and Robbins, Stephen P. (2008). *Fundamentals of Human Resource Management* (8 ed). Haryana, Wiley India (p) Ltd.
5. Flippo, Edwin B. (1984). *Personnel Management* (6 ed), Singapore, McGraw- Hill Book Co.
6. Dessler, Gary (2009). *Human Resource Management* (11 ed), Delhi, Pearson Education.

Suggested E Learning Materials:

1. Johnson, J. A. (2017). Big-Five model. In V. Zeigler-Hill, T.K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (1-16). New York: Springer. DOI: 10.1007/978-3-319-28099-8_1212-1.
2. Smriti. (2018). *Motivation Cycle-Fundamentals of Psychology/ Management Notes*. Retrieved from <https://www.managementnote.com/motivation-cycle/>.
3. Cappelli, P. (2018). *HR Exchange at Think*. Retrieved From <https://www.youtube.com/watch?v=bTH3qEoXAhk>

Information Technology and MIS

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To develop understanding of the various aspects of IT and MIS and their practical applications.
2. To develop understanding of Database Management, Data Administration, Entity Relationship Modeling etc.
3. To study the concepts of System Analysis, Role of system analyst, System development life cycle.
4. To develop understanding of the social dynamics of internet, e-commerce, mobile commerce, IPR, legal & ethical issues of IT.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section..

Course Content:

Section A

Definition of Information Technology (IT) & Its role in modern business, IT Capabilities and Their organizational impact, IT enabled services. Management Information Systems (MIS): Concept and Components of Information System, Definition of MIS, Need, Purpose and Objectives, Contemporary approaches to MIS: Information as a strategic resource, Use of information for competitive advantage, MIS as an instrument for the organizational change.

Concept of data, Information & Knowledge, Database Concepts: Fields, Records and Files: Basic architecture, Managing Data Resources: Introduction, the need for Data Management, Challenges of Data Management: Data Independence, Reduced data redundancy, Data Consistency, Data Access, Data administration: Managing Concurrency, Managing security, DBMS: Traditional File concepts and Environment, Database Management Systems Concepts, Types of Data Models, ER Modeling.

Section B

Systems Analysis and Design: Systems Development Life Cycle, Role of system and business analyst. Basic and essential concepts of MS-Office – word processing using MS-Word, Data Analysis using MS-Excel, Presentation skills using MS-Power Point

Social Dynamics of the Internet, Services of the Internet: Blogs, Social Networking Technology of the Internet, Social Networks in the Enterprise, Electronic Commerce: Introduction, E-commerce technology, Doing business over internet: Network, Electronic data interchange (EDI), Online payment technology, Mobile commerce, Ecommerce-portals, Search engines, E-business, E Appraisal. Use of IT & MIS in case of E- Commerce

Section C

Ethical and Legal issues in e-business ,IT & its impact on individual, organizations and society, Threats to information, Introduction to information security, Information privacy & protection - behavioral action to protect IT assets, Computer based actions to protect IT assets, Ethical practices and social impact of IT Intellectual Property Rights related to IT Services / IT Products, Overview of cyber laws.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Develop an understanding of application of MIS & IT in various areas of corporate and individual life.
- Become aware of the working of various IT- based, E-commerce based, data based organizations and the utility of data/Information.

- Understand and pursue their careers in of the concepts of cloud computing, system analysis, data analysis

Suggested Readings:

1. Turban, E., Rainer, K., & Potter, R. (2014). *Introduction to Information Technology* (2 ed.), New Delhi, Wiley.
2. Laudon, K.C & Laudon, J.P (2013). *Management Information Systems* (14 ed.), New Delhi, Pearson.
3. Alter, S. (1999). *Information Systems: A management perspective* (3 ed.). New Delhi, Pearson.
4. Rajaraman, (2011). *Analysis and Design of Information Systems* (3 ed.), Delhi, PHI.

Suggested E Learning Materials:

1. Baesens, B. (2013, Spetember 25). *Intreoduction to Database Management Systems*. Retrieved March 20, 2019, from Youtube: https://www.youtube.com/watch?v=6u2zsJOJ_GE
2. Date, C. (2016, March). *O'REILLY*. Retrieved February 2019, from Safari: <https://www.oreilly.com/library/view/relational-theory-for/9781449365431/ch01.htm>

Learn.Org. (2009, July). *What Is Management Information Systems (MIS)?* Retrieved February 2019, from Learn.Org: https://learn.org/multimedia/What_Is_Management_Information_Systems_MIS_-_Video.html

Marketing Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To provide an understanding of the underlying concepts, strategies and issues involved in exchange of products and services between the firm and markets.
2. To understand the distribution processes its types and factors affecting the choice of distribution channels.
3. To understand the promotion mix and various components of promotion mix.
4. To understand the product mix and related pricing strategies

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Core concepts of marketing, Marketing Management Philosophies, Elements of marketing mix, Market Segmentation, Alternative market targeting strategies, Consumer market and buyer behaviour, Industrial markets and buyer behaviour

Product concepts, Product Life Cycle, New Product Development, Product Mix Product positioning, Branding,.

Section B

Pricing – Objective and methods. Factors influencing pricing, Physical distribution, Meaning and utility of channels of distribution, types and functions of channel members, Packaging, Direct marketing, the distribution environment in 21st century, Marketing Planning, Marketing Research, Competitive Marketing.

Section C

Concept of Service marketing, Marketing mix of services, how service marketing differ from product marketing, recent trends Communication skills in English/ Hindi required for marketing managers; Communication process, role of communication in business organizations, Barriers to communication, Non verbal communication, business correspondence, Report writing, E-mail writing, Letter writing, Daily reports. New trends in marketing

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand various issues and activities involved in marketing management and related activities
- Understand different concepts, strategies and issues of marketing management for effective decision making.

Suggested Readings:

1. Kotler Philip, Keller Kevind Lane, Koshy Abraham and Jha Mithileshwar (2013). *Marketing Management. A South Asian Perspective* (14 ed.), New Delhi, Pearson education.
2. Ramaswamy and Nama kumari (2013). *Marketing Management* (5 ed.) New Delhi, McMillan.
3. Stanton William J (1984). *Fundamentals of Marketing* (10 ed.). New Delhi, MC Graw Hill.
4. Bovee, Thill & Schatzma (2006). *Business Communication*, (10 ed.) New Delhi, Pearson.

Suggested E- Learning Materials:

1. Kalpana, R. (2019). *Channels of Distribution of Products: Meaning, Functions, Factors and Types*. Retrieved from [http://www. businessmanagementideas.com/products/channels-of-distribution-of-products-meaning-functions-factors-and-types/2276](http://www.businessmanagementideas.com/products/channels-of-distribution-of-products-meaning-functions-factors-and-types/2276).
 2. Levitt, T. (1965). *Exploit the Product life cycle*. Retrieved from <https://hbr.org/1965/11/exploit-the-product-life-cycle>.
 3. Kumar, A. (2017, April 6). *Marketing Management*. Retrieved from www.youtube.com/watch?v=MBp_cqFlC0g.
- Pine, J. (2014). *What consumers want*. Retrieved from [www.ted.com/talks/joseph pine on what consumers want](http://www.ted.com/talks/joseph_pine_on_what_consumers_want)

Financial Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives :

1. To develop critical thinking and problem solving competencies, at both the individual and group levels, of financial statement analysis,
2. To familiarize the students with decision on financial planning, capital budgeting, capital structure, and issues in financial policy.
3. To apply financial theory to analyze real life situations in an uncertain environment with an incomplete data set.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Nature and scope of Financial Management, Techniques of Financial Analysis - Statement of change in financial position (Cash flow - Fund flow), Ratio Analysis. Investment Decision; Capital Budgeting, principles & techniques - Traditional & Discounted cash flow methods.

Section B

Projects selection under Capital Rationing, Measurement of cost of capital - Dividend Approach and CAPM. Financing Decision - Operation leverage, Financial Leverage, EBIT EPS analysis, Combined leverage, Capital Structure theories - NI, NOI, Traditional, M&M, Approach, Determinants of capital structure.

Section C

Working Capital Management - Nature of Working Capital, concepts of Working Capital, Determination of financing mix, Need & determinants of Working Capital, Computation of working capital, Working Capital Financing. Cash Management - Nature and concepts, optimum cash balance, techniques for forecasting cash. Management of Accounts Receivable - Concept, optimum credit policy, factors affecting receivables and procedures for credit. Introduction of Capital & Money Market- meaning and functions.

Learning Outcomes :

Upon completion of the course the student will be able to:

- Conduct financial analysis to form long-term financial policies for business.
- Judge the financial environment within which organizations must operate.
- Critically evaluate the financial objectives of various types of organizations
- Analyze the alternative sources of finance and investment opportunities
- Apply techniques in managing working capital .

Suggested Readings:

1. Brigham, E. F. (1979). *Financial management: theory & practice*. (1 ed.), New York, Dryden Press.
2. Van Horne James, C. (2002). *Financial Management & Policy*. (12 ed.), New Delhi, Pearson Education India.
3. Pandey, I. M. (1995). *Essentials of Financial Management*, (4 ed.), New Delhi, Vikas Publishing House.

4. Jain, P. K., & Khan, M. Y. (2005). *Basic Financial Management*. (4 ed.), New Delhi, Tata McGraw-Hill.
5. Chandra, P. (2011). *Financial Management*. (8 ed.), New Delhi, Tata McGraw-Hill Education.
6. Srivastava, R., & Misra, A. (2012). *Financial Management*. (1 ed.), New Delhi, Oxford University Press.

Suggested E Learning Materials:

1. Helfert, A. (2001). *Financial Analysis and Tools and Techniques*. Retrieved from <http://alqashi.com/book/book17.pdf>.
2. Saha, D. (2019). *WORKING CAPITAL MANAGEMENT*.ppt. Retrieved from <https://www.scribd.com/doc/98098428/WORKING-CAPITAL-MANAGEMENT-ppt>.
3. John, G. (2015). *Money Management through Financial Planning*. Retrieved From <https://www.youtube.com/watch?v=AbSL1ttViYE>.

Banking and Financial Services

Max Marks: 100
(CA: 40+ESA:60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the banking system and banking structure of India in light of the legal structure
2. To understand the banking operations in association with the retail banking in India.
3. To understand various products and services offered by the banks along with the various account operations and retail credit products offered by the banks
4. To understand the aspect of financial planning along with understanding of various third party products offered by banks and in line understands the retirement and estate planning.

Note: The paper will contain 3 questions from every section aggregating nine questions. In any one of the sections, there would be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Indian Banking Structure, Role & functions of RBI, RBI Act 1934, Banking Regulation Act 1949, KYC & AML, Banking Ombudsman, CRR, SLR, MCLR, Repo & Reverse Repo Rate, Functions of Banks. Payment banks, Small finance banks.

Retail Banking: Types of Customers, Account and Deposit, Banker Customer Relationship, Banker Customer Special Relationship, Negotiable Instruments: Cheques, Bills of Exchange, Promissory notes, Cheque collection, payer and holder in due course. Account Closure and Account Closure under Special Situation. Overview of direct banking channels

Section B

Credit: 5 C's of Credit, Loan Appraisal Process, Retail loan: Home loan, Personal loan, Educational Loan. Corporate Loans: Working capital financing, Export financing, Term loan.

Types of Mutual funds, Types of insurance: Life Insurance, General Insurance: Health, Motor vehicle, House, Accidental insurance.

Section C

Financial Planning & Wealth Management: Relevance, need, importance. Need assessment of client, developing optional plan, PF statement analysis. Retirement and Estate Planning: Relevance, Estate Planning: Succession Act (Hindu-Indian), Tax incidence of various transactions, succession efficiency. Retirement Planning- Retirement solutions & pension plans, choosing and managing retirement portfolio, reverse mortgage.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand and analyze the banking structure of India in light of the legal structure.
- Gets a practical outlook of the retail banking and the legal formalities associated with it.
- Understand the aspects of financial planning and retirement planning which will help in better future planning of finances.
- Job readiness for financial advising and banking jobs.

Suggested Reading:

1. Gomez, C. (2011). Banking and Finance Theory. Law and Practice (1 ed.), New Delhi, PHI Learning.
2. Gopinath, M. N. (2017). Banking Principles and Operations (7 ed.), Mumbai, Snow White Publications.

3. Halan M., (2018). Let's Talk Money: You've Worked Hard for it, Now Make it Work-for You. (1 ed.), New Delhi, Harper Business
4. IIBF. (2017). Legal and Regulatory Aspects of Banking (3 ed.) Chennai, Macmillan.
5. IIBF. (2017). Principles & Practices of Banking (3 ed.), Chennai, Macmillan.
6. IIBF (2017). Retail Banking (3 ed.), Chennai, Macmillan.
7. Vinay Dutta, K. S. (2013). Commercial Bank Management (1 ed.), Delhi, Tata McGraw Hill.
8. PROSCHOOL, I. (2012). Retirement planning and Employee Benems (Vol. 3), Delhi, Tata MCGraw Hill Education Private Limited.

Suggested E-Learning Resources:

1. Arslanian, H. (2016, December 5). How FinTech is Shaping the Future of Banking. Retrieved from Youtube: <https://www.youtube.com/watch?v=pPkNtN8G7q8>
2. MSG. (2014). Case Study of the Indian Banking and Financial Services Industry using Strategic Tools. Retrieved from Managment Study Guide: <https://www.managementstudyguide.com/case-study-of-indian-banking-and-financial-services-industry.htm>
3. MSG. (2018, December). Management Study Guide. Retrieved from Management Study Guide: <https://www.managementstudyguide.com/history-of-modern-banking.htm>

Consumer Behavior

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objective:

1. To develop an understanding of concepts and application of consumer behavior.
2. To develop an understanding of consumer as an individual and its marketing implications.
3. To develop an understanding of consumer's group dynamics including family, culture, groups, etc. and their marketing implications.
4. To develop an understanding of consumer's decision making process, its influencing factors and their marketing implications.
5. To develop an understanding of consumer behavior modelling and their marketing implications.
6. To develop an understanding of organizational buying and its process.
7. To develop an understanding of how better CRM can be conducted by studying consumer behavior.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Consumer Behavior- Nature, scope and Application. Consumers and market segments, limitations of Demographics in predicting consumer behaviour, lifestyle and psychographic segmentation.

Consumer as an Individual: Consumer needs and motivation, Theories of personality and their implications for consumer behaviour, Consumer perception and attitude. Theories of learning and communications.

Section B

Consumers in their social and cultural settings: Group dynamics, reference groups and consumer behaviour. Influence of family and social class. Influence of cultural, sub cultural and cross-cultural aspects on consumer behaviour.

Consumer decision processes: Problem recognition, search and evaluation, purchasing processes and post purchase behaviour, High involvement and low involvement consumer decisions.

Section C

Opinion leadership and its dynamics. Diffusion of innovation. Modelling consumer Behavior: Traditional models of consumer behaviour, Howard and Sheth model, Recent developments in modelling buyer behaviour, organizational buying behaviour: Influences, the buying situation, decision making process, concept of Customer Relationship Management and its Managerial Application Consumer Behaviour in non profit sectors

Learning Outcomes:

Upon completion of the course, the student will be able to:

- Understand consumer behavior in different settings.
- Apply consumer behavior knowledge in marketing and its applications.
- Apply the knowledge of CRM in its marketing applications.

Suggested Readings:

1. Blackwell, R. D., Miniard, P. W., & Engel, J. F. (2003). *Consumer Behavior* (9 ed.). Australia: Thomson.
2. Schiffman, L., & Kanuk, L. (2007). *Consumer Behavior* (9 ed.), New Delhi, Pearson.
3. Loudon, D. L., & Bitta, A. J. (1993). *Consumer Behavior: Concepts and Applications* (4 ed.), New York, McGraw-Hill.

Suggested E Learning Materials:

1. Lee, H. J., Jeong Cho, H., Xu, W., & Fairhurst, A. (2010). The influence of consumer traits and demographics on intention to use retail self-service checkouts. *Marketing Intelligence & Planning*, 28(1), 46-58.
2. Pine, J. (2014). *What consumers want*. Retrieved from https://www.ted.com/talks/joseph_pine_on_what_consumers_want
3. University of Tasmania (2016). *The psychology behind consumer behavior*. <https://www.youtube.com/watch?v=vJR2HwvrzCQ>

Sales and Distribution Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the meaning of the concepts of sales & distribution management
2. To develop knowledge about Salesmanship and various issues related to it
3. To understand the meaning of the concepts of Sales Quotas, Sales Territory, Sales Control recruitment, selection training and evaluation in sales
4. To study the distribution management, channel intermediaries in Indian context

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Objective & functions of sales management, Formulating personal selling strategies. Qualities of the effective sales executive, Salesmanship, organisation of sales department.

Sales force Management-Recruitment, Selection, Training, Motivation, Compensation, Evaluation of Sales persons.

Section B

Controlling the sales effort - Sales budget, Sales quota, Sales territories, Sales control & cost analysis, Distribution Functions: Role of Intermediaries, Role of distribution in service sector

Section C

Channel strategy, selection of channels, Dealer selection, motivation & evaluation, Indian Distribution system.

Physical distribution- Logistics for physical distribution, Transportation, warehousing inventory management, Recent trends in whole selling & retailing & dealers network.

Learning Outcomes:

- Understand the concepts of sales management
- Become well versed with the concept of distribution management and the related operations of various companies
- Develop understanding and choose one of the sales and distribution management areas like sales, logistics, channel management as their career option

Suggested Reading:

Upon completion of the course the student will be able to:

1. Still, R., Cundiff, W., & Govani, N.P (2016). *Sales Management : Decisions, Strategies and cases* (6 ed.), New Delhi: PHI.
2. S.L. Gupta (2013). *Sales and Distribution Management* (3ed.), New Delhi: Excel Books.
3. Allen, P. (). *Sales and sales management* (2 ed.), London: Macdonald & Evans.
4. Kapoor, S, Kansal, P. (2005). *Basics of Distribution Management* (3 ed.), Delhi: PHI.

Suggested E Learning Materials:

1. Starr, Rob. (2017). *What Makes a Good Salesperson? 25 Qualities to Look For*. Retrieved from <https://smallbiztrends.com/2017/08/what-makes-a-good-salesperson.html>.
 2. Pollitt, D. (1999). *Physical distribution and logistics management in the digital era*, *International Journal of Physical Distribution & Logistics Management*. Retrieved from <https://doi.org/10.1108/09600039910757752>.
- Rao, K.S.(2014). *Introduction to Sales and Distribution Management*.
Retrieved from https://www.youtube.com/watch?v=tTB52_VMCTc.

Organization Development and Change Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To prepare students as organizational change facilitators using the knowledge and techniques of behavioral science.
2. To explore important issues pertaining to the era of organization change and development.
3. To gain insight into various interventions as tools to help organizations and their members to enhance effectiveness and bring desired change.
4. To understand the importance of counseling for desired change.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Organizational Change: Reasons for change, Organizational evolution and life cycle, Process of organizational change, Guidelines for facilitating change, Role and skills of change agent, Internal and external change agents, Issues in client-consultant relationship. 'Resistance to change'

Changing corporate context and organization development, Concept, Need for O.D., History and various stems of O.D., Values, Assumptions and beliefs in O.D., The O.D. Process.

Section B

O.D. interventions – Classification, Individual development, Personal effectiveness, Sensitivity training, Life and career planning interventions, Group and team interventions, Role analysis, Process consultation, Team building, Visioning, Appreciative inquiry, Responsibility charting.

Inter-Group intervention–Organization mirroring, Partnering, Comprehensive interventions– Future search conference, Confrontation meeting, Survey feedback, Grid O.D., Structural Interventions, Quality and O.D.

Section C

Counselling: Introduction, Counselor's attitude and skills in counselling, Process of counselling, Problems in counselling- with counselor, With staff and with process, Issues in counseling.

Change and OD : Integrating OD and organization strategy, Change, competitive advantage and role of OD, Managing change in era of mergers and acquisitions.

Case studies may be used by the instructor for developing greater understanding of the course.

Learning Outcomes:

Upon completion of the course, the student will be able to:

- Gain an insight into how to lead, adapt, and manage change.
- Develop skills to collaboratively manage the culture of an organization to attain the goals and purposes of the organization.
- Develop the skills to design interventions as needed.
- Learn the technicalities of counseling and will gain skills for counseling as intervention.

Suggested Readings:

1. French, Wendell L., and Cecil, Bell H. (2014) *Organization Development* (6 ed), New Delhi, PHI.
2. Cummings, Thomas G., and Worley, Christopher G. (2007). *Organization Development and Change* (8 ed), Haryana, Thomson.
3. Singh, Kavita (2011). *Organisation Change and Development* (2 ed), New Delhi, Excel Books.
4. Nigel, MacLennan (1998). *Counselling for Managers*. Vermont, Grower Paperback.

Suggested E Learning Materials:

1. Moores, K., & Yuen, S. (2001). Management accounting systems and organizational configuration: a life-cycle perspective. *Accounting, organizations and society*, 26(4-5), 351-389.
2. HEATHFIELD, S. (2018). What is resistance to change? Retrieved from <https://www.thebalancecareers.com/what-is-resistance-to-change-1918240>.
3. **Zala, Y. (2014). Team Building.**Retrieved from [https:// www.slideshare.net/maximus66/team-building-presentation-35292365](https://www.slideshare.net/maximus66/team-building-presentation-35292365).

Human Resource Development Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the meaning of Human Resource Development and Human Resource Systems and differentiate between the concepts
2. Develop the knowledge about the various Human Resource Development Systems in the organization
3. To understand the changing trends in designing and managing Human Resource Development Systems.
4. To understand the issues involved in the implementation of HRDS.
5. Understand the need to reposition HR function to create value addition to the organization.

Note: The paper will contain 3 questions from every section aggregating nine questions. In any one of the sections, there would be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Changing role of HRD in Liberalized Economy, Trends in HR: Present and future; HRD climate; Role of HRD in improving effectiveness of a firm; Introduction to SHRM.

Work system: Work planning and role analysis; Performance Management: Potential Appraisal, Performance Appraisal- Methods and processes of performance appraisal, 360 degree appraisal. Recruitment, Induction & Socializing Systems

Section B

Career and development system: Career development and planning, Assessment centers, Career management, Motivational aspects of HRD, Practices in career management.

Training system: Identification of training and development needs, Managing the training system, Evaluating the effectiveness of training and development program, Cross cultural training, Action research in training.

Section C

Reward system: Job Evaluation- process and methods; Practices in wage payment, Paying for performance, Monetary and non monetary aspects of reward systems, Fringe Benefits, Trends in reward system

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand the fundamental differences among Human Resources, Human Resource System and Human Resource Development.
- Understand the changing trends in HRDS.
- Identify and work in each of the Human Resource Development Systems.

Suggested Readings:

1. Pareek, U & Rao V.T. (2003). *Designing and Managing Human Resource Development Systems* (3 ed.), New Delhi, Oxford and IBH Publishing Co. Pvt. Ltd.
2. Pareek, U. (2006). *Organizational Behavior Processes*. (3 ed) New Delhi: Rawat Publications.

Suggested E Learning Materials:

1. Farsight.(2019). Organizational effectiveness through HRD in the Changed Liberalized markets.Retrieved from [https:// farsightitsolutions.com/organizational-effectiveness-through-hrd/](https://farsightitsolutions.com/organizational-effectiveness-through-hrd/).

2. Mohanty, R. (2012). Shrm-Introduction. Retrieved from [https:// www.slideshare.net/rajivmohanty/shrm-introduction](https://www.slideshare.net/rajivmohanty/shrm-introduction).
3. Mehta, A. (2018). New Trends in HRM. Retrieved from <https://www.youtube.com/watch?v=dAFSHgr-Udk>
4. McCord, P.(2015). HR lessons from the world of Silicon Valley start-ups. Retrieved from https://www.ted.com/talks/patty_mccord_lessons_from_a_silicon_valley_maverick_new_ways_of_working_and_collaborating

Airline and Airport Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. The objective of the course is to introduce the students with the basic functionalities of Airports and Airlines.
2. To make students understand various security and legal aspects aligned with the airline management.
3. To introduce the functioning of airports in handling customers and goods and how the same is planned at all levels.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Airlines and Airport System Introduction: Airport, Airlines, Airport transportation system, Airside, Terminal, Landside, Airport security, ARFF, Aviation Industry: growth and development. Recent trends & future, Airport Planning Airport planning system, Airport master plan, Airport layout plan, Land use planning, Runway Orientation & Runway Safety, Airport organizational structure, Airline network, Air traffic, Airport capacity, Airspace capacity, Congestions and Delays, Slot Allocation.

Section B

Brief history of Air cargo business, Role of Aviation sector in supply chain management, Types of cargo products, Air cargo terminal, Air Cargo Agency, Air Cargo Rates & Cargo Charges, International Air Transport Association (IATA) regulations, Dangerous Goods Regulation. Airlines and Airport Operations Fleet Management (Planning, Assignment, Scheduling), Route & Network Planning, Crew Scheduling, Manpower planning.

Section C

Airside operation, Landside operation, Terminal operations, Airline & Aircraft product & performance. Aviation Enterprise Management, Enterprise Concept in Aviation, Business Aspect, Ownership Models, Complexity of Aviation Business, Revenue Generation & Technological Advancement, Service Aspects of Aviation, Scopes for Aviation Managers.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand Indian Aviation structure.
- Get a practical outlook of the Aviation Management.
- Job readiness for the Aviation sector.

Suggested Readings:

1. Twell Alexander, (2007) *Airport Planning and Management* (3 ed) Ashgate Publishing Ltd. New Delhi
2. Gullaume Barghouwt, (2010) *Airlines Network Development in Europe and its implication for Airport planning* (4 ed) Ashgate Publishing Ltd. New Delhi.
3. Jank Milan, (2012) *The sustainability of Air Transport-A qualitative Analysis & Assignment* (7 ed) Ashgate Publishing Ltd. New Delhi.

Suggested E Learning Materials:

1. Berry, T. (2019). *Using Porter's Five Forces when creating your marketing plan*. Retrieved from <https://www.mplans.com/articles/using-porters-five-forces-when-creating-your-marketing-plan/>.
2. Srinivas. (2015). *Airport Planning and Design*. Retrieved from <https://www.slideshare.net/srinivas2036/airport-planning-and-design>

Fundamentals and Principles of Aviation

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. The mission of the course is to provide students with a well-rounded liberal arts education, a solid foundation in business, and a focus on unique aspects of aviation as a business.
2. To understand the concept of Aviation management and fundamental delivery to the Aviation professionals..

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction to Aviation industry: Introduction, history & evolution, Global & Indian Perspectives, Classification of aviation, Civil Aviation, General aviation, Military aviation, Facts & figures regarding aviation industry. Aviation Regulatory Management : International Aviation Organizations.

Section B

Indian aviation organizations, Ministry of civil aviation, Director General Civil Aviation, Airport Authority of India, Bureau of Civil Aviation Security, NACIL & other Airlines. Aviation Terminologies & Codes: Introduction, Alphabetical Codes, Products, Airplane Parts, Technological Terminologies, Airlines & Airports Codes, Configurations & Roles.

Section C

AOCC & Air Traffic Management Introduction, Communications, Elements of ATM, Functions, Shortcomings of present ATM system, Future of ATM, Introduction of AOCC (Airport Operation Control Centre), Elements, components & Framework, Future aspects of operations. Aviation Management: Basic Operations (Airport, Airline, Pax & Cargo), Air Traffic Control, aviation security & safety, Airport prospective in different disciplines.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand the Indian Aviation structure.
- Get a practical outlook of the Aviation Management.
- Be job-ready for the Aviation sector.

Suggested Readings:

1. Alexander. T. (2010). *Airport Planning & Management*, (4 ed), New Delhi, Twell Alexander, Ashgate.
2. Bazargan M. (2011). *Airports, Operations & Scheduling* (5 ed), New Delhi, Ashgate

Suggested E Learning Materials:

1. Hill, Michael. And Varone, F. Retrieved from https://www.researchgate.net/publication/312814047_The_Public_Policy_Process.
2. OECD. (2012). *Public Governance of Public-Private Partnerships*. Retrieved from <http://www.oecd.org/governance/budgeting/PPP-Recommendation.pdf>.
3. Nathan, R. (1995). *Reinventing Government: What Does It Mean?* Retrieved from https://www.jstor.org/stable/977192?seq=1#metadata_info_tab_contents.

Strategic Financial Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To develop advance knowledge of the principle theories and techniques of Corporate Finance.
2. To develop the understanding of corporate restructuring and analyze with real life examples.
3. To develop the understanding of Derivatives and International Financial Market.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Inventory Management – Nature, Significance, Cost minimization through EOQ, ABC analysis. Advanced Capital Budgeting: Statistical techniques to handle risk, Decision tree utility theory. Dividend Decision – Dividend theories – Water, Gordon, Modigliani & Miller, Dividend policies, overview of Bonus Shares, Share split, Share buyback, Project appraisal and financing – concept, overview of process, financial appraisal by banks. Mergers and Takeovers: regulatory framework, various types, how mergers increase value, valuation approaches, and case studies, motives of spin off's and divestitures.

Section B

International Financial management- an overview, International Financial management and domestic financial management, Theories of Foreign Exchange rate movement and International Parity Conditions -Purchasing Power Parity, International Fisher Effect. The Foreign Exchange markets- Functions; rates -direct and indirect quotations, Spot market and forward market, premiums and discounts, Bid - ask spread, Interest Arbitrage - Covered Interest Arbitrage and Interest Parity theory. Management of Foreign Exchange Risk -Translation exposure, Transaction exposure Measurement and Management of Transaction exposure, Economic Exposure, Transaction Exposure Versus Economic Exposure.

Section C

Derivative - Hedging Currency Risk, Hedging Risk through Forward Contracts, Indian Derivatives Market; Option Market: Types, Uses, Payoffs, Trading Strategies, Involving Options Bull-Bear, Butter Fly, Calendar and Diagonal Spread, Straddles, Strip and Straps, Options Valuation and Pricing. Factors Determining Option Price.Black Scholes Models. Concept of Delta, Theta, Gamma Vega, Exchange Traded Option- Stock, Option, Foreign Currency Option, Over the Counter Exchange Option, Index Options, Put Call Parity; Future Contracts: Introduction to Futures Markets, Future Contract and Future Trading, Hedging using Futures, Index Futures. Basics of Stock Index Future, Interest Rate Futures, Foreign Exchange and Currency Future, Mechanism of Future, Hedging, Difference between Forward and Future contracts; Interest rate Swaps - rationale, liability and asset based interest rate swaps, pricing of swaps, forwards and options on swaps.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Apply the technical language and practices of financial management.
- Undertake sophisticated financial analysis with regard to corporate valuation, interest rate and currency risk management and present the information in an appropriate format.
- Evaluate, synthesize and apply the contemporary theories and empirical evidence concerning Financial Management to a range of problems and situations

- Critically evaluate the impact of macro economics and recognize the role of international financial institutions in the financial management of multinationals.

Suggested Readings:

1. Van Horne James, C. (2002). *Financial Management & Policy*, (12 ed), New Delhi, Pearson Education India.
2. Weston, J. F., Mitchell, M. L., & Mulherin, J. H. (2013). *Takeovers, Restructuring, and Corporate Governance*, (10 ed), New Delhi, Pearson New International Edition. Pearson Higher Ed.
3. Prasanna, C. (2001). *Financial Management Theory and Practice* (6 ed). Delhi, Tata McGraw-Hill Publishing Co. Ltd.
4. Brealey, R. A., Myers, S. C., Allen, F., & Mohanty, P. (2012). *Principles of Corporate Finance* (8 ed), Delhi, Tata McGraw-Hill Education.

Suggested E-Learning Materials:

1. Arslanian, H. (2016, December 5). *How FinTech is Shaping the Future of Banking*. Retrieved from Youtube: <https://www.youtube.com/watch?v=pPkNtN8G7q8>
2. MSG. (2014). *Case Study of the Indian Banking and Financial Services Industry using Strategic Tools*. Retrieved from Managment Study Guide: <https://www.managementstudyguide.com/case-study-of-indian-banking-and-financial-services-industry.htm>
3. MSG. (2018, December). *Managment Study Guide*. Retrieved from Management Study Guide: <https://www.managementstudyguide.com/history-of-modern-banking.htm>

Advertising and Brand Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. The objective of this course is to enable students to appreciate the various issues and activities involved in advertising and brand management
2. Correlate the role of Advertising and Brand in Marketing Management
3. To apprehend the importance of marketing communication channel in Marketing Mix
4. To design effective communication messages for promotion mix

Note: The paper will contain 3 questions from every section aggregating nine questions. In any one of the sections, there would be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Defining advertising - Meaning and scope, Brief history of development and growth of advertising, Benefits of advertising, Criticism of advertising. Role of marketing in the marketing strategy of a firm. Relationship of advertising with other elements of promotion mix, Legal ethical and social issues in advertising

Advertising agency: Need, organizing and functions of ad agency, Agency pitching process, Types of ad agencies, Choice of ad agency, agency compensation, client agency relationship.

Section B

Strategic Advertising Research, Planning an ad campaign: Advertising Planning, Advertising objectives, Advertising budget, Advertising Media Strategy, media selection, media planning and buying, Creative Strategy: Facets of creative strategy, Planning and managing creativity in advertisement, Developing an ad campaign

Section C

Digital Marketing – SEO, SEM, Web Analytics, Email marketing, Social Media Marketing, Blog Marketing, Mobile Marketing

Brand Management : Introduction, History and its current importance, Strategic Brand Management Process, Current challenges in building the brand, Brand elements, Brand Personality, Brand Positioning, Basic concepts of brand equity and Brand Reposition concept.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Select appropriate promotion mix to meet marketing objectives
- Analyze and implement branding strategies to solve business problems
- Understand various issues and limitations involved in promotion mix

Suggested Readings:

1. Batra Rajeev, John G. Myers, David A. Aaker (1996). *Advertising Management* (5 ed.), The University of Michigan, Prentice Hall
2. Keller K L, Parameswaran M G, Jacob I (2008). *Strategic Brand Management* (3 ed.), New Delhi, Pearson

Suggested E-Learning Resources:

1. Gaur, M. (2017). Advertsing agency, role and types.Retrieved from <https://www.slideshare.net/MonikaGaur1/advertising-agency-role-and-types>.
2. Nalawalla, Z. (2018). New Trends in Marketing: Ideas on Digital Marketing. Retrieved from [https://www.youtube.com/watch?v= Fj5DfjtTYec](https://www.youtube.com/watch?v=Fj5DfjtTYec)
3. Curleigh, J. (2013). How to enhance and expand a global brand. Retrieved from https://www.ted.com/talks/james_curleigh_how_to_enhance_and_expand_a_global_brand.

Industrial Relations Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the conceptual and practical aspects of industrial relations at the macro and micro levels with respect to changing economic, political and social scenario.
2. To understand management strategies to design the tools for Employee Empowerment and Employee Participation.
3. To introduce the various Labor Laws and the recent changes made in it to have a deep knowledge of laws to ensure adequate safety measures in the workplace.
4. To understand the human resource and industrial relation perspectives on the conflict in the employment relationship.
5. To have a deep knowledge of strategies regarding workforce acquisition, workforce management, and workforce optimization.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'Case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content :

Section A

Industrial Relations Perspectives

IR and the emerging socio economic scenario. Discipline and Grievance management; Negotiation and collective settlements. Role and future of Trade Unions. Trade Union strategies towards liberalization and technological change. Employee response to industrial restructuring and organizational re-engineering.

Employee empowerment and quality management Participative Management and Co-ownership; Decision Circles for participative decision making and problem solving. Productivity Bargaining and Gain Sharing. Internal and External Equity in Compensation systems. Fringe Benefits, Incentives and Retirement plans. Compensation practices of MNCs. Strategic compensation systems.

Section B

Legal Framework Governing Industrial Relations

Emergence and objectives of labour laws and their socio-economic environment. The Workmen's Compensation Act 1923, The Payment of Wages Act – 1936; The Employees Provident Funds and Miscellaneous Provision Act 1952. The payment of Gratuity Act 1972.

The Factories Act 1948. The Industrial Disputes Act 1947. The Trade Union Act 1926. Need for reforms in the current legal frameworks and the existing laws. The ESI ACT.

Section C

New Trends in Industrial Relations Management

From Industrial Relations to Human Relationships Management. Human Capital Management. Human Values approach to IR eg- 'Human Rights & Duties' and 'Honesty, Responsibility and Devotion.' From conflict approach to cooperation approach : Harmonization paradigm of IR. Changing role of state and industrial relations in the developed, newly developed and developing economics. Industrial Relations and globalization

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand various issues related to compensation, performance management, organization development, safety, wellness, benefits, employee motivation, training and others.
- Design various strategies related to Human Resource of the Organization.
- Understand various laws that protect worker's rights, improve worker safety, prevent child labor and increase workers' bargaining power relative to their employers.

Suggested Readings:

1. Monappa, A., Nambudiri, R. and Selvaraj, P. (2012). *Industrial relations and labour laws*. (3 ed) New Delhi, Tata McGraw-Hill Education.
2. Koontz, H., & Weihrich, H. (1990). *Essentials of management*. (2 ed), New York: McGraw-Hill.
3. Greenwood, J. H. (2015). *Handbook of industrial law: A practical legal guide for trade union officers and others*.
4. Locke, R. M., Kochan, T. A., & Piore, M. J. (1997). *Employment Relations in a Changing World Economy*. (1 ed), Cambridge, MA: MIT Press.

Suggested E Learning Materials

1. Quain, Sampson. (2019). *The role of trade unions in Industrial Relations*. Retrieved from <https://smallbusiness.chron.com/role-trade-unions-industrial-relations-65197.html>.
2. Yadav, R. (2011). *The Workmen's Compensation Act, 1923*. Retrieved from <https://www.slideshare.net/ranjeet143yadav/workmen-compensation-act-1923>.
3. Sachdeva, S. (2018). *Introduction to Industrial Employment (Standing Orders) Act 1946*. Retrieved from <https://www.youtube.com/watch?v=RQfE66gRkyM>

Crew Resource Management and Aviation Safety

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To introduce students to the concepts of Crew Resource Management
2. To introduce students to safe human –machine interaction.
3. To identify and categorize risk and how they relate to commercial and general aviation.
4. To provide a foundation and framework in safety and the important role of humans in safety administration.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a ‘Case study problem’ which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Crew Resource Management (CRM) – Definition, Scope, Objectives. Basic Concepts of CRM, Management theories of CRM. CRM History. The safety culture of the organization, Importance of Safety, Enhancement of Safety. Limitations to our Performance in our Environment. Human Error and Error Management. Communication and Assertiveness. Teamwork, Leadership and Followership. Situation Awareness. Decision Making. CRM Training Methods, Developing Training Activities, Delivering Training. Success & Failure of CRM Training.

Section B

Safety Management System: Introduction, History & Evaluation, Meaning, Definition, Risk Matrix, Quality Management Principles, Emergency Responses, Government efforts to Improve safety Airline flight Safety. Safety in Commercial Aviation: Risk Factor, Classification, Analysis, Treatment. Hazards – Definition, Methods of Identification. Hazards Control-Principles, Methods, Hierarchy, Elimination Models, Human Factors.

Section C

Air Operations Areas safety Management, CRM: Cross-Cultural Perspectives. The cockpit culture. Prevention of crew-related incidents and accidents. Introduction to Aviation Medicine. Introduction to Aviation Safety & Security, Critical Incident Stress Management in Airline, Future Perspective.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand the basic concepts of Crew Resource Management, its history and safety cultures of various organizations.
- Understand safety management systems and human- machine interaction in this context.
- Identify and categorize risk in commercial and general aviation.
- Learn cross- cultural perspectives, the framework of safety and the role of humans in safety administration.

Suggested Readings:

1. Jensen, R. S. (2015) *Pilot Judgement and Crew Resource Management* (4 ed) New Delhi, Ashgate.
2. Leonhardt, J. (2016) *Critical Incident Stress Management in Aviation* (5 ed), Mumbai, Macgraw Hill
3. MacLeod, N. (2009) *Building safe systems in Aviation* (3 ed), New Delhi, Ashgate.
4. Stolzer, A. (2008) *Safety Management System in Aviation*. (4 ed), New Delhi, Ashgate.

Suggested E Learning Materials:

1. Jones & Bartlett Learning (2016). *Crew Resource Management Concepts*. Retrieved from <https://www.youtube.com/watch?v=2AtyMuYEK9M>
2. FAA Safety Team Central Florida (2012). *Crew Resource Management - An Approach to System Safety*. Retrieved from <https://www.youtube.com/watch?v=vshw56Zd5f8>
3. George, R. Inside the secret shipping industry. Retrieved from https://www.ted.com/talks/rose_george_inside_the_secret_shipping_industry.

Strategic Airlines Marketing and CRM

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the concepts of marketing management in Aviation Industry
2. Deliver the knowledge of product delivery with reference to the aviation industry.
3. Devise the concept of air transport industry
4. To understand the airline business environment

Note: The paper will contain 3 questions from every section aggregating nine questions. In any one of the sections, there would be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction to Airline Marketing: What is Marketing, Application of marketing principles to airlines management, Marketing for Air Transport Service- Customers & market segment, Market Analysis and Planning, Business Environment of Aviation Industry, Marketing Environment and Marketing Strategies-Porter's 5 forces Model. Product/Service planning and Analysis: PLC in Aviation Industry; Fleet, Schedule & Customer service related product features, Product & Service quality, Freight as a product, Flight handling – Commercial activities.

Section B

Pricing and Revenue Management: Building blocks of Airline pricing, Uniform and differential pricing, Structure of air freight pricing, Pricing strategies, Passenger fares and Ticketing.

Distributing the product: Distribution channel strategies, Travel agency distribution system, Global distribution, Distribution channels in Air freight management.

Section C

Anatomy of a sale: AIDA and SPIN model, Sales planning; managing the sales process.

Airline Promotion: Brand building in Airline industry, marketing communication techniques, Airline advertising, Fundamentals of relationship marketing, Components of relationship marketing strategy, Frequent flier programs, Handling to passenger in Delayed flight.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand Indian Aviation structure.
- Get a practical outlook of the Aviation Management.
- Job readiness for the Aviation sector.

Suggested Readings:

1. Stephen, S. (2007). *Airline Marketing and Management* (6 ed.), New Delhi, Ashgate Publishing LTD.
2. Alexander T. Wells, Bruce D. Chadbourne (2003) *General Aviation Marketing and Management* (2 ed.), Delhi, Krieger Publishing Company
3. Berman & Evans. (2010) *Retail Management: A Strategic Approach* (5 ed.), Delhi, Pearson Education

Suggested E Learning Materials:

3. *Berry, T. (2019). Using Porter's Five Forces When Creating Your Marketing Plan.* Retrieved from <https://www.mplans.com/articles/using-porters-five-forces-when-creating-your-marketing-plan/>.
4. *Srinivas. (2015). Airport Planning and Design.* Retrieved from <https://www.slideshare.net/srinivas2036/airport-planning-and-design>.

Human Behaviour

Max. Marks : 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To analyze individual human behavior in the workplace as influenced by personality, values, perception, decision making and motivation
2. To enrich students with the essential content and experiences they need to become a motivating student, successful manager and an effective employee in any type of work they do in the future.
3. To enhance the critical thinking and analysis skills through the use of management case studies.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit

Course Contents:

Unit I Personality- Definition, personality determinants, trait theory, type theory, Heldon's theory, Freud's psychoanalytical theory. Major Personality attributes influencing organizational behavior, Personality-job fit.

Unit II Learning- Definition, Classical conditioning, instrumental conditioning.

Motivation-Meaning, Motivation cycle, Maslow's Theory, Herzberg's Theory, Theory X and Y, McClelland's Achievement Theory.

Unit III Perception– Difference between perception and sensation, Process, perceptual distortion, attribution theory, Application in organization.

Unit IV Decision Making- Meaning, process, Effect of perception on decision making, situations in decision making, Rationality and Bounded rationality.

Unit V Attitude- Meaning, Types of attitude, Cognitive dissonance theory, Measuring the A-B relationships- moderating variables, Self-perception theory.

Values- Definition, types of values, values across cultures.

Emotions- Meaning, emotional labor, felt vs. displayed emotions, emotion dimensions, external constraints on emotions, application of emotions in organizational context.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Learn about organizational behaviour.
- Exhibit analytical skills, and application of theories in organizational context.

Suggested Readings

1. Prasad, L. M. (2015). *Organizational Behavior*, (1 ed.), New Delhi, Sultan Chand and Sons.
2. Gupta, Shashi K and Joshi, Rosy. (2015) *Organizational Behavior*, (1 ed.), New Delhi, Kalyani Publishers
3. Robbins, Stephen, Judge, T. A. and Vohra, N. (2015) *Organizational Behavior*, (15 ed.), New Delhi, Pearson
4. Pareek, Udai (2011) *Understanding Organizational Behavior*, (3ed.), New Delhi, Oxford University Press
5. Bhattacharyya, Dipak Kumar (2016) *Organizational Behavior*, (2ed), New Delhi, Oxford University Press

Suggested E-Learning Material:

- 1) MSG. (2016). Scope of Human Resource Management. Retrieved from Management Study Guide: <https://www.managementstudyguide.com/scope-of-human-resource-management.htm>
- 2) Emcworthy (2017, August). *The Perception Process*. Retrieved from: <https://www.youtube.com/watch?v=iMcgu15MHVI>
- 3) Introduction to Psychology (2016, July 31). *Basic Concepts of Learning*. Retrieved from : <https://www.youtube.com/watch?v=oJ SqiuEBKh0>
- 4) Nikita, S (2014, May). *Meaning and Definitions of Personality*. Retrieved from https://www.youtube.com/watch?v=q0H_Lrli1ts

Micro Economics for Managers

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the basics of micro economics.
2. To understand the structure of economy and economic activities within economy.
3. To understand the structure of market and its functions in Indian economy.
4. To understand the effect of economics activities on managerial decision making.

Note: The paper will contain ten questions having two questions from each unit; candidates will be required to attempt five questions taking one question from each unit.

Course Contents:

- Unit I** Introduction of Economics: Nature and Significance of Economics, Micro and Macro Economics, Positive and Normative Economics, Economics in Management, Basic Concepts: Equilibrium, Opportunity Cost, Black Money, Price, Direct and Indirect Taxes.
- Unit II** Concept of Utility, Marginal Utility, Law of diminishing marginal utility and equimarginal utility, Indifference curve analysis- Assumptions and Consumer's Equilibrium, Consumer's Surplus.
- Unit III** Demand and Supply: Laws of Demand and Supply, Factors affecting demand and supply, Market demand and supply curve, Price determination amidst shift in demand and supply curves, Elasticity of demand and its Application, Income elasticity of demand, Demand Forecasting: level of forecasting and overview of methods.
- Unit IV** Theory of Production: Production function, Short run law of Production; production with one variable input, Law of Diminishing Returns, Long term Law of Production; Production with two variable input, Isoquant Curves and their properties.
- Unit V** Market Structure: Classification of Markets, Revenue and Cost curves, Price and output under perfect competition, Monopoly and Monopolistic competition, Introduction to Oligopoly.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand the economics activities.
- The relationship of economics activities with policy framework.
- Take better managerial decisions.

Suggested Readings:

1. Ahuja, H. L.(2002).*Principles of Microeconomics*, (21 ed), New Delhi, S.Chand.
2. Ahuja, H. L. (2007). *Advanced economic theory: Microeconomic analysis* (20 ed), S. Chand.
3. Case & Fair (2007), *Principles of Economics*, (8 ed) New Delhi, Pearson.
4. Hornby, W., Gammie, R., & Wall.s, (2001), *Business Economics*, (2 ed) Financial Times Management.
5. [Dholakia R. H](#) & OZA, A.N. (2012), *Micro Economics for Management Students*, (10 ed), Delhi, Oxford University Press.

Suggested E-Learning Material:

1. Agrawal, D. (2017, Mar 8). *Indifference Curve*. Retrieved from Youtube: https://www.youtube.com/watch?v=3l_rYca4eio.
2. Econ (2012). *Cost*. Retrieved from: Guide:<http://www2.econ.iastate.edu/classes/econ301/jintanakul/Notes/Ch7.pdf>
3. Bhogal, S. (2018, June 04). *Income and Cross Elasticity*. Retrieved from Youtube: <https://www.youtube.com/watch?v=i7O4CriwvrY>.

Foundations of Marketing Management

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives

1. The objective of this course is to demonstrate and stimulate students to appreciate the various issues and activities involved in marketing management.
2. To provide an understanding of the underlying concepts, strategies and issues involved in exchange of products and services between the firm and markets.
3. To understand the distribution process, its types and factors affecting the choice of distribution channels.
4. To understand the promotion, mix and various components of promotion mix.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Course Contents:

- Unit I** Marketing Concept & Approaches of Marketing, Market planning, Marketing Environment, Marketing Mix, Concept of Market Segmentation, Targeting & Positioning.
- Unit II** Product Mix: Type of products, Product mix & product line decision, New-product development, Product life cycle, branding & Packaging decision.
- Unit III** Product Pricing: Pricing concepts, understanding price, Setting the price, Methods of pricing, Price Adaptations, Initiating and Responding to price changes.
- Unit IV** Distribution: Distribution channel, Types of channels of distribution Factors effecting choice of distribution channels, Channel Management.
- Unit V** Promotion: Promotion Mix, Objectives & Types of Advertising, Major Advertising Media, Integrated Marketing Communication concepts, Meaning Objective & Tools of Sales Promotion, Basic concepts of Personal Selling & Publicity, Marketing 3.0.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand various issues and activities involved in marketing management
- Understand different concepts, strategies involved in exchange of products and services between the firm and the markets.
- Understand distribution process and distribution channels.
- Understand various components of promotion mix.

Suggested Readings:

1. Kotler Philip, Keller Kevind Lane, Koshy Abraham and Jha Mithileshwar (2013). *Marketing Management. A South Asian Perspective* (14 ed.), New Delhi, Pearson education.
2. Ramaswamy and Namakumari (2013). *Marketing Management* (5 ed.) New Delhi: McMillan.
3. Gandhi C. J (1985). *Marketing a management introduction* (1 ed.), New Delhi, Tata McGraw Hill.
4. Stanton William J (1984). *Fundamentals of Marketing* (10 ed.), New Delhi, MC Graw Hill.
5. Etzel M.J. Walker B.J. and Stanton William J (1994). *Marketing Concept & Cases Special Indian Edition* (10 ed.), New Delhi, Tata Mc Graw Hill.
6. McCarthy and Perreault (2002). *Basic Marketing, A Global Marketing Approach* (15 ed.), New Delhi, Tata Mc Graw Hill.

Suggested E-Learning Material:

1. Prachi, J. (2016). Classification of Advertising. Retrieved from Managment Study Guide: <https://www.managementstudyguide.com/classification-of-advertising.htm>
2. Evan, C. (2014, May). *Pricing Strategies*. Retrieved from: https://www.youtube.com/watch?v=4t_MEO_la_k
3. Alanis Business Academy (2016, November). *The product Mix*. Retrieved from : <https://www.youtube.com/watch?v=9y65-JDDifM>
4. Tim, F. (2012, March). *Marketing Concept*. Retrieved from <https://www.youtube.com/watch?v=5DfqPccGUgc>

Macro Economics for Managers

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the meaning of Macro Economics and its relation with Microeconomics.
2. Develop the knowledge about the financial markets and Banking system in India.
3. To understand the supply of money and inflation, tools, latest trends monetary, fiscal and globalization policies.
4. To understand perspective of international trade and the concept and significance of various institution like WTO, IMF, WB, and ADB.
5. To understand the structure, features and trends of Indian economy.

Note: The paper will contain ten questions having two questions from each unit candidates will be required to attempt five questions taking one question from each unit.

Course Contents:

- Unit I** Money, Banking and Employment: Overview of Macroeconomics and relationship with microeconomics, Concept and Measures of Money Supply and Inflation, Functions of Banks: RBI, Commercial Banks and Other Financial Institutions, Overview of Money Market and Capital Market.
- Unit II** National Income: Basic Concepts of National Income: GNP, NNP and GDP, Say's Law of Market, Income and Employment Determination: Keynesian Framework.
- Unit III** Macro Economic Policies: Monetary policy: Concept, tools and RBI's latest policy, Fiscal Policy: Concept, tools and Latest policy, Globalization: Policy Perspectives and Implications.
- Unit IV** International Trade: International Trade: Rationale and Gains, Free trade versus protection, Balance of Payments: Concept and Significance, Role of International Institutions- IMF, WTO, ADB, and WB.
- Unit V** Indian Economic Development: Structure and Features of Indian Economy, India's Service Sector: Role & Trends, Indian Agriculture: Emerging Challenges and Strategies, India's Industrial Development and Industrial Policy (latest policy only).

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand the perspectives of macroeconomics.
- Understand about the financial markets and banking system in India.
- Know about the concept and measurement of money supply and inflation.
- Understand latest trends and impact of monetary, fiscal and globalization policies.
- Know about the concept of international trade as well as significance of various institutions (WTO, IMF, WB, and ADB).

Suggested Readings:

1. Ahuja, H. L. (2017). *Macro Economic Theory and Policy* (20 ed.), New Delhi, S. Chand and Co.
2. Diwedi, D. N. (2015). *Managerial Economics* (8 ed.), New Delhi, Vikas Publications.
3. Dwivedi, D. N. (2015). *Macro Economics Theory & Policy* (4 ed.), New Delhi, McGraw Hill Education (India) Pvt. Limited.
4. Hajela, T. N. (2009). *Money and Banking Theory with Indian Banking* (8 ed.), New Delhi, Ane Books Pvt. Ltd.
5. Jhingan, M. L. (2016). *Macro Economic Theory* (12 ed.), Delhi, Vrinda Publication (P) Ltd.
6. Mishra, S. (2012). *Banking Law and Practice* (2 ed.), New Delhi, S. Chand and Co.
7. Ohri, V. K., & Jain, T. R. (2015). *Macro Economics*. (4 ed.) New Delhi, V.K. Global Publications.

8. Varshney, R. L., & Maheshwari, K. L. (2014). *Managerial Economics* (22 ed.), New Delhi, Sultan Chand & Sons.

Suggested E-Learning Material:

1. MSG. (2014). *Principles of Managerial Economics*. Retrieved from Managment Study Guide: <https://www.managementstudyguide.com/principles-managerial-economics.htm>
2. Mayank,K. (2018, September). *Theories of International Trade*. Retrieved from: <https://www.youtube.com/watch?v=uBp6secGhoE>
3. Economics on your tips (2016, August 22). *Concepts of National Income*. Retrieved from: <https://www.youtube.com/watch?v=95ijkT2vFJ4>
4. Jacob Clifford (2017, May 9). *Macroeconomics-Everything you Need to Know*. Retrieved from <https://www.youtube.com/watch?v=MKO1icFVtDc>

Foundation of Human Resource Management

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To provide the students with the basic knowledge of Human Resource Management frameworks and overall role of HRM in business,
2. To develop insight into the managerial skills required to effectively manage people in an organization, in order to achieve corporate goals successfully.
3. To advance students' cognitive skills and processes, their knowledge of theory and application, and develop their professional skills.
4. To strengthen the student's understanding how the alignment of human resources strategy within the organization as a whole.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Course Contents:

- Unit I** Human resource management- Meaning, Definition, Scope, Organization of human resource Department, Policies, Principles, Evolution of human resource management from personnel management.
- Unit II** Human resource planning- Meaning, Definition, Importance, Objectives and The factors influencing human resource planning, Demand forecasting techniques, Supply forecasting techniques
- Unit III** Recruitment-Definition, Purpose, Importance, Factors influencing recruitment, Process, Sources of recruitment. Selection-Meaning, role, process, Placement in organization.
- Unit IV** Training and development- Definition, Difference between training, education and development, Importance, Process, Learning principles, Methods of training.
- Unit V** Performance appraisal-Meaning, Definition, Process, Methods of performance appraisal, Performance appraisal errors.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Effectively manage and plan key human resource functions within organizations
- Proficiency in fundamental HR policies and practices that help to promote the organization's strategic goals
- Understand Human Resource Development.

Suggested Readings:

1. Gupta, Shashi K., & Joshi, Rosy. (2014) *Human Resource Management* (1 ed), New Delhi, Kalyani Publishers,
2. Rao, V.S.P. (2005) *Human Resource Management-Text and Cases*, (2 ed), New Delhi, Excel Books
3. Dessler, Gary. (2011) *Human Resource Management*, (13 ed.) New Delhi, Pearson
4. Ivancevich, John, M. (2016) *Human Resource Management* New Delhi (11 ed), McGraw Hill Education Pvt. Ltd.,
5. Pattanayak, Biswajeet. (2014) *Human Resource Management*, (4 ed.) New Delhi, PHI Learning Pvt. Ltd.,

Suggested E-Learning Material:

1. [Morris, S. \(2017, Feb 07\). Is Human Resource Management the Right Career for You?](#) Retrieved from Youtube: <https://www.youtube.com/watch?v=Jp7oM9mAIXQ>
2. Calicut University (2014). *Human Resource Management* Retrieved from: <http://www.universityofcalicut.info/cuonline/exnotif/ex5462.pdf>
3. E-HRM Web Guide. *Human Resource Management* Retrieved from: <http://panosa.org/wp-content/uploads/2015/01/resource1.pdf>
4. [Sommerlatte, S. \(2018, Nov 19\). Should Employees be Informed About the Assessment of Their Potential?](#) Retrieved from: <https://www.youtube.com/watch?v=CoDWJFKEhdc>.

Principles and Practices of Banking

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the basics of banking system of India.
2. To understand the functionalities associated with banking which affect the normal individuals' life.
3. To understand the banking operations and various norms related to banking instruments and negotiable instruments.
4. To provide the knowledge about credits, deposits and other important aspects related to retail banking.

Note: The paper will contain nine questions having a compulsory case study in any one unit. Candidates are required to attempt five questions taking at least one question from each unit. Case Study will be compulsory.

Course Contents:

- Unit I** Introduction to Indian Banking Structure, Legal Aspects of Banking: Definition, Licensing requirement of banks, Permitted and Prohibited Business, Capital requirement of Banks, Qualification of Board of Directors. RBI act 1934 and functions of RBI, Banking Regulation Act 1949.
- Unit II** Rates fixed by RBI: CRR, SLR, MSFR, MCLR, Repo and Reverse Repo rate, Call Rate. KYC & AML policy, Banking Ombudsman, Introduction to Basel Accord, Various Ratios of latest Basel Accord.
- Unit III** Retail Banking: Types of Deposits, Customers and Accounts. Account Opening in name of limited companies, clubs, associations, government departments, Trust and Co-Operative societies, Types of NRI accounts. FD Return to Depositors and Taxation issues (numerical Problems).
- Unit IV** Banker Customer Relationship: Legal Implications, Types of relationship, Obligation of banks, Precautions. Rights of banks: Type of lien, right to set off, concept-mandates, power of attorney, garnishee order and attachment order.
- Unit V** Negotiable Instruments: Key features, Cheque v/s bill exchange, crossing –Concept, Type, Endorsement-Concept, Type, CTS system of clearing and its importance, Holder and payer in due course. Banker's duties and responsibilities as paying banker and as a receiving banker, Electronic fund transfer: NEFT, RTGS, IMPS, ECS.

Learning Outcomes:

Upon completion of the course the student will be able to:

- To understand the banking operations.
- To advice and guide in basic banking operation.

Suggested Readings:

1. Gomez, C. (2011). *Banking and Finance Theory, Law and Practice* (1 ed.), New Delhi, PHI Learning.
2. Gopinath, M. N. (2017). *Banking Principles and Operations* (7 ed.), Mumbai, Snow White Publications.
3. IIBF. (2017). *Legal and Regulatory Aspects of Banking* (3 ed.), Chennai, Macmillan.
4. IIBF. (2017). *Principles & Practices of Banking* (3 ed.), Chennai, Macmillan.
5. IIBF. (2017). *Retail Banking* (3 ed.), Chennai, Macmillan.
6. Vinay Dutta, K. S. (2013). *Commercial Bank Management* (1 ed.), Delhi, Tata McGraw Hill.

Suggested E Learning Material:

1. Verma, N. (2018, September 27). *History of Banking in India in Brief*. Retrieved from Gradeup: <https://gradeup.co/history-of-banking-in-india-i-e02deb86-f4ac-11e5-b410-2f0cca4d3c07>.
2. MSG. (2014). *Case Study of the Indian Banking and Financial Services Industry using Strategic Tools*. Retrieved from Management Study Guide: <https://www.managementstudyguide.com/case-study-of-indian-banking-and-financial-services-industry.htm>.
3. Nishtha Pareek, M. D. (2018, Decemeber 1). *Emerging Trends in Banking*. Retrieved from <https://www.youtube.com/watch?v=gCBs313D46g>:

Basics of Financial Management

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To introduce the students to the basics of financial management.
2. To understand the role of financial manager to give them an input into various concepts.
3. To develop an understanding about techniques of financial analysis.
4. To understand the practicality of the capital structure planning, cost of capital, dividend policies and working capital.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Course Contents:

Unit I Overview of financial management, Principles, nature and scope of financial management, Profit maximization v/s wealth maximization, Stakeholder wealth maximization

Unit II Fundamental Valuation: Time value of money, Rationale, Future value of a single amount, Future value of an annuity, Present value of a single amount, Present value of an annuity, Concept of risk & return, Types of risk, Diversification, Concept and advantage

Unit III Financial Analysis- Techniques of financial analysis, Ratio analysis: advantages, Liquidity ratios, Turnover ratios, Profitability ratios, Leverage ratios

Unit IV Working Capital Management: Nature and concept, Factors influencing working capital, Computation of working capital, Leverage: Concept, DOL, DFL, DTL

Unit V Capital Budgeting: Meaning and importance, Cash flows v/s accounting profit, evaluation techniques – Pay Back Period, NPV, IRR, Cost of capital: basic concepts, measurement of specific costs- Cost of Equity and Debt

Learning Outcomes:

Upon completion of the course the student will be able to:

- Aware about capital structure and theories of capital structure.
- Understand the cost of capital in wide aspects.
- Understand working capital management

Suggested Readings:

1. Avadhani. (2010). *Financial Management (8 ed)*, New Delhi, Himalyan Publication .
2. Chandra. (2015). *Financial Management (11 ed)*, New Delhi, Tata McGraw Hill.
3. Jain, K. &. (2007). *Financial Management (7 ed)*, New Delhi, Tata McGraw Hill.
4. Kishore. (2016). *Financial Management (8 ed)*, New Delhi, Taxman.

Suggested E-Learning Material:

1. Helfert, A. (2001). Financial Analysis and Tools and Techniques. Retrieved from <http://alqashi.com/book/book17.pdf>.
2. Saha, D. (2019). Working Capital Management.ppt. Retrieved from <https://www.scribd.com/doc/98098428/WORKING-CAPITAL-MANAGEMENT-ppt>.

Advanced Human Resource Management

L	T	P	C
4	0	0	4

Max. Marks : 100

(CA: 40 + ESA: 60)

Course Objective: The course objective is to introduce students to the challenges that HR personnel faces in the ever changing business scenario. It offers guidance on how managers can use the HRM tools to enhance organizational effectiveness and make better human resource decisions.

Note: The paper will contain 10 questions having at least 2 questions from each unit. Candidates are required to attempt 5 questions in all taking at least 1 question from each unit.

Course Contents:

Unit I Role of HRM in the present economic environment, future of HRM, HRM- International and domestic, competencies of HR manager

Unit II Job analysis- definition, importance, process, methods of job analysis, Job description, job specification,
Job redesign- enlargement, enrichment and rotation
Job evaluation- meaning, methods, and process of job evaluation

Unit III Compensation- objectives, using pay to motivate employees, pay equity, compensation policy, Individual plans- time piece, differential wage rate

Unit IV Promotions-purpose, principles, types of promotion,
Demotion- meaning, causes, principles
Transfers-reasons, types of transfers
Separation- types and reasons for separation, retirement

Unit V Downsizing in organizations, work-life balance, HR policy manual.

Suggested Readings:

1. Flippo Edwin : Personnel management, Tata McGraw Hill.
2. Dessler Garry, Prentice Hall of India, New Delhi.
3. Decenzo David A., Robbins Stephen P.- Personnel/ Human Resource Management, Prentice Hall of India, New Delhi.
- 4.. Saiyadain Mirza: Human resource management, Tata Mc Graw Hill.
5. Dwivedi R.S.: Managing human resources and personnel management., Galgotia Publishing Co.
6. Aswathappa K., Tata Mc Graw Hill.
7. Mamoria C.B., Gankar S.V., Personnel management, text and cases, Himalaya Publishing House.

Application Software for Management

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. The main objective of this course is to provide students with the background to design, implement, and use database management systems
2. Provide an introduction of DBMS and their use;
3. Describe the main features and function of the DBMS;
4. Describe & Design of relational database and E-R diagrams;
5. To enable students to learn the concept of application software for business.
6. To work with basic application software tools like MS Excel, MS Access, Tally, Photoshop and its relevance in organizational functioning.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in taking at least one question from each unit.

Course Contents:

Unit I Organization of data in files, Introduction to Database and DBMS, Advantages and Disadvantages of Databases, Cases in Marketing, HR, Finance, Production etc.

Unit II Understanding Databases and its Environment, Understanding concept of Relational Model, Logical View of Data, Keys, Integrity Rules, Relationships, ER Model, Database Design, Normalization, SQL – DML & DDL.

Unit III Querying with QBE Grid, Creating and Customizing forms, Viewing data using forms, Exploring form Design Tools, Building forms, using Macros, Macro Window, Building Macros, Building Reports, Saving form as a report, Importing and Exporting Data.

Unit IV Features of Computerized Accounting, Company Creation, Alteration and Deletion of Company, Accounts Configuration: General Configuration, Accounts/Inventory Information Configuration, Classification of Accounts: Accounts group, Ledger Accounts, Hierarchy of Accounts, Reserved Accounts group, Contents of Reserved group, Account groups of balance sheet.

Unit V Graphics Environment : IDE, Creation of Files, Understanding Interface, Toolbox, Floating Palettes, Storing and Retrieving Files, Type Basics : Raster versus Vector Programs, Working with Types, Creating and Understanding Selection, Moving and Floating Selection, Flag Collage, Filling and Stroking Working in Layers, Clock Collage, Truck Collage.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand the use and basic designing of a database system
- Understand the concept of relational databases and normalization
- Design a database and run queries using MS Access
- Create ledger accounts and balance sheets using Tally
- Use Photoshop for simple image editing and creating collages.

Suggested Readings:

1. Greenberg, A. D. (2000). *Fundamental Photoshop 5.5* (1 ed.), New Delhi, Mc Graw Hill.
2. Nadhani, A. N. (2007). *Implementing Tally ERP 9* (1 ed.), New Delhi, BPB Publications.
3. Saxena, S. (2000). *MS Office 2000 for Everyone* (1 ed.), New Delhi, Vikas Publication.

Suggested E-Learning Material

1. Studios, S. (2018, March 24). *Adobe Photoshop For Absolute Beginners*. Retrieved March 2019, from Youtube: <https://www.youtube.com/watch?v=KfXSt4XLedc>
2. World, G. L. (2017, December 30). *Tally ERP 9 Basic Course for Beginners - Free Tally*. Retrieved March 2019, from Youtube: <https://www.youtube.com/watch?v=1d2y7J0gESM>

Personal Finance
Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand the concept of personal finance, personal financial planning process & personal financial statement analysis.
2. To understand the concept of retirement planning and estate planning.
3. To understand the concept of tax planning and investment planning
4. To understand the concept of financial literacy and role of regulators in promoting financial literacy.

Note: The paper will contain nine questions having a compulsory case study in any one unit. Candidates are required to attempt five questions in taking at least one question from each unit. Case Study will be compulsory.

Course Contents

Unit I Personal Finance: Introduction, Goals, Need, Personal Financial Statements, Personal financial planning process, Life cycle approach to financial planning, Components of financial plan, developing financial plan. Budgeting: Principles of Successful Budgeting, Spending money wisely, Time value of Money, careers in personal finance advisory.

Unit II Investment Avenues: Principles of successful investing, overview of securities markets, factors controlling investment returns, Types of investment options available to an individual investor, building successful investment portfolio.

Unit III Introduction to Bank and Banking services, Type of accounts, Types of deposits, KYC, Types of loans, deposit, credit and investment services offered by commercial banks, care while using mobile banking, mobile applications, internet banking etc.

Unit IV Insurance: Importance, need, principles of insurance, Types of life insurance, health insurance, Home & Liability Insurance. Estate Planning: Objectives of will and creating a valid will and power of attorney.

Unit V Retirement Planning: Principles, stages and steps in retirement planning, Tax planning: importance, PAN, Heads of Income, Tax saving under section 80C, Role of RBI, NISM, SEBI and others in promoting financial literacy in India.

Activities:

Understand the requirements for your Personal Financial Plan.

1. Develop and implement a budget.
2. Understand the joy of giving back to society.
3. How to use retirement planning calculator.
4. Using other financial calculators.
5. How to advise someone about financial planning process.
6. Proactive and reactive ways to deal with Investment frauds and low quality financial services.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand the requirements of Personal Financial Plan can develop and implement a budget.
- Use retirement planning calculators and other financial calculators.

- Understand Proactive and reactive ways to deal with Investment frauds and low quality financial services.

Suggested Readings:

1. Halan, M., (2018). *Let's Talk Money: You've Worked Hard for it, Now Make it Work for You.* (1 ed.), New Delhi, Harper Business
2. Mitra S. et al. (2018), *Financial Planning* (1 ed.), Sage Publications New Delhi
3. Mirashi, S., (2012). *I Can Do- Financial Planning.* (4 ed.), New Delhi: Academic Foundation
4. Preschool, IMS, (2015). *Investment Planning* (1 ed.), New Delhi, Tata Mc-Graw Hill
5. Gopinath, M. N. (2011). *Banking Principles and Operations.* (3 ed.), Mumbai: Snow white Publications.

Suggested E-Learning Material:

1. Kotak Securities (2019), Knowledge Bank, Retrieved from <https://www.kotaksecurities.com/ksweb/Research/Knowledge-Bank/Investment-Knowledge-Bank>
2. Halan M. (2019), *Let's Talk Money With Monika Halan: Financial Planning Ideas*, Retrieved from <https://www.bloombergquint.com/bqportfolio-videos/let-s-talk-money-with-monika-halan-financial-planning-ideas>, Courtesy BloombergQuint
3. Pareek, N., et al. (2018, December 1). *Emerging Trends in Banking.* Under Banasthali-MHRD NRC, Retrieved from <https://www.youtube.com/watch?v=gCBs313D46g>:
4. Purohit, H. (2015, October 13), Banasthali Vidyapeeth Presents the Bhartiya Model of Financial Literacy (BMFL), retrieved from https://papers.ssf.com/sol3/papers.cfrn?abstract_id=2673446
5. RBI. (n.d.). *Financial Education and RBI.* Retrieved March 1, 2019, from [rbi.org.in: https://rbi.org.in/fmancialeducation/home.aspx](https://rbi.org.in/fmancialeducation/home.aspx)
6. Sud, R. (2017, June 13). *Why India needs to work on financial literacy now more than ever.* Retrieved March 1, 2019, from [www.livemint.com: https://www.livemint.com/Opmion/f5xollOSPqxGWUdaWKVb8J/Why-India-needs-to-work-on-financial-literacy-now-more-than.html](https://www.livemint.com/Opmion/f5xollOSPqxGWUdaWKVb8J/Why-India-needs-to-work-on-financial-literacy-now-more-than.html)

Business Taxation
Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

1. To understand basic of direct as well indirect tax.
2. To understand income from various heads and their computations.
3. To understand various facets of indirect tax like GST.
4. To prepare income tax return of an individual and firm.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Course Content:

Unit I Income tax: - Introduction, Residential status of individuals, companies and exempted incomes, Introduction to income from salary, Concept of fringe benefit tax, Income from house property

Unit II Income from business & profession, Numerical problems on business & profession only.
Income from capital gains, Concept of securities transaction tax, Numerical problems on capital gains only.

Unit III Introduction to income from other sources, Important provisions related to deemed incomes and deductions from gross total income with emphasis on deductions related to business.

Unit IV Tax rates, Important provisions related to deduction of tax at source and advance payment of tax, Procedure of assessment of Individual, Concept of wealth tax.

Unit V Introduction to GST: Basics of Model, IGST, CGST, SGST, UGST laws, Levy of CGST, SGST in IGST, UGST.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand computation of income under various heads.
- Understand assessment of individual and firm.
- Practical orientation to direct as well indirect tax.

Suggested Readings:

1. Singhania, V.K., & Singhania, M. (2018). Students' Guide to Income Tax including GST. (61 ed.). New Delhi, Taxman Publication.
2. Mehrotra, H.C. (2018). Income Tax Law. (60 ed.), Agra, Sahitya Bhawan
3. Singhania, V.K., & Singhania, K. (2018). Direct taxes law and practice. (61 ed.), New Delhi, Taxman Publication.

Suggested E-Learning Material:

1. Clear Tax. (2019, Jan 30). *cleartax.in*. Retrieved march 1, 2019, from <https://cleartax.in/s/corporate-tax>: <https://cleartax.in/s/corporate-tax>
2. Dave, R. (2017, August 28). <https://economictimes.indiatimes.com/wealth/tax/how-to-calculate-short-term-and-long-term-capital-gains-and-tax-on-these/articleshow/60230745.cms>. Retrieved March 2019, from [economictimes.indiatimes.com](https://economictimes.indiatimes.com/wealth/tax/how-to-calculate-short-term-and-long-term-capital-gains-and-tax-on-these/articleshow/60230745.cms): <https://economictimes.indiatimes.com/wealth/tax/how-to-calculate-short-term-and-long-term-capital-gains-and-tax-on-these/articleshow/60230745.cms>
3. Ernst & Young Global Limited. (n.d.). <https://www.ey.com/in/en/services/ey-goods-and-services-tax-gst>. Retrieved March 1, 2019, from [www.ey.com](https://www.ey.com/in/en/services/ey-goods-and-services-tax-gst): <https://www.ey.com/in/en/services/ey-goods-and-services-tax-gst>
4. Income Tax Management. (2018). <http://incometaxmanagement.com/Pages/Taxation-System/Basic-Concepts-on-Tax-Systems-in-India.html>. Retrieved March 1, 2019, from [incometaxmanagement.com](http://incometaxmanagement.com/Pages/Taxation-System/Basic-Concepts-on-Tax-Systems-in-India.html): <http://incometaxmanagement.com/Pages/Taxation-System/Basic-Concepts-on-Tax-Systems-in-India.html>

Business Taxation

Max. Marks: 100
(CA: 40 + ESA: 60)

L T P C
4 0 0 4

Course Objectives:

5. To understand basic of direct as well indirect tax.
6. To understand income from various heads and their computations.
7. To understand various facets of indirect tax like GST.
8. To prepare income tax return of an individual and firm.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Course Content:

- Unit I** Income tax: - Introduction, Residential status of individuals, companies and exempted incomes, Introduction to income from salary, Concept of fringe benefit tax, Income from house property
- Unit II** Income from business & profession, Numerical problems on business & profession only.
Income from capital gains, Concept of securities transaction tax, Numerical problems on capital gains only.
- Unit III** Introduction to income from other sources, Important provisions related to deemed incomes and deductions from gross total income with emphasis on deductions related to business.
- Unit IV** Tax rates, Important provisions related to deduction of tax at source and advance payment of tax, Procedure of assessment of Individual, Concept of wealth tax.
- Unit V** Introduction to GST: Basics of Model, IGST, CGST, SGST, UGST laws, Levy of CGST, SGST in IGST, UGST.

Learning Outcomes:

Upon completion of the course the student will be able to:

- Understand computation of income under various heads.
- Understand assessment of individual and firm.
- Practical orientation to direct as well indirect tax.

Suggested Readings:

4. Singhania, V.K., & Singhania, M. (2018). Students' Guide to Income Tax including GST. (61 ed.). New Delhi, Taxman Publication.
5. Mehrotra, H.C. (2018). Income Tax Law. (60 ed.), Agra, Sahitya Bhawan
6. Singhania, V.K., & Singhania, K. (2018). Direct taxes law and practice. (61 ed.), New Delhi, Taxman Publication.

Suggested E-Learning Material:

5. Clear Tax. (2019, Jan 30). *cleartax.in*. Retrieved march 1, 2019, from <https://cleartax.in/s/corporate-tax>
6. Dave, R. (2017, August 28). <https://economictimes.indiatimes.com/wealth/tax/how-to-calculate-short-term-and-long-term-capital-gains-and-tax-on-these/articleshow/60230745.cms>. Retrieved March 2019, from [economictimes.indiatimes.com: https://economictimes.indiatimes.com/wealth/tax/how-to-calculate-short-term-and-long-term-capital-gains-and-tax-on-these/articleshow/60230745.cms](https://economictimes.indiatimes.com/wealth/tax/how-to-calculate-short-term-and-long-term-capital-gains-and-tax-on-these/articleshow/60230745.cms)
7. Ernst & Young Global Limited. (n.d.). <https://www.ey.com/in/en/services/ey-goods-and-services-tax-gst>. Retrieved March 1, 2019, from [www.ey.com:https://www.ey.com/in/en/services/ey-goods-and-services-tax-gst](https://www.ey.com/in/en/services/ey-goods-and-services-tax-gst)
8. Income Tax Management. (2018). <http://incometaxmanagement.com/Pages/Taxation-System/Basic-Concepts-on-Tax-Systems-in-India.html>. Retrieved March 1, 2019, from [incometaxmanagement.com: http://incometaxmanagement.com/Pages/Taxation-System/Basic-Concepts-on-Tax-Systems-in-India.html](http://incometaxmanagement.com/Pages/Taxation-System/Basic-Concepts-on-Tax-Systems-in-India.html)

सामान्य हिन्दी

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

अपेक्षित परिणाम

- भाषा के व्याकरणिक रूप, शुद्ध उच्चारण और मानक रूप के ज्ञान से संप्रेषण क्षमता विकसित हो सकेगी।
- वस्तुनिष्ठ मौलिक चिंतन और लेखन की प्रवृत्ति विकसित हो सकेगी।
- प्रयोजनमूलक हिन्दी विषयक ज्ञान में अभिवृद्धि होगी।
- पारिभाषिक शब्दावली एवं अनुवाद प्रक्रिया का ज्ञान हो सकेगा।
- चयनित निबंधों के लेखन से छात्राओं में अध्ययन प्रवृत्ति का विकास और मौलिक चिंतन की अभिवृद्धि हो सकेगी।
- निर्धारित पाठ के द्वारा पठन-पाठन प्रवृत्ति का विकास होगा।

निर्देश : इस प्रश्न-पत्र में आठ प्रश्न पूछे जायेंगे। परीक्षार्थी को किन्हीं पाँच प्रश्नों के उत्तर देने होंगे।

सामान्य हिन्दी

- शब्द विचार – शब्द के स्रोत, (उत्पत्ति, व्युत्पत्ति, प्रयोग व अर्थ के आधार पर)
- वाक्य के अंग, वाक्य के भेद (रचना और अर्थ के आधार पर)
- शब्द – शुद्धि, विराम चिह्न, वर्तनी प्रयोग।
- पर्यायवाची, विलोम, एकार्थक और अनेकार्थक शब्द।
- मुहावरे और लोकोक्तियाँ।
- प्रयोजनमूलक हिन्दी और व्यावहारिक हिन्दी

प्रयोजनमूलक हिन्दी के प्रकार

- प्रयोजनमूलक हिन्दी की शब्दावली
पारिभाषिक शब्दावली, अनुवाद प्रक्रिया, वैज्ञानिक एवं तकनीकी शब्द निर्माण।
- पत्र लेखन : कार्यालयी पत्र, वाणिज्यिक पत्र, शिकायती पत्र, प्रार्थना पत्र, बधाई पत्र।
- निबंध लेखन – चयनित निबंध
वनस्थली की शिक्षा प्रणाली, आपाजी के जीवन मूल्य और नैतिक शिक्षा, धर्म और मानव जीवन, भागवत् गीता का जीवन में महत्व, आधुनिक जीवन में तकनीक का प्रभाव
- निर्धारित पाठ – इतिहास से शिक्षा – पत्र साहित्य (जवाहर लाल नेहरू), राजेन्द्र प्रसाद – संस्मरण (महादेवी वर्मा)
- निर्धारित कविताएँ –
नीड़ का निर्माण फिर-फिर – हरिवंश राय 'बच्चन', कलम आज उनकी जय बोल – रामधारी सिंह 'दिनकर', हे ग्राम देवता नमस्कार – रामकुमार वर्मा

सहायक पुस्तकें –

- श्रीवास्तव, रविन्द्र, (2005), हिन्दी भाषा संरचना और प्रयोग, नई दिल्ली, राजकमल प्रकाशन।
- नन्दन, डॉ. वासुदेव, (2015), आधुनिक हिन्दी व्याकरण और रचना, राँची, भारती भण्डार।
- बाहरी, हरदेव, (1972), हिन्दी का व्यवहारिक व्याकरण, इलाहाबाद, लोकभारती प्रकाशन।
- सिंह, डॉ. विजयपाल, (2017), कार्यालयी हिन्दी, वाराणसी, विश्वविद्यालय प्रकाशन।

5. सिंह, रवीन्द्र प्रसाद, (2014), शुद्ध हिन्दी कैसे लिखें, राँची, भारती भवन।
6. नन्दन, डॉ. वासुदेव, (2015), हिन्दी व्याकरण और रचना, राँची, भारती भण्डार।
7. झाल्टे, दंगल, (2002), प्रयोजनमूलक हिन्दी, दिल्ली, वाणी प्रकाशन।
8. नारायण, शिव, (2016), प्रालेखन प्रारूप, कोलकत्ता, आवाज प्रकाशन।
9. प्रशासनिक शब्दावली, केन्द्रीय हिन्दी निदेशालय।
10. बैकिंग शब्दावली, आगरा, केन्द्रीय हिन्दी संस्थान।

ANALYTICAL LABORATORY PRACTICE

CHEMISTRY -

- (1) Preparation of Adhesives (Polymeric adhesive).
- (2) Preparation of Antiseptic Creams (Boric acid containing cream).
- (3) Preparation of Surfactants (Soap from oil, Preparation of Vim).
- (4) Extraction of some important Natural products from Plants (Caffeine from tea leaves).
- (5) Isolation of citric acid from lemon juice.
- (6) Estimation of Iron in food Stuffs.
- (7) Estimation of milk fats by Gerber's Method.
- (8) Estimation of milk protein contents.
- (9) Estimation of milk sugar, lactose by Benedict's quantitative method.
- (10) Volumetric estimation of Vitamin-C (L-ascorbic acid).
- (11) Synthesis of Dyes (Azo dyes).
- (12) Preparation of Analgesic Ointments (Non-staining iodine ointment, eg. Iodex).

(List of ALP Practical)

BOTANY -

1. Testing of adulterated foods
2. Preparation of different culture media
3. Sterilization
4. Isolation
5. Inoculation
6. Staining of microbes
7. Physical Properties of soil viz, pH, density and water retentives.
8. Qualitative analysis of nitrate, carbonate and replaceable base deficiency soil samples.

List of ALP Practical (Medical Pathology)

ZOOLOGY -

1. Blood group testing along with Rh factor
2. Counting of R.B.C and W.B.C
3. Haemoglobin estimation.
4. Hematocrit/PCV value
5. ESR
6. Blood pressure measurement
7. Pathological examination of blood for sugar, cholesterol & parasites.
8. Pathological examination of urine for sugar and albumin.
9. Preparation of Immune sera.
10. Differential W.B.C count.

List of ALP Practical

BIOTECHNOLOGY -

1. To test for adulteration in turmeric.
2. To test for adulteration in wheat flour.
3. To test for adulteration in ghee.
4. To test for adulteration in milk.
5. Description of plant identification.
6. To study vegetation by Quadrat method.
7. Determine of soil pH.
8. Qualitative analysis of nitrate, carbonate and replaceable base deficiency in soil samples.

9. Blood group testing and Rh factor.
10. RBC counting in blood samples.
11. WBC counting in blood samples.
12. Estimation of Hemoglobin.
13. To perform Differential Leucocyte Count (DLC).
14. Biochemical testing for protein and albumin.
15. Biochemical test for sugar and albumin in urine samples.
16. Demonstration of fermenter.
17. Encapsulation of zygotic embryo.
18. Determination of BOD.
19. Determination of COD.

INTRODUCTION TO COMPUTER PROGRAMMING

Objectives :

1. To prepare the students for life in a technological world where computing is all pervasive.
2. To understand the basics of computer programming.
3. To develop skills to systematically analyze a problem and formulate an algorithm for solving it on the computer.

Unit I Introduction to computer: Basic components and their functions, input output devices, concept about data and information, bits and bytes.

Unit II Number system (binary, octal, hexadecimal, decimal), binary arithmetic, simple concepts and theorems of boolean algebra, representation of numbers (integer, real, positive and negative numbers), representation of characters (BCD, ASCII & EBCDIC codes).

Unit III System software & Application software, Programming languages, conceptual understanding of assemblers, compilers, interpreter and operating system.

Unit IV Problem solving process, algorithm, flow chart, stepwise refining.

Unit V Program design: Data type, Program structure, Control flow (sequence, alternate, looping), designing simple programmes

Note: The course is to be taught with 'C' language.

Scheme of Examination

Continuous Assessment	30
Two periodical tests	20
One periodical tests	10
Annual Assessment	60
Theory	20
Practical	40
Practicals	25
Record	5
Viva Voce	10

ANALYTICAL LABORATORY PRACTICE-II

Biotechnology

ALP II

1. Blood group testing and Rh factor.
2. RBC counting in blood samples.
3. WBC counting in blood samples.
4. Estimation of Hemoglobin.
5. To perform Differential Leucocyte Count (DLC).
6. Hematocrit/PCV value
7. ESR
8. Blood pressure measurement
9. Biochemical test for sugar, albumin and ketone bodies in urine samples.
10. Pathological examination of blood for sugar, cholesterol & parasites.
11. Preparation of Immune sera.
12. Determination of BOD.
13. Determination of COD.

Botany

ALP II

1. Inoculation
2. Staining of microbes
3. Physical Properties of soil viz., pH, density and water retentive.
4. Qualitative analysis of nitrate, carbonate and replaceable base deficiency soil samples.

Zoology

ALP II

1. Blood pressure measurement
2. Pathological examination of blood for sugar, cholesterol & parasites.
3. Pathological examination of urine for sugar and albumin.
4. Differential W.B.C. count.

Chemistry

ALP II

1. Analysis of food stuffs (moisture, crude, protein, crude fat, crude fiber, mineral ash).
2. Analysis of milk contents (gravity, precipitation of casein, tests for calcium & phosphorus, total milk solids, milk fat, milk protein and milk sugar).
3. Analysis of fat (saponification value, iodine value and acid value).
4. Analysis of carbohydrates.
5. Preparation of urea-formaldehyde resin.
6. Preparation of phenol-formaldehyde resin (Bakelite).
7. Preparation of potash alum $[K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O]$.
8. Preparation of chrome alum $[K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O]$.

Parenthood and Family Relation

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Learning Outcomes:

Upon completion of the course students will be able to:

- Observe children at different age levels in different situations and record them
- Prepare age related teaching aids
- Evaluate ,modify and compose age related printed materials / songs /and stories
- Plan and organize play activities / games, role plays, parties/ get together for children of different age groups

Note : The paper will contain Eight questions in all. Candidates are required to attempt any five.

Content

- Preparing for parenthood:
 - Personal readiness and understanding the responsibilities of becoming a parent
 - Pre and post parenthood health issues and concerns - Management of reproductive health issues
- Antenatal, natal and postnatal care: Health, nutritional and emotional
- Infant care practices: feeding, weaning, toilet training, hygiene, sleep and rest
- Milestones of developments and role of parents as facilitators
- Effective parenting skills:
 - Disciplinary techniques and their impact
 - Strategies for positive parenting
 - Handling behavioural problems such as sibling rivalry and aggression
- Significance of family harmony in changing society:
 - fostering positive inter personal relationships family conflict and resolution

Learning Experiences :

1. Observing children at different age levels in different situations through Field Visit
2. Recording observations, including Anecdotal records on Individual differences in difference aspects of behaviour
3. Preparing age related teaching aid
4. Viewing educational films followed by group discussion
5. Case Studies
6. Evaluating printed materials – (Magazines, news papers, articles from the books)
7. Collecting, composing and modifying age related songs and stories
8. Introspecting one's own past childhood experiences, with parents, siblings, friends neighbours etc.
9. Planning and organizing play activities and games for children of different age groups
10. Group discussions/Buzz sessions
11. Role playing
12. Planning for celebrating festivals, parties, get together.

References :

1. Kulkarni, S. & Kulkarni, S. (1995). *Responsible Parenthood and Harmonious Families*. Jaipur: Classis Pub. House.
2. Minett, P.M. (2001). *Child Care and Development* (4th ed.). London, United Kingdom, UK: John Murray.
3. Santrock, J.W. (2008). *Life Span Development*. New York, NY: Tata McGraw Hill Companies, Inc.
4. Sharma, K. (1993). *Bal Vikas*. Agra: Star Publications.
5. Sharma, K. & Sharma, L. (1993). *Matrkala Evam Bal Vikas* (pancham sanskarn). Agra: Star Publications.
6. Sharma, N. (1999). *Understanding Adolescence*. New Delhi: National Book Trust.
7. Singh, V. (2012). *Matrkala Evam Shishu Kalyan* (5th ed.). Jaipur: Panchsheel Prakashan.
8. Hurlock, E.B. (1988). *Child Development* (6th ed.). New York, NY: Tata McGraw Hill Publishing Co. Ltd.

Suggested E-Learning materials

1. Childhood and Growing Up 1MB
<https://drive.google.com/open?id=0Bwk5FIsl0ctxTUNrazYzRFpSdms>
2. Guidance and Counseling 14MB
[https://drive.google.com/open?id=Bwk5FIsl0ctxSm5ERUNtTG1 KalU](https://drive.google.com/open?id=Bwk5FIsl0ctxSm5ERUNtTG1KalU)

Selected Writings of Great Authors - II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Objectives: The objectives of the course of study are:

1. To fulfill one of the objectives of Five Fold Education (Panch Mukhi Shiksha) of Banasthali University that is to educate girls in cultural traditions and preserving and inculcating the essential values and ideas of Indian Culture.
2. To develop an acquaintance with Indian Epics.
3. To develop analytical faculty and habit of self study and reading good books among the students.

Note : The paper will contain Eight questions in all. Candidates are required to attempt any five.

1. Students are required to select any one of the following books:

छात्रा को निम्नलिखित में से किसी भी एक पुस्तक का चुनाव करना है:—

'Fundamental Unity of India' - राधा कुमुद मुखर्जी— भारत की मूलभूत एकता— (हिन्दी (अनुवाद) — विपिन कुमार)

अथवा

Jawahar Lal Nehru - India Rediscovered (Abridged from the Discovery of India by C.D. Narasimhaiah. Professor of English, Maharaja's College, Mysore) Geography Cumberlege Oxford University Press.

अथवा

जवाहरलाल नेहरू, संपादक रामचन्द्र टंडन हिन्दुस्तान की कहानी (संक्षिप्त संस्करण) 1995 सस्ता साहित्य मंडल, नई दिल्ली

2. Students are required to select any one of the following books:

छात्रा को निम्नलिखित में से किसी भी एक पुस्तक का चुनाव करना है:—

प्रो. दिवाकर शास्त्री — गीता का नीति शास्त्र (हिन्दी/अंग्रेजी)

अथवा

डॉ. राधा कृष्णन् — श्रीमद्भगवत गीता (हिन्दी/अंग्रेजी)

अथवा

महादेव देसाई The gospel of Self Action or The Geeta (Hindi/English)

अथवा

विनोबा भावे— गीता प्रवचन

अथवा

गांधी — अनासक्ति योग

अथवा

विनोबा भावे — कुरआन सार (हिन्दी/अंग्रेजी)

अथवा

बाइबिल न्यू टेस्टामेंट — (हिन्दी/अंग्रेजी)

Indian Cultural Heritage

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Learning Outcomes:

After the completion of the course, students will be able to:

- Comprehend the importance of Culture as a specific field of heritage studies.
- Differentiate between the 'material' and 'non-material' aspects of cultural heritage.
- Recognize heritage as a 'process' as well as a 'product' of human activities.
- Appreciate the expansion and sustenance of Indian cultural heritage.

Note : The paper will contain Eight questions in all. Candidates are required to attempt any five.

Content:

- Cultural Heritage: Its Constituents and Significance
- Plurality of Cultures: Unity in Diversity
- Influence of Bhagvad Gita and Ramayan on Indian culture: Formation of Self and Social Values
- Contribution of Buddhism & Jainism: Ethics in Human Life
- Indigenous Knowledge System: Contributions to Education and Science
- Development of Composite Culture: Indo-Islamic Art, Bhakti and Sufism
- Interaction between Indian and Western Cultures: Education and Society
- Gandhi's views on Non-violence and Social Issues
- The Popular Culture: Food, Sports and Festivals
- The Making of Greater India: Expansion of Culture beyond Boundaries
- Constitutional Provisions for Sustenance of Cultural Values
- Conservation of Heritage: Issues and Measures

Recommended Books:

1. Basham, A.L. (2004). *The Wonder that was India*. England: Picador.
2. Bhattacharya, H. (Ed.). *Cultural Heritage of India* (in 5 Vol.). Calcutta: Sri Ram Krishna Mission.
3. Dinkar, Ramdhari Singh (1956). *Sanskriti ke Char Adhyay*, Allahabad: Lok Bharti Prakashan.
4. Kabir, Humayun (1947). *Our Heritage*, Bombay.
5. Nehru, J.L. (1981). *The Discovery of India*, J.L. Nehru Memorial Fund, Oxford University Press.
6. Nehru, J.L. (2001). *Hindustan ki kahani*, Sasta Sahitya Mandal Prakashan. (Hindi)
7. Pande, Susmita (1989). *Medieval Bhakti Movement: its History and philosophy*, Kusumawali Prakashan, Meerut.
8. Raza, M. (1961). *Introducing India*. Aligarh: Aligarh Muslim University.

Suggested E-Resources:

- Sri Aurobindo. (1953). *Foundations of Indian Culture*. New York, NY: The Sri Aurobindo Library. Retrieved from <https://archive.org/details/FoundationsOfIndianCultureAurobindo/page/n5>
- World Heritage Sites, Culture and Heritage, in 'Know India', An Initiative under india.gov.in, <http://knowindia.gov.in/culture-and-heritage/>

Women in Indian Society

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Learning Outcomes:

After the completion of the course, the students will be able to:

- Understand the basic concept of equality in mythological narratives.
- Develop an understanding of how identity formation of women in socio cultural and professional settings takes place and sustains in our social setting.
- Learn about life changing experiences and accomplishments of women role models in different fields and be inspired.
- Critically evaluate the contributions of women's universities in making of women leaders.

Note : The paper will contain Eight questions in all. Candidates are required to attempt any five.

Content:

- Women in Indian society: Concept of equality from mythological narratives to present perspectives.
- Identity formation of women: Socio-Cultural Identity, Professional Identity and impact of socialization in identity formation.
- Women's participation in Indian freedom struggle: Rani Laxmi Bai, Sarojini Naidu, ArunaAsaf Ali, Usha Mehta.
- Changing status of women in post independence India with context to social, education, political, economic, and health.
- Women role models in various fields such as (not limited to): Savitri Bai Phule (Education), Indira Gandhi (Politics), Mahashweta Devi (Literature), Kalpana Chawla (Science), Binny Yanga (Social Sector), P.T. Usha (Sports), Indira Nooyi (Corporate).
- Contribution of Women's Universities in nurturing women leaders in India.

Recommended Books

1. Ahuja, M. L. (2011). *Women in Indian Mythology*. Delhi: Rupa Publications.
2. Altekar, A. S. (1956). *Position of Women in Hindu Civilization*. Delhi: Motilal Banarsidas.
3. Desai, Neera. (2001). *Women in Modern India*. Delhi: National Book Trust.
4. Desai, Neera & Maitreyi. (1986) *Women and Society*. Delhi: Ajanta Publications.
5. Kumar, Radha. (1993). *The History of Doing; An Illustrated Account of Movements For Women's Rights And Feminism in India, 1800-1990*, Zubaan, New Delhi.
6. Bhalla, K. S. (2006). *Great Women of India*. Delhi: Kalpaz Publications.
7. Forbes, Geraldine. (2008). *Women in Independent India*. New York: Cambridge University Press.\

Suggested E-Resources

1. Women in Ancient India, Mythology
<http://www.legalservicesindia.com/article/1867/The-Socio-Economic-Status-of-Women-in-India-Ancient-to-Modern-Era.html>
<https://timesofindia.indiatimes.com/life-style/books/photo-stories/fascinating-women-from-mythology/photostory/58495315.cms>
2. Gender, Identity and Socialization
<https://blogs.unicef.org/evidence-for-action/what-is-gender-socialization-and-why-does-it-matter/>
https://www.jstor.org/stable/27520847?seq=1#metadata_info_tab_contents

Library Science - I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
1	0	0	1

Learning Outcomes:

- Students will be able to recognize and apply contribution of library science to other fields.
- Understand the principles for identification, selection, organization, evaluation, retrieval, dissemination, evaluation and preservation of information in all formats.
- Understand the basics of the documentation for the future researchers.

Note : The paper will contain Eight questions in all. Candidates are required to attempt any five.

Introduction to Library Science

- Five laws of library Science
- Reading habits (measures for its promotion)
- Types of libraries (Academic, Public and Special)

Sources of Information (Printed)

- Primary and secondary sources of information
- Reference sources (Types and uses)
- Dictionary (Lexicon, Glossary, Thesaurus)
- Objectives of a standard dictionary

Academic/Scientific Communication: Print form

- Books vs. Journals/Periodicals

Basic tenets of a books

Contents: text books and research books)

Authorship: (single, joint and multiple authors, editor)

Year: Edition, reprint

Publisher and Place of Publication

- Measure of a standard book

Journals

- Basic tenets of a journal
- Editors(s), Publisher, Periodicity, Volume, Issues no. Page.
- Types of Journals (based on the contents) Journal, Abstracting, Indexing
- Article vs. Research paper (Abstract, Index, Reference, Bibliography)

Academic writing

Research paper, Dissertation, Thesis, Project, Assignment

- Research paper (how to write a research paper)

Academic writing

Research paper, Dissertation, Thesis, Project, Assignment

- Research paper (how to write a research paper)

Nature of Research Paper: Considerations

- Limiting of subject,
- Selecting and organizing, (giving a title)
- Paraphrasing and Plagiarizing

- Revising and polishing
- Proof reading
- Supporting and documenting,
- Reference/ Footnotes,
- Bibliography

Academic documentation (Example: Reference/Research Paper)

- Objectives of Academic Documentation
- Steps:
- Finding materials : the card catalogue, standard bibliographical sources,
- Evaluating material : The audience, length and documentation, primary and secondary sources, publisher, author, value
- Taking notes : sample to be shown and made
- Making of a reference/Footnotes
- Making of a bibliography
- Making of a proof
- Making of a reference
- Making of common abbreviation used in notes

Library Science – I Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

- Cataloguing of books according to AACR-II of the following
- Single and joint authors
- Authors with collaborators (translator, editor, reviser, Commentator etc.)
- Edited books (Title as heading)

Semester Assessment

- Reference Paper & Note taking
- Proof Reading

Scheme of Examination

Theory

Practical: Cataloguing

Q. Catalogue 2 out of 3 titles

Note: The external examiner will conduct the viva-voce and the reference paper will be placed before the examiner. In the viva the question will be asked from the entire syllabus.

Suggested Books:

1. Rangnathan, S. R. (1957). *Five laws of library science*. Madras: Madras Library Association.
2. Swain, Nirmal K. (2000). Talking of Book Culture. In S. D.Vyas, Usha Pawan and Nirmal K. Swain (Eds). *Readings in Library Science* (pp.257-262)). Jaipur: Raj Publishing House.
3. Millward, Celia(1980). *Handbook for Writers*. Winston: Holt, Rinehart.
4. Irmscher, William F. (1981). *The Holt Guide to English*(3rd ed). Winston: Holt, Rinehart.
5. Girija Kumar & Krishan Kumar, (1990) .*Bibliography*(3rd rev. ed). New Delhi: Vikash Publishing House.
6. Sood, S. P. & M.R. Rawatni. Kriyatmak (1991). *Dewey Dasamlab Bargikaran*, Jaipur: R.B.S.A. Publishers.
7. Sood, S.P. (1996). *Kriyatmak AACR_II*. Jaipur:R.B.S.A. Publishers.
8. Modern Language Association (1990). *MLA Handbook for Writers of Research Papers*, Joseph Gibaldi Ed. (4th ed.) Washington, DC.

Suggested E-Resources:

Five Law of Library science

1. [https://babel.hathitrust.org/cgi/pt?id=uc1.\\$b99721&view=1up&seq=20](https://babel.hathitrust.org/cgi/pt?id=uc1.$b99721&view=1up&seq=20)
2. <https://www.nios.ac.in/media/documents/SrSecLibrary/LCh-004.pdf>
3. <https://www.librarianshipstudies.com/2017/09/five-laws-of-library-science.html>
4. <http://egyankosh.ac.in/bitstream/123456789/35226/5/Unit-4.pdf>

Reading habits (measures for its promotion)

1. <https://www.indiastudychannel.com/resources/145813-How-To-Promote-Reading-Habits-and-Skills-In-Children.aspx>
2. <http://www.iosrjournals.org/iosr-jhss/papers/Vol14-issue6/C01461317.pdf?id=6916>
3. <https://unesdoc.unesco.org/ark:/48223/pf0000013412>
4. <https://www.oxfordlearning.com/encourage-good-reading-habits/>

Types of libraries (Academic, Public and Special)

1. http://www.kuk.ac.in/userfiles/file/distance_education/Year-2011-2012/B_Lib%20lecture%201.pdf
<http://egyankosh.ac.in/bitstream/123456789/34898/1/Unit-2.pdf>

Library Science – II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
1	0	0	1

Learning Outcomes:

After completion of the course, students will be able to:

- Recognize and apply contribution of library science to other fields.
- Understand the principles for identification, selection, organization, evaluation, retrieval, dissemination, evaluation and preservation of information in all formats.
- Analyse and prepare solution to respond the needs of users.

Note : The paper will contain Eight questions in all. Candidates are required to attempt any five.

Syllabus

Source of Information

- Encyclopedia Types, Special Features and Evaluation
- Directory, Year book
- University Handbook, India: a reference annual
- Demonstration: New Encyclopedia Britannica

Academic/Scientific Communication: Non-print form

- Assemblage of Academicians
Seminar, Conference, Workshops, Symposium (National, Regional and local)
 - The functional aspect of the assemblage (detail discussion)
- How to make effective an oral presentation
 - Preparation:- achieving Focus, Determining the goal and objective, Summery, developing a title
 - Organizing the presentation: - Selecting and arranging the mail points, Arrangement patterns of an informative presentation.
 - Outlining the body of the presentation:-
 - Preparing introductions, conclusions and connectives, attention step orientation step, concluding step and making connections
 - Using languages effectively:- Attributes of information conversational style
 - Achieving speaking excellence:-
 - Visual aids:- choosing means of displaying information
 - Conclusion

Library Science – II Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Classification of books according to DDC-19th ED

(Only T-1 and T-2)

- **Compilation of Bibliography with catalogue cards (50 documents: 30 books + 20 journals)**
- **Seminar Presentation**

Scheme of Examination

Theory

Practical:

Practical paper will be in following two parts

Classification

Q.1 Classify 2 titles out of 3 based on index and schedule

Q.2 Classify 4 titles out of 6 based on T-1 and T-2

Note: The external examiner will conduct the viva-voce. In the viva the questions will be asked from the entire syllabus.

Suggested Books:

1. Rangnathan, S. R. (1957). *Five laws of library science*. Madras: Madras Library Association.
2. Swain, Nirmal K. (2000). Talking of Book Culture. In S. D. Vyas, Usha Pawan and Nirmal K. Swain (Eds). *Readings in Library Science* (pp.257-262). Jaipur: Raj Publishing House.
3. Millward, Celia (1980). *Handbook for Writers*. Winston: Holt, Rinehart.
4. Irmscher, William F. (1981). *The Holt Guide to English* (3rd ed). Winston: Holt, Rinehart.
5. Girija Kumar & Krishan Kumar, (1990). *Bibliography* (3rd rev. ed). New Delhi: Vikash Publishing House.
6. Sood, S. P. & M.R. Rawatni, Kriyatmak (1991). *Dewey Dasamla Bargikaran*, Jaipur: R.B.S.A. Publishers.
7. Sood, S.P. (1996). *Kriyatmak AACR_II*. Jaipur: R.B.S.A. Publishers.
8. Modern Language Association (1995). *MLA Handbook for Writers of Research Papers*, Joseph Gibaldi Ed. (4th ed.) Washington, DC.

Suggested E-Resources:

1. Sources of information

<http://www.lisbdnet.com/sources-of-information/>

2. Encyclopedia

<https://en.wikipedia.org/wiki/Encyclopedia>

3. Seminar

<https://foodsci.rutgers.edu/gsa/SeminarGaudelines.pdf>

4. Encyclopedia Britannica

https://en.wikipedia.org/wiki/Encyclop%C3%A6dia_Britannica

5. Conference

<https://evenues.com/event-planning-guide/what-is-a-conference>

6. Organizing the Presentation

<http://successfully-speaking.com/blog/2016/9/3/organize-your-presentation>

Basic Dress Making

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

Upon completion of the course students will be able to:

- Understand basic essentials of clothing construction and process of garment making
- Use acquired garment construction skills for different age groups and figure types

Course Content:

- Equipment and supplies used in Clothing construction, their use and care, common defects in sewing and their remedies.
- Body measurements for different garments.
- Preparation of Fabric: Layout of paper pattern & cutting material, calculation of material required for different garments.
- Elements & Principles of design & their application on apparel.
- Selection of fabric: Suitability of different fabrics for various articles.
- Types of stitches- running, basting, back, hemming, overcasting, buttonhole, Types of seams- plain and its finishing, French, run and fell, lapped, types of decorative seams.
- Tucks, Pleats, Gathers, Smocking.
- Plackets: even hem, continuous wrap, kurta, placket, wrap and projection.
- Types of Yokes, Necklines and its finishing.
- Collars- Peterpan, Sailors, Shirt, Mandarin band, Sleeves- basic, puff, flared, Cape, Pockets- patch, bound, Well
- Embroidery stitches- running, chain, stem, satin, herringbone, buttonhole, mirror attachment and patch work.

Dress Designing

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

Upon completion of the course students will be able to:

- Select fabrics and other materials for different age groups
- Intelligently design and construct garments and accessories

Course Content:

- Drafting of basic blocks of children.
- Stitching of Baby layette.
- Drafting of Romper,
- Drafting of Shirt and Short.
- Drafting and stitching of Salwar Kameej, Blouse, Petticoat.
- Project work-Designing of a garment accessories and its construction.

Computer Fundamentals

Contact Hrs: Th: 1 hrs/week

Pr.: 2 hrs/week

Objectives:

1. To prepare the students for life in a technological world where computing is all pervasive.
2. To understand the basics of computer programming.
3. To develop skills to systematically analyze a problem and formulate an algorithm for solving it on the computer.

Note: Question paper is of 2 hours duration having 7 questions out of which any four are to be answered.

1. Introduction to computer: Basic components and their functions, concept about hardware and software, concept about data and information.
2. System software & Application software: Programming languages, conceptual understanding of assemblers, compilers, interpreter and operating system. Introduction to DOS and Windows.
3. Number system: binary, octal, hexadecimal, decimal, binary arithmetic, representation of characters (BCD, ASCII & EBCDIC codes).
4. PC Software: Word Processing: Creating and Saving Documents, formatting, Inserting Tables and Pictures, and Mail Merge, Spread sheet: Creating worksheet, Use of functions and Creating Charts., Introduction to Presentation Packages, Graphics and Animation packages.
5. Introduction to database: Concept of DBMS, Advantages and Disadvantages of DBMS, Applications of DBMS
6. Computer network: LAN, WAN, MAN, Internet, Internet Services: www, email etc.

LAB WORK

Lab No. Topic Practical

- 1-3 Dos Internal Commands : COPY, REN, DIR, DEL, CLS, TYPE, DATE, TIME, VER
- 4-10 Windows : Familiar with My computer, My Documents, Recycle Bin, Network Places icons, Search, Run, Calendar, Calculator, Notepad, Wordpad, Paint
- 11-16 MS Word : Menu Bar, Tool Bar, Fonts, Alignment, Insert -Page no, date time, table, header, Footer, Bullet, Numbering, Spell Check, Mail merge, Comment, Formula insert, Sorting
- 17-25 MS Excel : Cut, Copy & Paste, Paste Special, Insert- cells, row, column, worksheet, function, chart, Format cells, Data Sort, Spell check
- 26-30 Ms Power Point Slide layout, Slide color scheme, background, design template, new slide, comment, Insert - date, time, picture, sound, header, footer, Slide Show, Custom animation, Slide no, master slide, Slide design.

Computer Programming

Contact Hrs: Th: 1 hrs/week, Pr.: 2 hrs/week

Objectives:

1. To prepare the students for life in a technological world where computing is all pervasive.
2. To understand the basics of computer programming.
3. To develop skills to systematically analyze a problem and formulate an algorithm for solving it on the computer.

Note: Question paper is of 2 hours duration having 7 questions out of which any four are to be answered.

1. Programming Fundamentals: Program, Steps in program development, Algorithm and Flowchart.
2. Overview of C language- Structure of a program, data types, variables, constants, operators (arithmetic, logical, relational), expressions (arithmetic and logical), assignments. Conditional statements, Control statements.
3. Arrays: Single - Searching (linear, binary), Sorting (bubble) and Merging, Multi dimensional - matrix arithmetic (addition, multiplication).
4. Concept of pointers, pointer expression..
5. Functions, parameter passing (call by value, call by reference), recursion.
6. Structure, union and enumerated data types, concept of structured programming.

Text Book: Kanetkar Yashwant, Let us C, 3rd Edition, BPB Publication

LAB Work

Lab Topic Programs

1-5	Simple Programs	i) Arithmetic Calculation ii) Formula Based Calculation
6-12	Conditional Statements	i) Check odd-even, positive-negative ii) Calculation of Division, Rank of student iii) Solution of Quadratic Equations iv) Menu Driven Programs v) Programs using switch statement
13--18	Looping :	i) Sum of digits of number, reverse of number ii) Table Generation iii) Prime number checking, generation iv) Sum of various series, fibonnaci series, sin, cos, exp etc. i) Pattern Drawing
19-22	Programming with Single dimensional Arrays	i) Max, min & Average calculation ii) Linear Search\Binary Search iii) Bubble Sort iv) Merging

23-24	Programming with Multi dimensional Arrays	i)	Matrix Arithmetic (Addition, Subtraction, Multiplication)
25-27	Using Pointers and Functions:	i)	Factorial
		ii)	Swapping two values using call by reference
28	Recursion	i)	Factorial
29-30	Structure and Union	i)	Display Mark sheet of n students

Hangar Workshop

Significance of Safety Precautions	Familiarization with aircraft documents and Basic concept of Tools and ground handling
1. General Safety Precautions	1. On board documents
2. Basic concept of marshalling signals	2. Significance of aircraft documents
3. Human factor	3. Concept of ground handling and taxing, towing, mooring, parking area etc
4. Human factor	
5. Human factor	

Basic Radios

Unit I: Recapitulation of semiconductor Intrinsic and Extrinsic Semiconductor Physics including P-N diode, Diode Equation and Load Line Concept, Break down diodes, Zener Diode, Tunnel Diode, Light Emitting Diode, Varactor Diode, Photo Diode. Diode Applications: Clipping circuits. Comparators, Rectifiers, Capacitor Filters and Clamper circuit. Constant Voltage and Constant current Adjustable Regulated Power Supplies.

Unit II: BJT; Transistor current components, The Transistor as an Amplifier, CB configuration, Early Effect, I/O Characteristics, including ICBO & Circuit Considerations, Saturation region in detail. Typical Transistor Junction Voltage Values, CC Configuration, Photo transistor and Maximum Voltage Testing. Transistor Biasing and Bias Stabilization. Small signal low frequency Transistor model-Two Port devices & Hybrid Model, Analysis of Transistor Amplifier circuits using h-parameters & simple numerical. Cascading of the stages.

Unit III: FET-Operation and Characteristics of JFET, Enhancement & Depletion Mode MOSFET. Introduction to UJT and its applications

Unit IV: Feed back in Amplifiers: General theory of feedback. Effect of Negative Feed-back on Gain, Stability, Bandwidth, Noise, I/P & O/P Resistance, Different Feedback Schemes (Voltage series feedback in detail).

Unit V: Oscillators: Basic principles of Feed back Oscillators; Barkhausen criteria, RC & LC Oscillators (Hartley, Colpitt, Wein bridge, R-C phase shift oscillator). Derivation for frequency of Practical oscillators

Text books:

1. Millman Halkias, "Integrated Electronics," TMH Publications
2. Robert Baylsted, "Electronics Devices," PHI Publications

Reference book:

1. Malvino Leach, "Principle of Electronics," Tata McGraw Hills.

Meteorology I (PPL Level)

Unit 1: Aviation Meteorology: Physical basis of meteorology, Brief description of the composition and extent of the atmosphere, presence of water vapour, Definition of pressure, temperature and density, their relationship, variation with height, altimeter, Lapse rates, inversion, stability and instability (in very general terms)

Unit 2: General meteorological Phenomena: Winds: Winds and their relation to isobars, Buys Ballot's Law, Diurnal variation of winds, Land and sea breezes, Orographic, anographic, and katabatic winds, gusts and squalls; Clouds: International cloud classification, description, altitude and vertical extent, flying conditions associated with them; Precipitation: Formation of rain, drizzle, snow, sleet and hail; Thunderstorms: Formation of thunderstorms and their hazards to Aviation; Visibility: Factors affecting visibility, definitions of fog, mist and haze; Turbulence: Definitions of mechanical, thermal and resultant turbulence; Ice accretion: Types of ice accretion, Dangers of the effects of icing on air frames and engines.

Unit 3: Synoptic Meteorology: Structure of pressure systems, Weather conditions associated with different types of pressure systems such as tropical and extra – tropical depressions, Cyclones and anti – cyclones, Weather meteorological phenomena of special interest to aviators e.g. dust and sandstorms, North Wasters, tornadoes etc. (synoptic situations giving rise to them in very general terms), The effects of topography on winds, up an vertical currents over hills, cliff eddies etc., Flying conditions

Unit 4: Indian Climatology: Salient features of distribution of wind, rainfall, thunderstorm and fog. Observations of meteorological elements: Units, methods and equipment used on the ground to measure pressure, temperature, humidity, precipitation, cloud, upper winds, surface wind, visibility (in general terms)

Unit 5: Meteorological Organization: Meteorological organization for aviators in India, Brief description of Net works, types on meteorological offices, meteorological broadcast for aviation, Means of obtaining forecasts and reports, Meteorological codes and units QFE, QFF, QNH, METAR, SPECI & TAF

Navigation I (PPL Level)

Unit 1: Position and direction on the Earth's surface: *The shape of the earth:* Form of earth, its axis and poles; *Position on the earth:* Great and small circles, Rhumb line, Equator, Parallels of latitude, Latitude, Longitude, Meridian, Prime Meridian, Position expressed by latitude and longitude and grid co-ordinates; *Direction on earth:* Cardinal and quadrantal points, Degrees, Minutes and Seconds, Bearings, True and Magnetic, Variation; *Units of measurements:* Nautical mile, Statute mile, Yard, Foot, Inch, Kilometer, Centimeter, Conversion of one into another, Centigrade, Fahrenheit and conversion of one into other.

Unit 2: Aeronautical Maps and Charts: *Graticule:* Definition; *Scale:* Methods of indicating scale; *Relief:* Methods of showing relief on maps and charts; *Projections:* The problems of presenting a spheroidal surface on a plane surface (appreciation); *International Modified Polyconic, Mercator, Lambert Conformal conic projections:* Properties and uses of above projections, Conventional signs, Measurement of tracks and distances, Map orientation.

Unit 3: Magnetic Compass and Instruments: *Magnetism:* Properties of a magnet, Earth as a huge magnet; *Magnetic Compass:* Principle of a magnetic compass, Brief construction and uses of a 'P' type Compass, Unreliability during turns, Accelerations and decelerations errors, Reading and setting of headings, Purpose and meaning of Compass, Swinging, Purpose of Deviation Card; *Altimeter and Air Speed Indicator:* Principle of construction and errors, Basic Construction of VSI, Basic knowledge of Gyro Instruments

Unit 4: Time: Civil day, I. S. T. G. M. T. / U.T.C., month and year.

Flight Navigation: *Elements of Flight Navigation:* Heading true, magnetic, compass, Track – true, magnetic, Deviation, Air Speed –indicated, rectified, true, Wind Velocity, Ground Speed, Drift, Principle of triangle of velocities, Methods of calculating track error and correction to heading by the 1 in 60 Rule and by 5 and 10 – degree drift lines (not for Gliders Pilots), Corrections to E.T.A. (not for Gliders Pilots); *Flight Planning:* The preparation of flight plan for level flights and at constant airspeeds, Calculations of fuel requirements, (Not for Gliders Pilots); *Use of navigational computer:* solution of triangle of velocities, solution of time, speed and distance problem, conversion of nautical and statute miles and kilometer into one another.

Unit 5: Radio Aids: Direct and alternating current, Electromagnetic radiation (Appreciation only), Uses of various Radio Aids in air navigation (in general terms only), Basic knowledge of the following: NDB, VOR, ILS & DME

Regulations I (PPL Level)

Unit I: Aircraft Act, 1934: Chapter I, Section short title and extent, Definitions, Power to detain aircraft, Penalty for act in contravention of rule made under this Act, Penalty for flying so as to cause danger.

Unit II: Indian Aircraft Rules, 1937:

Part I – Extent, Definitions & Interpretations.

Part II – General conditions of flying (Rules 4 to 20)

Part III – General safety conditions (Rules 21, 24, 24A, 24C, 25, 25A, 25B, 26, 27, 28 & 29)

Part IV –Registration and marking of aircraft : change in ownership (Rules 33 & 34)

Part V – Personnel of aircraft as applicable to private pilots (Rules 38, 38A (1) (a), 38A (5), 38A (6), 38A (7), 39A, 39B, 42A & 47)

Part VI – Airworthiness : Minimum instruments & equipment (Rule 53), Period of validity of certificate of airworthiness (Rule 55).

Part VII –Radio Telegraphic Apparatus (Rule 63).

Unit III: Indian Aircraft Rules, 1937:

Schedule I – Prohibited Areas.

Schedule II – General :

Private Pilot's Licence – Validity, Renewal and Privileges.

Instrument Rating – Validity, Renewal and Privileges.

Schedule IV – (Excluding water operations and seaplanes), Rules of the Air.

Unit IV: Relevant contents of Aeronautical Information Publications

Relevant Notices to Airman

Relevant Aeronautical Information Circulars & CARs (Civil Aviation Requirements)

Air Traffic Control Services – Objectives & Divisions (Annex II to the Convention on International Civil Aviation).

Altimeter setting procedure.

Search and rescue Organisation and procedures in India.

Indian Aircraft Rules, 1920 (Part IX) – Rules 53, 54, 56, 60, 61 & 62.

Unit V: Indian Aircraft Act (Public Health) Rules, 1954

Part I

Part II (General Provisions)

Part III

Part IV

Notifications.

Technical General I (Airframes & Engines)

Unit I: Aerodynamics and theory of flight – Relationship between pressure, density and temperature of air in general terms, definition of aeronautical terms e.g. angle of attack, angle of incidence, dihedral, sweep back lift, drag, streamlining, stability (lateral, longitudinal and directional), forces acting on an aircraft in straight & level flight, climb and gliding.

Unit II: Aircraft – Purpose and use of aircraft components, like fuselage, main – planes, tail – plane, fin, under – carriage, shock absorbers, brakes, propellers, etc., knowledge of functioning of control surfaces, such as rudder ailerons, elevators, different high lift devices, such as flaps, slats etc.

Unit III:Engines – General knowledge of the working of an Aero – engine and its components; Instruments – Elementary knowledge of working of aircraft and engine instruments, such as altimeter, air speed indicator, turn and bank indicator, artificial horizon, RPM indicator, cylinder head temperature gauge, oil pressure gauge, manifold pressure gauge, fuel contents gauge, etc., elementary knowledge of electricity – meaning of electrical terms, e.g. volts, ampere insulation, fuses, circuit breakers etc., purpose of battery, generator, voltage, regulator etc.

Unit IV:Operating limitations – centre of gravity, its relation to aircraft performance, distribution and adjustment of load before and during flight, ballast, etc. Handling and Care – General precautions while starting, running up and closing down of engines – use of chocks, control locks etc.

Unit V: Preflight Inspection – External damage to aircraft and its control surfaces, movement of controls, removal of control locks, pilot – head covers, serviceability of equipment, safety belts, fire extinguishers, etc., starting and running up of engines, ground RPM, knowledge of causes of its oil pressure, loss of power, sputtering, mag-drop, vibrations etc.

Air Regulation - II (CPL Level)

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Aircraft Act, 1934: Chapter I, Section short title and extent, Definitions, Power to detain aircraft, Penalty for act in contravention of rule made under this Act, Penalty for flying so as to cause danger.

Unit II Indian Aircraft Rules, 1937:

Part I – Extent, Definitions & Interpretations.

Part II – General conditions of flying (Rules 4 to 20)

Part III – General safety conditions (Rules 21, 24, 24A, 24C, 25, 25A, 25B, 26, 27, 28 & 29)

Part IV – Registration and marking of aircraft : change in ownership (Rules 33 & 34)

Part V – Personnel of aircraft as applicable to private pilots (Rules 38, 38A (1) (a), 38A (5), 38A (6), 38A (7), 39A, 39B, 42A & 47)

Part VI – Airworthiness : Minimum instruments & equipment (Rule 53), Period of validity of certificate of airworthiness (Rule 55).

Part VII – Radio Telegraphic Apparatus (Rule 63).

Unit III Indian Aircraft Rules, 1937:

Schedule I – Prohibited Areas.

Schedule II – General :

Private Pilot's Licence – Validity, Renewal and Privileges.

Instrument Rating – Validity, Renewal and Privileges.

Schedule IV – (Excluding water operations and seaplanes), Rules of the Air.

Unit IV Relevant contents of Aeronautical Information Publications

Relevant Notices to Airman

Relevant Aeronautical Information Circulars & CARs (Civil Aviation Requirements)

Air Traffic Control Services – Objectives & Divisions (Annex II to the Convention on International Civil Aviation).

Altimeter setting procedure.

Search and rescue Organisation and procedures in India.

Indian Aircraft Rules, 1920 (Part IX) – Rules 53, 54, 56, 60, 61 & 62.

Unit V Indian Aircraft Act (Public Health) Rules, 1954

Part I

Part II (General Provisions)

Part III

Part IV

Notifications.

Text Book :

(1) Air Regulation, Vol I & II, Wg. Cdr. R.K. Bali; Sterling Book House, India

Meteorology - II (CPL Level)

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

- Unit I Aviation Meteorology:** Physical basis of meteorology, Brief description of the composition and extent of the atmosphere, presence of water vapour, Definition of pressure, temperature and density, their relationship, variation with height, altimeter, Lapse rates, inversion, stability and instability (in very general terms)
- Unit II General meteorological Phenomena:** Winds: Winds and their relation to isobars, Buys Ballot's Law, Diurnal variation of winds, Land and sea breezes, Orographic, anabatic, and katabatic winds, gusts and squalls; Clouds: International cloud classification, description, altitude and vertical extent, flying conditions associated with them; Precipitation: Formation of rain, drizzle, snow, sleet and hail; Thunderstorms: Formation of thunderstorms and their hazards to Aviation; Visibility: Factors affecting visibility, definitions of fog, mist and haze; Turbulence: Definitions of mechanical, thermal and resultant turbulence; Ice accretion: Types of ice accretion, Dangers of the effects of icing on air frames and engines.
- Unit III Synoptic Meteorology:** Structure of pressure systems, Weather conditions associated with different types of pressure systems such as tropical and extra – tropical depressions, Cyclones and anti – cyclones, Weather meteorological phenomena of special interest to aviators e.g. dust and sandstorms, North Westers, tornadoes etc. (synoptic situations giving rise to them in very general terms), The effects of topography on winds, up an vertical currents over hills, cliff eddies etc., Flying conditions
- Unit IV Indian Climatology:** Salient features of distribution of wind, rainfall, thunderstorm and fog. Observations of meteorological elements: Units, methods and equipment used on the ground to measure pressure, temperature, humidity, precipitation, cloud, upper winds, surface wind, visibility (in general terms)
- Unit V Meteorological Organization:** Meteorological organization for aviators in India, Brief description of Networks, types on meteorological offices, meteorological broadcast for aviation, Means of obtaining forecasts and reports, Meteorological codes and units QFE, QFF, QNH, METAR, SPECI & TAF

Air Regulation - II (CPL Level)

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Aircraft Act, 1934: Chapter I, Section short title and extent, Definitions, Power to detain aircraft, Penalty for act in contravention of rule made under this Act, Penalty for flying so as to cause danger.

Unit II Indian Aircraft Rules, 1937:

Part I – Extent, Definitions & Interpretations.

Part II – General conditions of flying (Rules 4 to 20)

Part III – General safety conditions (Rules 21, 24, 24A, 24C, 25, 25A, 25B, 26, 27, 28 & 29)

Part IV – Registration and marking of aircraft : change in ownership (Rules 33 & 34)

Part V – Personnel of aircraft as applicable to private pilots (Rules 38, 38A (1) (a), 38A (5), 38A (6), 38A (7), 39A, 39B, 42A & 47)

Part VI – Airworthiness : Minimum instruments & equipment (Rule 53), Period of validity of certificate of airworthiness (Rule 55).

Part VII – Radio Telegraphic Apparatus (Rule 63).

Unit III Indian Aircraft Rules, 1937:

Schedule I – Prohibited Areas.

Schedule II – General :

Private Pilot's Licence – Validity, Renewal and Privileges.

Instrument Rating – Validity, Renewal and Privileges.

Schedule IV – (Excluding water operations and seaplanes), Rules of the Air.

Unit IV Relevant contents of Aeronautical Information Publications

Relevant Notices to Airman

Relevant Aeronautical Information Circulars & CARs (Civil Aviation Requirements)

Air Traffic Control Services – Objectives & Divisions (Annex II to the Convention on International Civil Aviation).

Altimeter setting procedure.

Search and rescue Organisation and procedures in India.

Indian Aircraft Rules, 1920 (Part IX) – Rules 53, 54, 56, 60, 61 & 62.

Unit V Indian Aircraft Act (Public Health) Rules, 1954

Part I

Part II (General Provisions)

Part III

Part IV

Notifications.

Text Book :

(1) Air Regulation, Vol I & II, Wg. Cdr. R.K. Bali; Sterling Book House, India

Navigation - II (CPL Level)

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

- Unit I Position and direction on the Earth's surface:** *The shape of the earth:* Form of earth, its axis and poles; *Position on the earth:* Great and small circles, Rhumb line, Equator, Parallels of latitude, Latitude, Longitude, Meridian, Prime Meridian, Position expressed by latitude and longitude and grid co-ordinates;
- Unit II Direction on earth:** Cardinal and quadrantal points, Degrees, Minutes and Seconds, Bearings, True and Magnetic, Variation; *Units of measurements:* Nautical mile, Statute mile, Yard, Foot, Inch, Kilometer, Centimeter, Conversion of one into another, Centigrade, Fahrenheit and conversation of one into other.
- Unit III Aeronautical Maps:** *Graticule:* Definition; *Scale:* Methods of indicating scale; *Relief:* Methods of showing relief on maps and charts; *Projections:* The problems of presenting a spheroidal surface on a plane surface (appreciation);
- Unit IV Aeronautical Charts:** *International Modified Polyconic, Mercator, Lambert Conformal conic projections:* Properties and uses of above projections, Conventional signs, Measurement of tracks and distances, Map orientation.
Magnetic Compass: *Magnetism:* Properties of a magnet, Earth as a huge magnet; *Magnetic Compass:* Principle of a magnetic compass, Brief construction and uses of a 'P' type Compass, Unreliability during turns, Accelerations and decelerations errors, Reading and setting of headings, Purpose and meaning of Compass, Swinging, Purpose of Deviation Card;
- Unit V Instruments:** Altimeter and Air Speed Indicator: Principle of construction and errors, Basic Construction of VSI, Basic knowledge of Gyro Instruments

Text Books :

- (1) GSP - Navigations, 6th ed, R.B. Underdour Tony P., Wiley
- (2) GSP - Radio Navigation, Blackweel Publishing
- (3) GSP - Flight Instrumeats Automatic Flight Coution, Blackwell Publishing
- (4) GSP - Magnetises of coupass
- (5) GSP - Flight Planning
- (6) Oxford - Navigation General

Technical General - II (CPL Level)

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

- Unit I** Aerodynamics– Relationship between pressure, density and temperature of air in general terms, definition of aeronautical terms e.g. angle of attack, angle of incidence, dihedral
- Unit II** Theory of flight: Sweep back, lift, drag, streamlining, stability (lateral, longitudinal and directional), forces acting on an aircraft in straight & level flight, climb and gliding.
- Unit III** Aircraft–Purpose and use of aircraft components, like fuselage, main–planes, tail–plane, fin, under–carriage, shock absorbers, brakes, propellers, etc., knowledge of functioning of control surfaces, such as rudder ailerons, elevators, different high lift devices, such as flaps, slats etc.
- Unit IV** Engines – General knowledge of the working of an Aero – Piston engine and its components; Instruments – Elementary knowledge of working of aircraft and engine instruments, such as altimeter, air speed indicator, turn and bank indicator, artificial horizon, RPM indicator, cylinder head temperature gauge, oil pressure gauge, manifold pressure gauge, fuel contents gauge, etc.,
- Unit V** Elementary knowledge of electricity – meaning of electrical terms, e.g. volts, ampere insulation, fuses, circuit breakers etc., purpose of battery, generator, voltage, regulator etc.

Text Books:

1. FAA 15 A (Air Frame)
2. FAA 12 A (Power Plant)

Technical Specific-I (C-152) CPL Level

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : Following items are applicable only if the relevant systems, accessories etc. are fitted on the specific aircraft, engine, etc. The questions shall be cockpit oriented.

Unit I Airframe: General knowledge of the construction of the fuselage and stabilizing surfaces, General knowledge of the aircraft systems including hydraulic, electric, pneumatic, pressurization, instrument pressure and static, General knowledge of the operation of landing gear and its position indicators, brakes and tire pressure, also pressures (levels), The operation of the pressurization, temperature control humidity control, electronics, radar, auto-pilot, deicing, anti-icing, fire detecting, fire extinguishing and oxygen systems.

Unit II Engines and Propeller: Knowledge of the construction and operation of the engine and its components in general terms, Knowledge of the ignition system, fuel system, oil system, starter system in general terms, Knowledge of the functioning of types of the carburetor / injector, fuel pumps, oil pumps filters, boosters, superchargers, mixture control etc. fitted on the aircraft, Procedure for starting, idling, testing, fuel throttle operation and shutting down, precaution to be taken during these operations, operation of fire detecting and fire extinguishing systems, Knowledge of grades / rating of fuel and oil prescribed for use for the engine and precautions to be taken during replenishing, capacities of tanks, alternatives if any, Elementary knowledge of propellers, knowledge of their operation including pitch – changing mechanism

Unit III Instruments: General knowledge of functioning of the instruments and equipment installed in the aircraft, broad indications of their malfunctioning / unserviceability

Unit IV Operating Limitations: Speed limitations prescribed in the Flight Manual, e.g. diving, touch down, lowering the under – carriage, lowering flaps, flying through rough weather, etc. Weight limitations prescribed in the Flight Manual e.g. maximum weight for take off, maximum weight for touch down, weight distribution, zero fuel weight etc., Limitations on engine running, maximum RPM, maximum cylinder head and oil temperature, etc. Handling and Care, Knowledge of picketing, ground locking of controls, provision for protecting form damage while the aircraft is parked or stored.

Unit V: Safety precautions: Provision of emergency exists, procedures to be followed in case of power plant failure in air, fire detecting and extinguishing systems, life belts, rafts dinghies etc.

Pre-flight Inspection – External damage to the aircraft and its components, full throttle ground RPM, minimum oil pressure, maximum cylinder head & oil temperatures, minimum fuel pressure, broad indications of serviceability of shock absorbers, tires, skids, checking quantity of fuel and oil on board.

For aircraft whose AUW is 5700 kgs, or above separate exam may be held to ascertain the knowledge of flight performance and pilots operating handbook and the terms used therein.

Hanger Workshop-IV Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 6)

Aircraft and engine in details			
1	A/C cockpit demo and importance of radio equipment . Location and positions of antenna.	1.	Stability and control
2	Propeller and types of propeller	2.	Fuel system
3	Primary and secondary controls and surfaces	3.	Oil system
4	Axes of aircraft and control around the axes	4.	Ignition system

Technical General - III (CPL Level)

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

- Unit I** Operating limitations – centre of gravity, its relation to aircraft performance, distribution and adjustment of load before and during flight, ballast, etc.
- Unit II** Handling and Care – General precautions while starting, running up and closing down of engines – use of chocks, control locks etc.
- Unit III** Preflight Inspection – External damage to aircraft and its control surfaces, movement of controls, removal of control locks,
- Unit IV** Pilot – head covers, serviceability of equipment, safety belts, fire extinguishers, etc.,
- Unit V** Starting and running up of engines, ground RPM, knowledge of causes of its oil pressure, loss of power, sputtering, mag-drop, vibrations etc.

Technical Specific-II (C-172) CPL Level

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : Following items are applicable only if the relevant systems, accessories etc. are fitted on the specific aircraft, engine, etc. The questions shall be cockpit oriented.

Unit I Airframe: General knowledge of the construction of the fuselage and stabilizing surfaces, General knowledge of the aircraft systems including hydraulic, electric, pneumatic, pressurization, instrument pressure and static, General knowledge of the operation of landing gear and its position indicators, brakes and tire pressure, also pressures (levels), The operation of the pressurization, temperature control humidity control, electronics, radar, auto-pilot, deicing, anti-icing, fire detecting, fire extinguishing and oxygen systems.

Unit II Engines and Propeller: Knowledge of the construction and operation of the engine and its components in general terms, Knowledge of the ignition system, fuel system, oil system, starter system in general terms, Knowledge of the functioning of types of the carburetor / injector, fuel pumps, oil pumps filters, boosters, superchargers, mixture control etc. fitted on the aircraft, Procedure for starting, idling, testing, fuel throttle operation and shutting down, precaution to be taken during these operations, operation of fire detecting and fire extinguishing systems, Knowledge of grades / rating of fuel and oil prescribed for use for the engine and precautions to be taken during replenishing, capacities of tanks, alternatives if any, Elementary knowledge of propellers, knowledge of their operation including pitch – changing mechanism

Unit III Instruments: General knowledge of functioning of the instruments and equipment installed in the aircraft, broad indications of their malfunctioning / unserviceability

Unit IV Operating Limitations: Speed limitations prescribed in the Flight Manual, e.g. diving, touch down, lowering the under – carriage, lowering flaps, flying through rough weather, etc. Weight limitations prescribed in the Flight Manual e.g. maximum weight for take off, maximum weight for touch down, weight distribution, zero fuel weight etc., Limitations on engine running, maximum RPM, maximum cylinder head and oil temperature, etc. Handling and Care, Knowledge of picketing, ground locking of controls, provision for protecting form damage while the aircraft is parked or stored.

Unit V Safety precautions: Provision of emergency exists, procedures to be followed in case of power plant failure in air, fire detecting and extinguishing systems, life belts, rafts dinghies etc.

Pre-flight Inspection – External damage to the aircraft and its components, full throttle ground RPM, minimum oil pressure, maximum cylinder head & oil temperatures, minimum fuel pressure, broad indications of serviceability of shock absorbers, tires, skids, checking quantity of fuel and oil on board.

For aircraft whose AUW is 5700 kgs, or above separate exam may be held to ascertain the knowledge of flight performance and pilots operating handbook and the terms used therein.

Navigation-III (CPL Level)

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Time: Civil day, I. S. T. G. M. T. / U.T.C., month and year.

Unit II Flight Navigation: *Elements of Flight Navigation:* Heading true, magnetic, compass, Track – true, magnetic, Deviation, Air Speed –Calibrated, indicated, rectified, true, Wind Velocity, Ground Speed, Drift, Principle of triangle of velocities, Methods of calculating track error and correction to heading by the 1 in 60 Rule and by 5 and 10 – degree drift lines (not for Gliders Pilots), Corrections to E.T.A. (not for Gliders Pilots);

Unit III Flight Planning: The preparation of flight plan for level flights and at constant airspeeds, Calculations of fuel requirements, (Not for Gliders Pilots);

Unit IV Use of navigational computer: solution of triangle of velocities, solution of time, speed and distance problem, conversion of nautical and statute miles and kilometer into one another.

Unit V Radio Aids: Direct and alternating current, Electromagnetic radiation (Appreciation only), Uses of various Raids Aids in air navigation (in general terms only), Basic knowledge of the following: NDB, VOR, ILS & DME

Text Books :

1. GSP - Flight Plannin
2. GSP - Radio Aids
3. Oxford- Radio Aids
4. Oxford- Navigation General

Crew Resources Management

L T P C

4 0 0 4

Max. Marks : 60

(CA: 20 + ESA: 40)

Unit I: Introduction: Definitions, Scope, Objective, Concept of CRM and History of CRM

Unit II: Importance of safety, behavior of human being, environmental human error, Cabin crew role in CRM.

Unit III: Communication, leadership, situational awareness, briefing and De-briefing.

Unit IV: Training method and activity, success and failure of CRM training.

Unit V: Future of CRM, cockpit culture, prevention of crew related incident and accident, introduction to aviation medicine.

Books:

1. Pilot judgment and crew resource management, BY: Richard S. Jensen
2. CRM developer Handbook

Computer Applications for Mass

Communication Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical Exercises and Assignments: Microsoft Office: Word, Power Point and Excel, Corel draw: Features, basic use, creating a file, designing simple graphics, and creating simple layouts with text and vector and bitmap graphics.

Suggested Readings:

- Brebner, G. (2002), *Computers in Communication*, London, UK: McGraw Hill International
- Sinha.P.K. (2004), *Computer Fundamentals*, New Delhi, India: BPB Publications
- Rajaraman. V. (2001), *Fundamentals of Computer*, New Jersey, US: Prentice Hall
- D.P. Mukherjee. D.P. (2000), *Fundamentals Of Computer Graphics And Multimedia*, New Jersey, US: Prentice Hall
- Jaiswal, A. (2003), *Fundamentals Of Computer Information Technology*, Noida, India: Wiley India Pvt. Ltd

Suggested E-Learning Material:

Computer Fundamentals - by P.K.Singh Free PDF - EduTechLearners

<https://www.edutechlearners.com/computer-fundamentals-p-k-sinha-free-pdf/>

Peter Norton Introduction To Computers 7th Edition - DocPlayer.net

<https://docplayer.net/33338618-Peter-norton-introduction-to-computers-7th-edition.html>

Become a Master of Microsoft Office With These Free Training Videos

<https://www.makeuseof.com/tag/become-master-microsoft-office-free-training-videos/>

Print Media: Reporting and Writing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of the course, Student will be able to :

- Demonstrate their intellectual abilities to analyze the print media through group and discussion work.
- Evaluate current print media practices.
- Learn to work within the given deadline

Unit I News: Meaning and Definition; News Values, Types, Sources, News Gathering, News and information; Hard vs. Soft News, Difference between article, news, feature, Backgrounder, editorial.

Unit II News Writing: Types of News Stories; Essentials of News Writing (5Ws and 1H of news writing), News Story Structure- Inverted Pyramid: Importance and Various Kinds of Leads. Headline writing: Types & Functions.

Unit III News Reporting: Basics of News Reporting, Specialized reporting - Interpretative, Investigative and Development Reporting; Reporting for Newspapers; News Agencies and Magazines; Pitfalls and Problems in Reporting-Attribution, Off-the-record; Embargo Reviews - Book, Film, Theatre. Art of Interviewing – Kinds, Purpose, Technique; Reporting for Magazines.

Unit IV Reporters: Categories of Reporters, Special Correspondent, Qualities and Responsibilities of Reporter; **Reporting of Rural and other autonomous Bodies;**

Unit V Types of Writing: Features, commentary, editorial, Middles and letters to the Editors; Difference between features and articles.

Suggested Readings:

- A Manual for News Agency Reporters. Indian Institute of Mass Communication,
- Allied Publishers Pvt. Ltd., New Delhi.
- Agrawal, Veerbala Gupta, V.S. (2001) *Handbook of Journalism and Mass Communication*, New Delhi : Concept Publishing Co.
- Bandhyopadhyay, P.K. and Singh, Arora Kuldeep, *A Practitioners' Guide to Journalistic Ethics* : Published by Media Watch Group, Distributed by D.K.
- Delhi George, T.J.S. Editing, *A Handbook for Journalists*. Indian Institute of Mass Communication, New Delhi.
- Shrivastava, K.M., (2003) *News Reporting & Editing*, New Delhi : Sterling Publishers Pvt. Ltd.
- Saxena, Dr. Ambrish (2007) *Fundamentals of Reporting and Editing*, New Delhi : Kanishka Publishers and Distributors.
- Kamath, M.V. (2018) *Professional Journalism*, New Delhi : Vikas Publishing House.
- Lewis, James () *The Active Reporter*. New Delhi : Press Institute of India.
- MacDougall, Curtis D. (1938) *Interpretative Reporting*, New York : Macmillan.

Photo Journalism Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical Exercises/Assignments:

1. Outdoor Shoot:
 - i. Using Digital SLR and Mobile camera/ developing an idea for practice.
Making a Photo Feature on a Specific Topic by using Self-clicked Photographs with the help of Digital Camera.
 - ii. Photographs should be of Postcard Size. A photo feature comprises 10–16 Photographs.
2. Studio Photo Shoot: Shooting Exercise in Artificial Lights.
3. Photo Lab:
 - i. Use of Software for Modification of Pictures.
 - ii. Editing of Captured Images with the help of Photoshop
 - iii. Preparing a Softcopy of Photo Feature in CD.

Suggested Readings:

- *100 Days in photographs : pivotal events that changed the world*, Nick, Yapp, National geographic
- Sarkar, NN (2009) *Art and Print Production*, New Delhi : oxford university Press.
- Chandra, PK (2007) *visual communication and photojournalism*, New Delhi : Swastika publishers.
- Blackwell, Wiley. 2009) *Photojournalism and Today's News: Creating visual reality* : Loup Langton, Sussex.
- पंत, नवीन चंद्र (1990) *मुद्रण के तकनीक सिद्धान्त*, नई दिल्ली : तक्षशिला प्रकाशन।
- मिश्र, डॉ. माला (2010) *प्रसारण और फोटो पत्रकारिता*, नई दिल्ली : ज्योति फाउंडेशन।
- प्रभाकर, प्रो. मनोहर (2003) *फोटो पत्रकारिता*, नई दिल्ली : राधाकृष्ण प्रकाशन।

Print Media: Reporting and Writing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical Exercises/Assignments:

Reading of Newspapers in the Class Particularly the Front Page and the Local News Pages. Writing Reports on Civic Problems Incorporating Information from Civil Organizations Based on Interviews. Preparing questions for a specific interview. Preparing Stories – Crime, Weather, City life, Speech, Accident, Disaster, Court; (in Hindi & English) Election Issue for a Daily Newspaper. Opinion Writing-Criticism; Articles; Writing Reviews- Book, Film, Theatre Analysis-News, Articles Features. Scoops - Exclusives; Specialized Reporting – Science, Sports, Economics, Commerce, Gender; Conducting Interviews.

Radio Journalism and Production

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of the course, Student will be able to :

- Write and report the news stories for radio news bulletins of 5, 10 and 15 minutes duration.
- Produce and present radio programmes in different formats.
- Record, edit and mix of audio programmes using single track and multi-track audio software.
- Work as professionals in private/community FM radio stations in the country and abroad.

Unit I Radio as a Medium: Radio as a Medium of Mass Communication; Characteristics of Radio; Limitations of Radio; Types of Transmission: AM, SW and FM & DRM.

Unit II Radio Programme Formats: News, Music and Spoken words. Talks, Running Commentary, Vox-pop, Interviews, Discussions, features, Documentaries, Radio Play. Commercial Spots and Jingles.

Unit III Writing for the Ear: Introduction; Characteristics of spoken Words; Knowing your Audience; Developing your Style; Writing for Different Formats and Messages; Dramatizing Messages.

Unit IV Radio Production Technology: Introduction; Elements of Radio Productions; Acoustics; Sound Effects; Music; Types of Microphones; Recording, Editing & Mixing.

Unit V Radio News Presentation: News Anchoring – Important Guidelines; Breathing; Quality of Speech and Diction.

Radio Journalism and Production Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Recording and Editing Exercises in the Studio. OB Recordings; Writing Exercises; Operation & Handling of Audio Equipments; Interviews- Simulated and Actual; Research and Scripting of Radio Documentary/Feature/Drama; Production of Radio Discussions; Presentation of Various Types of Programmes; Production of Social Messages (max. 30 seconds). Production of Radio Documentary/Feature; Preparation of Audience Profile; End Product. News reporting; news writing; editing; news presentation; news packaging & producing radio news bulletin.

Suggested Readings:

- Style Book Air.
- Awasthy, GC (1965) *Broadcasting in India*, Bombay : Allied.
- Luthra, HK (1987) *Indian Broadcasting*, New Delhi : Publication Division.
- Mehra, Masani (1958) *Broadcasting and the people*, NBT, New Delhi.
- Mcleish, Robert (2005) *Radio Production* : Focal Press oxford.
- Thomson Rick (2010) *Writing for broadcast journalists*, New York : Routledge.
- Aspinall, Richard (1971) *Radio Programme Production: A Manual for Training*, UNESCO, Paris.
- Messere, Hausman Benoit & Wadsworth O' Donnel .2010) *Modern radio production : Production, programming and performance* : Boston.
- Keith, Michal C. (2010) *The Radio Station : Broadcast satellite and internet* : Focal Press, oxford.
- Paul Chantler & Peter Stewar (2003) *Basic Radio journalism*, Oxford.
- Boyd, Andre (1997) *Broadcast Journalism: Techniques of Radio and TV News (Media Manuals)*, Landon : Focal Press.
- Thomas, Pradip Ninan (2010) *Political Economy of communication in India, : The Good, the bad and the ugly*, Delhi : sage.
- Bandopadhyay, PK (2010) *Radio Communication at close Range* : BR Publishing Corporation.
- Paravala, Vinod and Malik, Kanchan K. (2007) *Other Voices: The struggles for community Radio in India*, New Delhi : Sage.
- Hendy, David (2000) *Radio in the Global Age*, Combridge : Polity Press.
- जमलोकी, डॉ, ओमप्रकाश (2002) आकाशवाणी एवं दूरदर्शन: उद्भव तथा विकास, नई दिल्ली : अरावली बुक्स इंटरनेशनल ।

Suggested E-Learning Material:

RADIO JOURNALISM AND PRODUCTION – SlideShare

<https://www.slideshare.net/KATAMUNEDINANI/radio-journalism-and-production-64273246>

NOTES ON RADIO TV JOURNALISM II | Ganeswar Prusty - Academia

http://www.academia.edu/4068242/NOTES_ON_RADIO_TV_JOURNALISM_II

FORMATS OF RADIO PROGRAMMES

<http://download.nos.org/srsec335new/ch11.pdf>

Writing for Radio - The Basics

<http://bolhyd.commuoh.in/wp-content/uploads/2014/10/writingforradio.pdf>

Introduction to Radio Systems

https://cdn.ttgtmedia.com/searchMobileComputing/downloads/radio_systems.pdf

Creative Writing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning Outcomes:

After the completion of the course, Student will be able to :

- Explore beyond News Writing.
- Conceptualize and develop the skill for Editorial Writing.
- Write the Columns
- Write in different formats

Unit I Beyond News Writing: Types and Areas Beyond News Writing; Necessity and Importance of Beyond News Writing; New Trends in Beyond News Writing.

Unit II Article and Essay: Definition and Difference. Writing skill and Important Points. Difference between Article and Feature; Types and Qualities of a Feature.

Unit III Significance of Editorial Writing: Ideas and Analysis in Editorial Writing; Editorial Writing and Campaigning; Special Occasions Articles: Definition, Necessity; Diary and News Letter.

Unit IV Column Writing: Definition and Types. Importance of Column Writing and Necessity. Art Reviews; Music, Dance, Drama, Film Review, Book Reviews; Sport Reviews. Economics Reviews.

Unit V Reportage Travel and Memories: Definition and Difference; Study of Important Travel Reportage; Importance of Reportage in Covering Leisure and Life Style, Social Science Studies; New Emerging Trends in Entertainment.

Creative Writing Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Reviewing a TV Programme; Film; Theatre; Critical Appreciation of Poetry; Novel; Play. Writing–Features; Articles; Profiles; Interview Stories. Writing a Script of a Play. Copy Writing for Advertisements

Suggested E-Learning Material:

Basics of News Writing

<https://www.slideshare.net/ArielDizon/basics-of-news-writing>

Writing for Print Media

<http://www.manage.gov.in/studymaterial/printmedia.pdf>

Fundamentals of news writing

http://www.zeepedia.com/read.php?fundamentals_of_news_writing_inverted_pyramided_style_telling_the_story_radio_news_reporting_and_production&b=80&c=27

The Art of Interviewing

<https://www.slideshare.net/SenseWorldwide/the-art-of-interviewing-28964742>

Creative Writing

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Beyond News Writing: Types and Areas Beyond News Writing; Necessity and Importance of Beyond News Writing; New Trends in Beyond News Writing.

Unit II Article and Essay: Definition and Difference. Writing skill and Important Points. Difference between Article and Feature; Types and Qualities of a Feature.

Unit III Significance of Editorial Writing: Ideas and Analysis in Editorial Writing; Editorial Writing and Campaigning; Special Occasions Articles: Definition, Necessity; Diary and News Letter.

Unit IV Column Writing: Definition and Types. Importance of Column Writing and Necessity. Art Reviews; Music, Dance, Drama, Film Review, Book Reviews; Sport Reviews. Economics Reviews.

Unit V Reportage Travel and Memories: Definition and Difference; Study of Important Travel Reportage; Importance of Reportage in Covering Leisure and Life Style, Social Science Studies; New Emerging Trends in Entertainment.

New Media Journalism

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I New Media Journalism: Meaning and Concept; History of Web Journalism in India; Terminology of Web Journalism; ICT and Media; Characteristics of Online Media, New World Information Order. Use of New Communication Medium (Internet, Mobile): Advantages, Limitations and Risk Factor Involved in it

Unit II Introduction to Internet, Web Browsers, Web Sites and Net Working, Home Pages, News Groups, Portal, Blog, E-Zines; Interactive Web Casts; Digital Story Telling Tools.

Unit III Writing for New Media: Writing for hypertext, hyperlinks, RSS, Video and Audio Clips and Graphics.

Unit IV Impact of Internet on Mass Media: Storing and Retrieval; Processing and Production; Presenting and Distribution and Access; Traditional v/s Cyber Journalism; do's and don'ts Cyber Crimes & Security: Types and Dimension Cyber Laws & Ethics and the difficulty in enforcing them

Unit V Ethics in Web Journalism, Cyber Laws in India: an Overview, Cyber Crimes; Citizen Journalism, Community Journalism; Convergence Journalism and Social Media; Types of Social Media; Need and Impact of Social Media; Study of Face book; Twitter; emails; SMS Media Digitalization; Media Convergence; Interactive TV; User Generated Content; Mobile Telephony; On-line Gaming.

New Media Journalism Lab

L T P C
0 0 4 2

Max. Marks : 100
(CA: 40 + ESA: 60)

To create and maintain Blogs; Analyze different elements and content of a News Website; Distinguish between News, Views, Opinions, and Advertisements.; Web publishing, learning HTML; Creating a simple Web page with links to text document; Graphics and Audio & Video document; Students in groups should create a dynamic website with each one given a different assignment regarding the components of website; Study of differences between print, web and electronic in terms of writing, Layout and Representation Techniques; Designing blogs (Writing, Articles, Features, Video clips, News, Stories, Poems, Photo Features) Content Writing.

Suggested Readings:

- Exploring Front Page 2002, Raghav Bahl, Cybertech.
- Flash MX: Virtual Classroom, Sahlin Doug, Dreamtech Press, New Delhi.
- Flash MX action script programming bible, Reinhardt Robert Lott Joey, Wiley dreamtech India P Ltd., Delhi
- BPB मल्टीमीडिया कोर्स, BPB
- Web Design Fundamentals Handbook, Daniel Gray, Dreamtech, Delhi
- Flash 5 Magic with Action Script, Emberton David J. Hamin J. Scott, Techmedia, New Delhi.
- Principles of Multimedia, Ranjan Parekh, the McGraw-hill.
- Claudette Guzan Artwick; Reporting and Producing for Digital Media; Surjeet Publications; Delhi
- John Vernon Pavlik: *New Media Technology* Allyn and Bacon, 1997 ISBN 020527093X
- Michael M. Mirabito, Barbara. Mogrenstorn: *Focal Press, 2000*, 4th edition ISBN 0240804295
- Ronal Dewolk: *Introduction to Online Journalism* Allyn and Bacon, 2001 ISBN

Public Relations and Corporate Communication

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Public Relations: Definition of Public Relations - principles, nature and scope; Types of Public functions of PR; Tools of PR; E-PR; Difference between PR, Propaganda, Publicity and Advertisement; Corporate Communication; Difference between Corporate communication & PR. Ethics of PR – IPRA, PRSI; Quality of PR.

Unit II Tools & Techniques: Tools and Techniques of Corporate Communication; News Release - Seven Point Formula; Media Relations - Press Conference and Press Tours; Internal and External PR Media - Corporate Film, Community relations and employee relations; Structure and functions of government and non-government Public Relations.

Unit III Qualities of PRO: Role of PR in Developing Countries; Role of PR in Educational and Research Institutions; PR in Rural Sector; Defense; Political and corporates; PR for Individuals.

Unit IV Event Management: Concept, Significance, Planning, Budgeting and Implementation; Strategies and Challenges.

Unit V PR Campaign: Finding a Problem; PR Campaign - Programme Planning, Evaluation; special information and political campaign: Research in PR; PR and law – Code of ethics; Emerging Trends in PR; PR and Crisis; Management – Case studies; Corporate Social Responsibilities.

Suggested Readings:

- जनसंपर्क सिद्धान्त और व्यवहार डॉ० सुशील त्रिवेदी, शशिकांत शुक्ला, मध्यप्रदेश हिन्दी ग्रंथ अकादमी।
- जनसंपर्क प्रशासन डॉ० लाल चंद, रचना प्रकाशन जयपुर।
- प्रभावी जनसंपर्क, डॉ० मनोहर प्रभाकर,, डॉ० संजीव भानावत, यूनिवर्सिटी बुक हाउस जयपुर।
- आधुनिक विज्ञापन, डॉ० प्रेमचंद पातंजलि, वाणी प्रकाशन, दिल्ली।
- विज्ञापन तकनीक एवं सिद्धान्त, नरेन्द्र सिंह यादव, राजस्थान हिन्दी ग्रंथ अकादमी।
- जनसंपर्क एवं विज्ञापन, डॉ० संजीव भानावत, जनसंचार केन्द्र राजस्थान विश्वविद्यालय।
- Effective Public Relation, Center and Cultip.
- Advertising and Public Relation, B.N. Ahuja, S.S. Chabra, Surjet Publication Delhi.
- The Principal of Public Relation, Horold Oxely, Kogan Sage, London.
- Applied Public Relation and Communication, K.R. Balan, Sultan Chand and Sons, Delhi.
- Basu, Anil, Public Relations: Problems and Prospects, Calcutta.
- Kaul, J.M. Public Relations. Allied Publishers, New Delhi.
- Mehta, D.S., Handbook of Public Relations. Allied Publishers, New Delhi.
- Sengupta, Sailesh, Management of Public Relations and Communication, Vikas Publishing House, New Delhi.
- Black, Sam, Practical Public Relations, Universal Book Stall, New Delhi.
- Ghosh Subir – Public Relations.

Advertising and Commercial Communication Lab

L T P C
0 0 4 2

Max. Marks : 100
(CA: 40 + ESA: 60)

Print Advertising Preparation – Copy Writing and Designing; Making Posters and Handbills, Newspaper and Magazine Advertisement; Planning and Execution of an Advertising Campaign; Writing Radio Spots and Jingles; Writing TV Commercials - Developing Script and Story Board; Planning and Execution of an Advertising Campaign.

Suggested Readings:

- Aakar, David A., Rajeev Batra and John G. Myers, Advertising Management, Prentice-Hall, New Delhi.
- Sengupta, Subroto, Brand Positioning, Tata McGraw Hill Publishing Co., New Delhi.
- Rege, G.M., Advertising Art and Ideas, Kareer Institute, Mumbai.
- Caples, John, Tested Advertising Methods, Harper & Bros, New York.
- William Wells, John Burnett, Sandra Moriarty, Advertising: Principles and Practice, Pearson Prentice Hall.
- Harriosn, Tony (Ed.), A Handbook of Advertising Techniques, Kogan Page, London.
- K. Chandrakandan, Noorjehan A.K. Hanif, N. Balasubramani, C. Karthikeyan.

Film Studies

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Unit I Indian Cinema: Evolution, New wave cinema, Regional Cinema, Documentary and Feature Films. Stalwarts of Indian Cinema.

Unit II Cinematography Act: Films Censorships and its relevance.

Unit III Indian and International Film Festivals: Film Awards

Unit IV Film review, appreciation and reports in different media.

Unit V New Trends and Pressures on Indian Cinema

Film Studies Lab

L T P C
0 0 4 2

Max. Marks : 100
(CA: 40 + ESA: 60)

Filmmaking: Production Stages:

- Idea Generation, Scripting, Story Boarding And Shooting Schedule
- 3 Short Films Based On Different Genre
- 2 Documentaries

Camera Handling and Operations:

- Various Shots And Angles
- Camera Moments
- Rule Of Third
- 180° Axis Rule

Lighting:

- 3 Point Lighting
- Use Of Reflector And Cutter

Editing:

- Sequencing the Raw Files.
- Video Transaction & Effects

Film Review

- Journalistic film review

Suggested Readings:

- How to Read a Film, James Monaco, Oxford University Press, New Delhi, 2007
- Bollywood: A Guide to Popular Hindi Cinema, Tejaswini Ganti, Routledge, New York, 2005
- An Introduction to Film Studies, ED. Jill Nelmes, Routledge Landon, 1996
- Documentary Storytelling, Sheila Curran Bernard, Focal Press, Oxford, 2011
- Encyclopedia of Indian Cinema, Ashish Rajadhyaksha and Paul willemen, British Film Institute London, 2000.
- Liberty and Licence in the Indian Cinema , Aruna Vasudev, Vikas, New Delhi, 1978
- सिनेमा और संस्कृति, राही मासूम रजा, वाणी प्रकाशन, नई दिल्ली, 2003.
- हिन्दी सिनेमा का सुनहरा सफ़र, संपादक – बद्री प्रसाद जोशी, सिनेवाणी प्रकाशन, बंबई, 1988
- फिल्म पत्रकारिता, विनोद तिवारी, वाणी प्रकाशन, नई दिल्ली, 2007
- हॉलीवुड बॉलीवुड, अनवर जमाल व सैबल चटर्जी, वाणी प्रकाशन, नई दिल्ली, 2006
- हिन्दी सिनेमा का समाजशास्त्र, जवरीमल्ल पारख
- फिल्में कैसे बनती हैं, ख्वाजा अहमद अब्बास
- हिन्दी सिनेमा का इतिहास, मनमोहन चड्ढा
- भारतीय सिने सिद्धान्त, डॉ. अनुपम ओझा
- Journals and Web Resources
- Journals of south Asian Cinema, Landon
- Cinemaya, Journals of Asian Cinema, New Delhi
- Cinema in India, Bombay: NFDC, 1987-1991.

Suggested E-Learning Material:

Basics of News Writing

<https://www.slideshare.net/ArielDizon/basics-of-news-writing>

Writing for Print Media

<http://www.manage.gov.in/studymaterial/printmedia.pdf>

Fundamentals of news writing

http://www.zeepedia.com/read.php?fundamentals_of_news_writing_inverted_pyramided_style_telling_the_story_radio_news_reporting_and_production&b=80&c=27

The Art of Interviewing

<https://www.slideshare.net/SenseWorldwide/the-art-of-interviewing-28964742>

Suggested E-Learning Material:

Brief history of Photography

<https://www.picturecorrect.com/tips/history-of-photography/>

Photography as medium of Mass Communication

<https://leica-academy.gr/en/the-revolutionary-role-of-photography-in-mass-communication/>

Photography as medium of Mass Communication

<https://www.photographytalk.com/en/photography-articles/2141-what-is-photography-mass-communication>

Sources of light: natural and artificial

<https://digital-photography-school.com/natural-versus-artificial-light-which-do-you-prefer-working-with/>

Color temperature, types of light

<https://lumicrest.com/colour-temperature/>

Types of light

<https://digital-photography-school.com/9-lighting-types-to-harness-improve-your-photography/>

Principles of photographic composition

<http://digicamhelp.com/taking-photos/advanced-techniques/composing-photos/>

<https://www.photographymad.com/pages/view/10-top-photography-composition-rules>

Photography for News paper and magazines

<https://www.all-about-photo.com/photo-publications/paper-photo-magazines.php>

Photo Journalism as A profession

https://learn.org/articles/Careers_in_Photojournalism_Your_Questions_Answered.html

Ethics of Photo Journalism

<http://www.mediahelpingmedia.org/training-resources/editorial-ethics/527-editorial-ethics-for-photojournalists>

Responsibilities of Photo journalists in different situations

<http://download.nos.org/srsec335new/ch28b-opt.pdf>

Qualities of Photo Journalists

<http://photographyschools.com/resources/top-10-qualities-of-a-great-photographer>

TV Journalism and Production

L T P C
4 0 0 4

Max. Marks : 60
(CA : 20 + ESA : 40)

- Unit I TV as a medium of Mass Communication:** Understanding the Medium - Nature and Language of TV; Formats and Types of TV Programs; TV News Script Format; Scripting for Fiction/Non Fiction.
- Unit II TV News Production:** Fundamentals of TV Reporting - Reporting Skills, Ethics for TV Reporting for TV. Types of Visuals, Structuring a TV news story: Anchor Leads, Voice over and PTC. Interview: Types of TV Interviews, Anchoring - Live Shows and Packaging.
- Unit III TV Program Production:** Stages of Production: Pre-Production, Production and Post-Production; The Production Personnel: Single Camera and Multi Camera Production; Use of Graphics and Special Effects. Developing a Video Brief. Live and OB coverage.
- Unit IV** Basics of video editing and Program Evaluation: Grammar and aesthetics of Video Editing; Types of Video Editing: Non-Linear Editing Cut- to-Cut, Assemble & Insert, On-line, Off-line Editing, Designing, Evaluation and Field Testing of Program.
- Unit V** Basic concepts of TV Animation and Graphics: Various software and their applications.

TV Journalism and Production Lab

L T P C
0 0 6 3

Max. Marks : 90
(CA : 30 + ESA : 60)

Preparation of a Video Brief; Idea Generation - Fiction and Non-Fiction; Developing an Idea into Story; Script and Story Board; Production Schedule; Budget; Floor Plan; Lighting Plan Shooting Script; Production of a Program; Post Production.TV news production and presentation. Packaging of TV news bulletin.

Suggested Readings:

- Ralph Donalds, Thomas Spann, Fundamentals of TV Production, Surjeet Publications, New Delhi
- Lynne S. Gross, Larry W. Ward, Electronic moviemaking, Wadsworth Publishing
- Neill Hicks, Screen writing, Michael Wiese Productions.
- Herbert Zettl, TV Production Handbook, Thomas-Wadsworth, learning
- Thomas D Burrows, Lynne S. Gross, Video Production, MC Graw Hill
- Jan R. Hakemulder, Broadcast Journalism, Anmol Publications, Ray AC de Jonge, PP Singh New Delhi
- Janet Trewin, Presenting on TV and Radio, Focal Press, New Delhi
- Stuart W. Hyde TV & Radio Announcing, Kanishka Publishers
- Andrew Boyd Techniques of Radio and Television News Publisher: Focal Press, India.

Communication Research

L T P C

4 0 0 4

Max. Marks : 60
(CA : 20 + ESA : 40)

Unit I Research Concepts: Meaning, Objectives, Significance and Types of Research. Research Process - the Steps Involved and Research Design.

Unit II Data Collection: Primary and Secondary Data; Observation Method; Interview Method; Collection of Data through Questionnaire; Collection of Data through Schedule; Content Analysis; Case Study Method.

Unit III Survey: Survey - Meaning, Characteristics and Types; Public Opinion Surveys, TRPs; Readership Survey, IRS, NRS, Election Related Survey - Opinion Poll and Exit Poll.

Unit IV Data Analysis and Report Writing: Writing a Proposal, Synopsis, Abstract for a Project; Processing of Data - Editing, Coding, Classification, Tabulation

Unit V Measures of Central Tendency: Mean, Median and Mode; Analysis and Interpretation of Data; Report Writing - Parts of a Report, Steps Involved; Measuring impact; Evaluation.

Suggested Readings:

- Stempel, Guide H. and Bruce Westley, Research Methods in Mass Communication, Prentice Hall, New Jersey.
- Berger, Arthur Asa, Media Research Techniques, New Delhi.
- Das, G. Social Survey and Research. Manu Enterprises.
- Emmert, Philip and William D. Brooks (Eds.) Methods of Research in Communication.
- Houghton Mifflin Co., Boston. Backstrom, Charles H. and Gerald D. Hursh Survey Research Northwestern University Press, Illinois.
- Wlikinson, T.S. and Bhandarar, P.L. Methodology and Techniques of Social Research. Himalaya Publishing House, Mumbai.
- Research Methodology, Ethods and Techniques, C.R.Kothari.
- Mass Media Research: an Introduction, Regers D. Wimmer and Joseph R, Dom Inide wade worth Pub. Company Belmount.
- Introduction to Mass Communication Research, Ralph. O.Nafziger and David M.Greenwood Press New York.
- Media Research Methods: Measuring audience reaction and impact, Barrie Gunter, Sage Publication - New Delhi.
- Research and Report Writing, P.Saravana Vel, V.K. Publishing House.
- Research Methodology: The discipline and its dimensions, Jai Narain Sharma, Deep & Deep Publication.

Community Media

L T P C
4 0 0 4

Max. Marks : 60
(CA : 20 + ESA : 40)

Unit I Community Radio: Concept, definition and Objectives; Origin and development in India; Structure and functioning, Role and responsibility of the Community.

Unit II Management: Involvement of Community. Motivation of volunteers and capacity building.

Unit III Community Television: Concept, definition and Objectives, Origin and development in India. Structure and functioning, Role and importance of the Community Television.

Unit IV Production: Programme formats, Content development, writing for Community Media. Presentation techniques.

Unit V Challenges and Issues: Sustainability (Financial, Resources, Training), Community Media Vs Main Stream Media.

Suggested Readings/Resources:

- How to do community radio, UNESCO
- www.mib.nic.in
- www.banasthali.org/communityradio
- Mass Communication in India, Keval J.Kumar, Jaico Publication - New Delhi.
- Broadcast Technology - A Review, Dr. H.O. Srivastava, Gyan Publishing House, New Delhi.
- Sharma, K.C., Journalism in India: History, Growth & Development, Regal Publications, New Delhi.
- Joshi Uma, Textbook of Mass Communication & Media, Anmol Publications[P] Ltd.,
- Ravindaran R.K., Handbook of Radio, Television & Broadcast Journalism, Anmol Publication, Delhi.

Indian Society and Culture

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Concept of Society: Inter-relation between person and society, socialization - concept and theory, social control and change.

Unit II Indian Social Structure: Stratification of Indian Society - Caste, Class and Community.

Unit III Dynamics of Indian Society and Diversity of Culture: Meaning, Definition and concept of Culture. Economic development and social mobility.

Unit IV Changing pattern of India Societies: Family, Marriage and Impact on Status of Women. Socio-economic changes and impact on different segments of society.

Unit V Current Social Issues: Gender discrimination, caste conflicts and power relations

Suggested Readings:

- Baran Stanley J and Denis K. Davis. 2009. *Mass Communication Theory: Foundation, Ferment, and Future*, 6th Edition. California, US: Wadsworth
- Kumar, Keval J 2010. *Mass Communication in India*. Mumbai: Jaico Publications.
- Greenspan, Anna. 2005. *India and the IT Revolution: Networks of Global Culture*. Plagrave Macmillan.
- Saith, Ashwani, M Vijaybaskar and V Gayathri. 2008. *ICTs and Indian Social Change: Diffusion, Poverty, Governance*, New Delhi: Sage Publication.
- Singhal, Arvind and Everett Rogers. 2006. *India's Information Revolution*. New Delhi: Sage Publications.
- Wasko, Janet and Vicent Mosco. 1992. *Democratic Communication in the Information Age*. Toronto: Garamond Press.
- Agrawal, Vir bala & Gupta, V.S. 2001 *Handbook of Journalism and Mass Communication*, Concept Publishing

Indian Society and Culture

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Concept of Society: Inter-relation between person and society, socialization - concept and theory, social control and change.

Unit II Indian Social Structure: Stratification of Indian Society - Caste, Class and Community.

Unit III Dynamics of Indian Society and Diversity of Culture: Meaning, Definition and concept of Culture. Economic development and social mobility.

Unit IV Changing pattern of India Societies: Family, Marriage and Impact on Status of Women. Socio-economic changes and impact on different segments of society.

Unit V Current Social Issues: Gender discrimination, caste conflicts and power relations

Suggested Readings:

- Baran Stanley J and Denis K. Davis. 2009. **Mass Communication Theory:** Foundation, Ferment, and Future, 6th Edition. California, US: Wadsworth
- Kumar, Keval J 2010. Mass Communication in India. Mumbai: Jaico Publications.
- Greenspan, Anna. 2005. India and the IT Revolution: Networks of Global Culture. Plagrave Macmillan.
- Saith, Ashwani, M Vijaybaskar and V Gayathri. 2008. ICTs and Indian Social Change: Diffusion, Poverty, Governance, New Delhi: Sage Publication.
- Singhal, Arvind and Everett Rogers. 2006. India's Information Revolution. New Delhi: Sage Publications.
- Wasko, Janet and Vicent Mosco. 1992. Democratic Communication in the Information Age. Toronto: Garamond Press.
- Agrawal, Vir bala & Gupta, V.S. 2001 Handbook of Journalism and Mass Communication, Concept Publishing

Economic Development and Planning in India

L T P C

2 0 0 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Meaning of Economic Growth and Development. Measures of Economic Development. Characteristics of Underdeveloped Economics. Prerequisites for Economic Development.

Unit II Interrelationship between environment and economic development. Global Environmental Issues. National efforts to reduce environmental problems. Concept of sustainable Development.

Unit III Economic Planning: Meaning, Need and objectives. Prerequisites of effective planning. Planning under Mixed Economy.

Unit IV Economic Planning in India: Strategies and Objectives. Salient features of current Five Year Plans.

Unit V Appraisal of economic planning in India. Changing Role of Public Sector.

Suggested Readings:

- Mishra, S.K and Puri, V.K: "Economics of Development and Planning: Theory and Practice." – Himalaya Publication.
- Dhingra, I.C.: "The Indian Economy: Environment and Policy: - S. chand Publication.
- Dutt, R. and Sundaram, K.P.M: "Indian Economy"- S. Chand Publication.

Communicative English

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Overt Transactional skills in spoken Discourse. Initiating in discourse; maintaining and terminating, discourse identifying & indicating the main points or important information in a piece of discourse.

Unit II Cohesion & Reference in Written & Oral Discourse through Lexical and Grammatical Devices: Repetition, Synonymy, Hyponymy, Antithesis, Apposition, Substitution, Ellipsis.

Unit III Rhetorical Devices: Enumeration, Listing, Time sequence, conjunction (Addition) Reinforcement Transitional Semantic Markers.

Unit IV Organizing Discourse: Planning and organizing information in expository language, recording information, distinguishing the main and the sub idea.

Unit V Operations on a Text Written & Oral: Extracting salient points to summarizing (Skimming, Scanning); Selective extraction; Expanding salient points into the summary; reducing the text.

Suggested Readings:

- Yule, George - "The Study of Language" Cambridge University Press (2010)
- Weiss, Edmond H.-"Writing Remedies: Practical Exercises for Technical Writing" Oryx Press (2000)
- Goddard, Angela-" The Language of Advertising" Rout ledge, (2005)
- Hutchinson, Tom and Alan Waters-" English for Specific Purposes" Cambridge U Press (1987)
- Mills. Sara -"Discourse" Rout ledge, (1997)
- MC Loughlin, Linda- "The Language of Magazines" Rout ledge, (2000)
- Cornblet, Sandra & Ronald Carter- "The Language of Speech and Writing" Rout ledge, (2001)
- Van Dijk A. Teun- "Discourse and Communication: New Approaches to the Analysis of Mass Media Discourse & Communication" Berlin: De Gruyter . (1985)
- Halliday, M.A.K & Rukaiyya Hasan- "Cohesion and Coherence Linguistic Approaches" Longman (1976)
- Gee, James Paul-"An Introduction to Discourse Analysis: Theory and Method" Rout ledge, (1999)
- Mapheson, Donald-"Media Discourses: Analyzing Media Texts" Tata Mc Graw Hill, (2005)
- Wahl, Karin, Jorgenson and Thomas Hanitzsch-"The Handbook of Journalism Studies" Rout ledge, (2009)
- Coulthard, M.-"An Introduction to Discourse Analysis London" Longman (1977)
- Coulthard, M & J.M. Sinclair- "Towards an Analysis of Discourse the English Used by Teachers & Pupils" OUP (1975)

Digital Photo Journalism Lab

LTPC

0 0 10 5

Max. Marks : 100

(CA : 40 + ESA : 60)

Exercises/Assignments (Group Production):

- Photo feature
- Audio Visual
- Special Effects

Radio Jockeying/Anchoring Lab

LTPC
00 105
ax. Marks : 100
(CA : 40 + ESA : 60)

Exercises/Assignments:

- Live Commentary
- Announcements
- Anchoring
- Calendar of Events
- One minute sound story
- Jingles
- Short feature

Contemporary Issues and Current Affairs

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit I Indian Foreign Relations: India's Foreign Policy; India's Relations with its Neighbors especially China, Pakistan, Sri Lanka, Bangladesh and Nepal; India's relationship with the developed and developing countries, role in various international organization and groupings.

Unit II India and Major Concerns: Rapid Urbanization; Major Poverty Alleviation Programs; Food Self-Sufficiency; Indian Industry, Agriculture, Health and Education.

Unit III Security Issues: India as a Nuclear Power; India's Defense; Criminalization of Politics and politicization of criminals; Naxalite Movement.

Unit IV Global Issues: Terrorism and Anti-terrorist Measures; Human Rights Issues; Gender Issues; Consumerism.

Unit V Current Affairs: Topical issues, concerns and debates.

Suggested Readings:

- Tapan Biswal, Human Rights Gender and Environment, Vina Books
- Prof. S.D. Muni Indian and Nepal , Konark Publisher,
- Madan Gopal, India through the Ages, Publication Division
- Muchkund Dubey, Political Issues
- Prakash Chander International Politics
- R.S. Yadav (ed.), India's Foreign Policy: Contemporary Trends
- J.N. Dixit, Assignment Colombo
- I.K. Gujral, Continuity and Change: India's Foreign, Policy (Mac Millan, India)
- Rajan Harshe & K.N. Sethi, Engaging the World: Critical Reflections on India's Foreign Policy (Orient Longman)
- S.R. Sharma, Indian Foreign Policy (Om Sons)

Communicative French

MM: 70

Learning Outcomes:

After the completion of the course, students will be able to:

- listen to short and simple texts on familiar topics or topics of interest with literal understanding.
- grasp and recall the main ideas and important details.
- express themselves on topics of interest in simple terms and structures.
- engage in brief conversations on familiar topics with relative fluency, with at least one participant.
- read with appropriate pronunciation, intonation, pitch and pace.
- read and understand texts they are familiar with, such as invitations, recipes, letters, posters, notices and advertisements.
- produce short narrative and other texts they are familiar with e.g. greeting cards and informal letters.

Course Content:

Unit-I a) les Articles (indéfini, défini, partitif)

b) Féminin, Pluriel (noms)

c) les Prépositions (10)

Unit-II a) les Pronoms (conjoint, disjoints)

b) les Pronoms relatif, interrogatif (15)

Unit-III a) les Adjectifs possessif, démonstratif

b) l'Adverbe (10)

Unit-IV a) le Présent de l'indicatif, impératif

b) le passé composé, l'imparfait

c) le futur proche, le futur simple (25)

Unit-V Comprehension

The passage will be based on the grammar covered in the prescribed lessons (Nouveau Sans Frontières-1, Unit I, II & III) (10)

Recommended Reading:

- Dominique, P., Girardet, J. & Verdalen, M. (1999) *Cahier d'exercices- Le Nouveau Sans Frontières-I* Paris : CLE
- Dondo, M. (1999) *Modern French Grammar*. New York: Oxford University Press
- *Le Robert and Nathan Conjugation of French verbs*. (1999) Paris: Nathan
- Gregoire, M. & Merlo, G. (1998) *Grammaire Progressive du français- A1* . Paris: CLE Internationale
- Charliac, L. & Motron, A.C. (1999) *Phonétique Progressive du français* Paris: CLE Internationale
- Dr. Pradip Kumar Seth, *A Primer on French Grammar*, Navjeevan Publication Rajasthan
- Dictionnaire de poche (2018) Larousse or Hachette

Suggested E-Resources:

WEB PORTAL- BBC French, Reverso online French- English dictionary

Following links could be referred to:

- For French Grammar-
- www.laits.utexas.edu
- Interactive exercises and online practice tests-

- [www.bbc.com>languages>french](http://www.bbc.com/languages/french)
- Oral and written comprehension and expression-
- [https://apprendre.tv5monde](https://apprendre.tv5monde.com/niveau/a1/a2) NIVEAU A1/ A2
- For correct pronunciation and accent –
- www.phonetique.free.fr
- For vocabulary building and translation work-
- www.reverso.net

Translation and Written Expression

MM:70

Learning Outcomes:

After the completion of the course, students will be able to:

- carry out translation of simple and short texts with the help of a bilingual dictionary.
- produce short narrative and other texts they are familiar with, using the vocabulary and grammar they have learnt.

Course Content:

Unit-I a) Translation of any one passage (out of 2) from French into English or Hindi

b) Translation of 10 sentences(out of 15) from French into English or Hindi (15+10=25)

Unit-II a) Translation of any one passage (out of 2) from English into French

b) Translation of 10 sentences(out of 15) from English into French (10+10=20)

Unit-III Short dialogue writing (one out of three choices) on the themes dealt within the syllabus (5)

Unit-IV Composition in 50-100 words (one out of three choices)

Topics for composition will be based on the following themes:

- i) votre ami/amie
- ii) votre maison
- iii) votre journée
- iv) votre université / votre professeur/ votre salle de classe
- v) votre famille
- vi) votre ville (10)

Unit-V Questions based on the text (Nouveau Sans Frontières -1; Unit I, II & III) (10)

Prescribed text:

Dominique, P., Girardet, J., & Verdalhen, M.(1999) *Le Nouveau Sans Frontieres-1*. Paris : CLE

Recommended Reading:

- Dominique, P., Girardet, J., & Verdalhen, M.(1999) *Cahier d'exercices- Le Nouveau Sans Frontieres-I* Paris : CLE
- Dondo, M. (1999) *Modern French Grammar* . New York: Oxford University Press
- Bulger, A. (1998) *New French with Ease*. Paris: Assimil
- *Le Robert and Nathan Conjugation of French verbs*. (1999) Paris: Nathan
- Gregoire, M., & Merlo, G. (1998) *Grammaire Progressive du français- A1* . Paris: CLE Internationale
- Charliac, L., & Motron, A.C. (1999) *Phonétique Progressive du français* Paris: CLE Internationale
- Dictionnaire de poche (2018) Larousse or Hachette

Suggested E-Resources:

WEB PORTAL- BBC French, Reverso online French- English dictionary

Following links could be referred to:

- For French Grammar topics covered in the syllabus-
- www.laits.utexas.edu
- For interactive exercises and online practice tests-
- www.bbc.com>languages>french

- For oral and written comprehension and expression-
- <https://apprendre.tv5monde> NIVEAU A1/ A2
- For correct pronunciation and accent –
- www.phonetique.free.fr
- For vocabulary building and translation work-
- www.reverso.net

Communicative French

MM:70

Learning Outcomes:

After the completion of the course, students will be able to:

- process longer messages containing more unfamiliar words
- demonstrate awareness of speaker bias, emotions and tone.
- engage in and sustain conversation.
- read aloud longer texts varying their pace, tone, pitch and stress as required.
- write using correct grammar, spelling and punctuation.
- write in coherent manner and include adequate and relevant information.

Course Content:

- Unit-I** a) le Nom (féminin, pluriel), les Prépositions
b) l'article, l'adjectif
c) l'adverbe, comparatif (15)
- Unit-II** a) les Pronoms conjoints, disjoint
b) les Pronoms relatif, composé
c) les pronoms possessif, démonstratif interrogatif (15)
- Unit-III** a) le Gérondif, le Participe présent (10)
b) le Passif (10)
- Unit-IV** a) le Présent de l'indicatif, le Subjonctif présent
b) le Futur simple, futur antérieur (15)
- Unit-V** a) les Conditionnels (présent, passé)
b) le passé composé, l'imparfait, le plus que parfait (15)

Prescribed text:

Dominique, P., Girardet, J. & Verdalen, M.(1999) *Le Nouveau Sans Frontieres-2*. Paris : CLE

Recommended Reading:

- Dominique, P., Girardet, J. & Verdalen, M.(1999). *Cahier d'exercices- Le Nouveau Sans Frontieres-2* Paris : CLE
- Dondo, M. (1999). *Modern French Grammar* . New York: Oxford University Press
- Bulger, A. (1998). *New French with Ease*. Paris: Assimil
- *Le Robert and Nathan Conjugation of French verbs*.(1999) Paris: Nathan
- Gregoire, M. & Thievenaz, O. (2003). *Grammaire Progressive du français- Intermediaire* Paris: CLE Internationale
- Charliac, L. & Motron, A.C. (1999). *Phonétique Progressive du français* Paris: CLE Internationale
- *Dictionnaire de poche* (2018). arousse or Hachette

Suggested e-resources:

WEB PORTAL- BBC French, Reverso online French- English dictionary

Following links could be referred to:

- For French Grammar topics covered in the syllabus-
- www.laits.utexas.edu
- Interactive exercises and online practice tests-

- [www.bbc.com>languages>french](http://www.bbc.com/languages/french)
- Oral and written comprehension and expression-
- <https://apprendre.tv5monde> NIVEAU A2/ B1
- For correct pronunciation and accent –
- www.phonetique.free.fr
- For vocabulary building and translation work-
- www.reverso.net

Translation, Comprehension and written expression

MM:70

(Dictionary is allowed)

Learning Outcomes:

After the completion of the course, the students will be able to:

- write using correct grammar, spelling and punctuation
- express in coherent manner giving adequate and relevant information.
- carry out translation of simple as well as complex texts, with the help of a dictionary.

Course Content:

- Unit-I** a) Translation of any one passage (out of 2) from French into English or Hindi
b) Translation of 10 sentences(out of 15) from French into English or Hindi (10+10=20)

- Unit-II** a) Translation of any one passage (out of 2) from English into French
b) Translation of 10 sentences(out of 15) from English into French (10+10=20)

- Unit-III** a) Comprehension (unseen passage) (15)

- Unit-IV** Letter writing (50 words)
Informal or formal (any one out of 3 choices) (5)

- Unit-V** Essay writing (100-150 words) (any one out of 3 choices)

Topics for essay writing will be based on the following themes:

- i) Votre université ii) votre ville iii) festival iv) votre auteur favori v) une journée/soirée mémorable
vi) le cinéma/film vii) votre ambition/ projet d'avenir viii) votre passe-temps favori ix) une excursion. (10)

Recommended reading:

- Dominique, P., Girardet, J. & Verdalhen, M. (1999). *Cahier d'exercices- Le Nouveau Sans Frontieres-2* Paris : CLE
- Dondo, M. (1999). *Modern French Grammar*. New York: Oxford University Press
- *Le Robert and Nathan Conjugation of French verbs*.(1999). Paris: Nathan
- Gregoire, M. & Thievenaz, O. (2003). *Grammaire Progressive du français- Intermediaire* Paris: CLE Internationale
- Dr. Pradip Kumar Seth, *A Primer on French Grammar*, Navjeeewan Publication Rajasthan
- *Dictionnaire de poche* (2018). Larousse or Hachette

Suggested e-resources:

WEB PORTAL- BBC French, Reverso online French- English dictionary

Following links could be referred to:

- For French Grammar topics covered in the syllabus-
- www.laits.utexas.edu
- Interactive exercises and online practice tests-
- www.bbc.com>languages>french
- Oral and written comprehension and expression-
- <https://apprendre.tv5monde> NIVEAU A2/ B1

- For correct pronunciation and accent –
- www.phonetique.free.fr
- For vocabulary building and translation work-
- www.reverso.net

Communicative French

MM: 70

Learning Outcomes:

After the completion of the course, the students will be able to:

- listen more extensively to a wider range of speakers and different topics.
- differentiate between facts and personal opinion.
- draw valid inferences from the message and their critical response is more obvious.
- expand their vocabulary and use varied sentence structures .
- use conventions according to the audience, context and purpose.
- select, retrieve, evaluate and combine information from different written texts.
- select and include ideas or information in a coherent manner and to use some stylistic devices .

Course Content:

Unit-I	a) L' article, Pluriel des mots composés	(15)	
	b) Le rôle et la place des adjectifs		(15)
Unit-II	a) L'adverbe, comparatif, superlatif	(15)	
	b) Les pronoms (personnel, relatif, possessif, interrogatif, démonstratif)	(15)	
Unit-III	a) le présent de l' indicatif	(10)	
	b) le Futur simple, le futur antérieur		(10)
Unit-IV	a) le Passé composé, l' Imparfait, le Passé récent, le Plus que parfait	(15)	
	b) le Passé simple		(15)
Unit-V	a) les Conditionnels (présent, passé)	(15)	
	b) le Subjonctif présent		(15)

Recommended reading:

- Dominique, P., Girardet, J. & Verdalhen, M. (1999). *Le Nouveau Sans Frontieres-3* Paris : CLE
- Dominique, P., Girardet, J. & Verdalhen, M. (1999). *Cahier d'exercices- Le Nouveau Sans Frontieres-3* Paris : CLE
- *Le Robert and Nathan Conjugation of French verbs.* (1999). Paris: Nathan
- Boulares, M. & Frerot, J. L. (1999). *Grammaire Progressive du français- Avance* Paris: CLE Internationale
- Gardaire, E. (1997). *La France vous connaissez—histoire et civilization* Paris: Didier
- *Dictionnaire Larousse Standard* (2007).

Suggested e-resources:

WEB PORTAL- BBC French, TV 5 le monde, Reverso online French- English dictionary

Following links could be referred to:

- For the French Grammar topics covered in the syllabus-
- www.languageguide.org
- For interactive exercises or practice tests-
- www.bbc.com>languages>french
- for functional French and cultural insights-
- www.apprendre.tv5monde NIVEAU B1 & B2
- For Oral and written comprehension and expression-
- <https://savoirs.rfi.fr>; www.francethisway, www.tv5monde.fr
- For vocabulary building
- www.reverso.net

Literature

MM:70

Learning Outcomes:

After the completion of the course, the students will be able to:

- display critical thinking skills by presenting arguments with adequate support or justification.
- develop familiarity with major French literary movements.
- provide personal response to the literary text.
- demonstrate empathic skills and justify their views.

Course Content:

Unit-I Glimpses of French literature in different centuries –(XVI-XX)

(2/3 out of 4/5 questions to be answered) (15)

Unit-II a) Ronsard, La Fontaine, Molière, Voltaire, Rousseau

b) Victor Hugo, Baudelaire, Alfred de Vigny, Camus, Sartre

(2 out of 4 questions to be answered) (10)

Unit-III Drama “Les Précieuses Ridicules”- Molière

(2 out of 4 questions to be answered) (10)

Unit-IV Drama “Les Précieuses Ridicules”- Molière

(2 out of 4 questions to be answered) (10)

Unit-V Poetry

a) A Cassandre -- Ronsard

b) Le Cigal et la Fourmi—La Fontaine

c) Le Corbeau et le Renard--- La Fontaine

d) Demain dès l’aube –Victor Hugo

e) La Mort du Loup (3rd stanza)-- Alfred de Vigny

f) Le Message ----- Jacques Prévert (25)

Recommended reading:

- Lagarde, A. & Michard, L. (2001). *Collection littéraire – (XVII-XX SIECLE)* Paris: Bordas .
- Nouveau sans frontières-3
- Gardaire, E. (1997). *La France vous connaissez—histoire et civilisation* Paris: Didier.
- Ladurie, E.L.R. (1991). *Histoire de France L’ancien Regime* Paris: Hachette.
- Fuet, F. (1988). *Histoire de France La Revolution* Paris :Hachette.
- Agulhon, M. (1990). *Histoire de France La Republique* Paris: Hachette.
- De Ligny, C. & Rousselot, M. (1998). *Repères pratiques-- La literature francaise-* Paris : Nathan.

Suggested e- resources:

WEB PORTAL- BBC French, TV 5 le monde, Journaux français, Reverso online French- English dictionary

Following links could be referred to:

- For the French Grammar topics covered in the syllabus-
- www.languageguide.org
- For interactive exercises or practice tests on literature
- www.bbc.com>languages>french
- For functional French and cultural insights-
- www.apprendre.tv5monde NIVEAU B1 & B2

- For written comprehension and expression-
- <https://savoirs.rfi.fr>; [www.francethisway](http://www.francethisway.com) , www.tv5monde.fr
- For vocabulary building and literary terms-
- www.reverso.net

Translation, Comprehension & Civilization

MM:70

Learning Outcomes:

After the completion of the course, the students will be able to:

- carry out translation of simple to complex texts with the aid of a dictionary.
- expand their vocabulary and use varied sentence structures .
- select and include ideas or information in a coherent manner and to use some stylistic devices to write for effect.
- develop familiarity with French and Francophone culture.

Course Content:

- Unit-I** a) Translation of any one passage (out of 2) from French into English or Hindi
b) Translation of any 10 sentences (out of 15) from French into English or Hindi (10+10=20)

- Unit-II** a) Translation of any one passage (out of 2) from English into French
b) Translation of any 10 sentences (out of 15) from English into French (10+10=20)

Unit-III Essay writing (one out of three choices)

Topics for essay writing will be based on the following themes:

- i) votre ambition ii) votre auteur/écrivain préféré iii) vos projets de l'avenir iv) le cinéma/le film v) une excursion/un voyage vi) votre pays vii) le rôle de la science/de la technologie viii) l'importance d'apprendre une langue étrangère (10)

- Unit-IV** Letter writing (formal or informal)
(one out of three choices) (10)

Unit-V La Culture et la Civilisation française (4 au choix).

- a) La géographie (la superficie, les frontières, le climat, le relief & les régions)
b) La francophonie (la définition, les espaces francophones)
c) L'Industrie et la technologie
d) L'éducation (le système, les niveaux)
e) Les fêtes nationales et traditionnelles
f) Le sport (10)

Recommended reading:

- Lagarde, A. & Michard, L. (2001). *Collection littéraire – (XVII-XX SIECLE)* Paris: Bordas
- Nouveau sans frontières-3
- Gardaire, E. (1997). *La France vous connaissez—histoire et civilisation* Paris: Didier
- Ladurie, E.L.R. (1991). *Histoire de France L'ancien Regime* Paris: Hachette
- Fuet, F. (1988). *Histoire de France La Revolution* Paris : Hachette
- Agulhon, M. (1990). *Histoire de France La Republique* Paris : Hachette
- Joubert, J.L. (1999). *La Francophonie niveau 4* Paris: CLE
- Carlo, C. & Causa, M. (2010). *Civilisation progressive du français* Paris: CLE
- Dictionnaire LAROUSSE Standard (2007).

Suggested e-resources:

WEB PORTAL- BBC French, TV 5 le monde, Journaux français, Reverso online French- English dictionary
Following links could be referred to:

- For the French grammar topics covered in the syllabus-

- www.languageguide.org
- For interactive exercises or practice tests-
- [www.bbc.com>languages>french](http://www.bbc.com/languages/french)
- For functional French and cultural insights-
- www.apprendre.tv5monde NIVEAU B1 & B2
- For Oral and written comprehension and expression-
- <https://savoirs.rfi.fr>; [www.francethisway](http://www.francethisway.com) , www.tv5monde.fr
- For vocabulary building & translation work –
- www.reverso.net

Communicative German –I

Time : 3 hrs. No. Teaching hours: 60 hrs.

Max. Marks: 70

Learning Outcomes:

After the completion of the course, learners will be able to:

- To perceive through attentive listening and understand key information in media.
- To use correct grammatical structures acquired through functional grammar.
- To understand, to pronounce, to acquire reading through intonations and rhythm
- To express and engage in simple conversation themselves on simple topics.
- To understand similarities and differences between German and mother tongue/second language and to write short narrative or texts.

Course Content:

Unit-I	(a) Articles and Nouns (Nominative Case)	2
	(b) Accusative and Dative Cases	3
	(c) Prepositions (Accusative, Dative)	4
	(d) Verb Conjugation, Separable verbs and Possessive Pronouns	4
Unit-II	(a) Personal Pronouns and Modal Verbs	4
	(b) Prepositions with Dative and Accusative case	3
	(c) Genitive Case and Prepositions	4
	(d) Reflexive Pronouns.	2
Unit-III	(a) Imperfect Tense	6
	(b) Perfect Tense	6
	(c) Past Perfect Tense	6
Unit-IV	(a) Imperative Mood	2
	(b) Adjective Declarations	5
	(c) Numbers, Price and Time	4
	(d) Forming Interrogative Sentences	2
Unit-V	(a) Subordinate Clause	6
	(b) Ja, nein, doch, Keins	3
	(c) Welche, Was für ein	4

Text Comprehension and Written Expression

Time : 3 hrs.

No. Teaching hours : 60 hrs

Max. Marks : 70

USE OF DICTIONARY IS ALLOWED

- Unit-I** (a) Translation of 1 passage out of 2 from German to Hindi/English. 10
(b) Translation of 5 Sentences out of 8 into English or Hindi from German 10
- Unit-II** (a) Translation of any one passage out of 2 from English into German 10
(b) Translation of any 5 sentences out of 8 from English into German 10
- Unit-III** (a) Comprehension of an unseen passage 10
- Unit-IV** Narrative or Dialogue Writing. 10
(Any 1 out of 3 given Topics)
- Unit-V** Letter writing formal/informal (any one out of three given topics)10
- NOTE** (a) Unit I & II The passages and sentences from German should be Unseen but strictly based on the Syllabus of the prescribed lessons.
(b) Dictionaries :- (i) Langenscheidt's German-English/English German Dictionary
(ii) Collins Dictionary (iii) Cassel's Dictionary.

Recommended Reading:

- Deutsche Sprachlehre für Ausländer-Schulz-Grieshbach (1 to 15 lessons)
- Themen Aktuell
- Collins easy learning German Grammar
- Wir les Lesen Deutsch 1
- Deutsch-2000 Bd1
- Deutsch als Fremdsprache - BNS 1 A
- Lesson: 1-D, 2-D, 3D, 2LT, 4D, 6D, 3LT, 11-D, 14-D, 16-D, 17-D, 7D, 8D, 6LD, 7LT

Suggested E-learning Material:

- General Grammar learning

<https://www.deutsch-lernen.com/learn-german-online/beginners/summary.php>

https://www.german-grammar.de/grammar/content/english_german_table_of_content.htm

- For Verb Conjugation

<http://conjugator.reverso.net/conjugation-german.html>

- For different types of verbs like Separable Verbs, Reflexive Verbs etc.

<https://deutsch.lingolia.com/en/grammar/verbs>

- To study Tenses in German

<https://deutsch.lingolia.com/en/grammar/tenses>

<https://www.thegermanprofessor.com/german-verb-tenses/>

- To study about Prepositions

<https://www.fluentu.com/blog/german/german-prepositions/>

<http://germanforenglishspeakers.com/prepositions/accusative-prepositions/>

- For Adjectives

<http://germanforenglishspeakers.com/adjectives/adjective-declensions/>

http://german.speak7.com/german_adjectives.htm

- For Subordinate Clause

<https://www.germanveryeasy.com/subordinate-clause>

https://german.tolearnfree.com/cgi2/myexam/liaison.php?liaison=_subordonnee

Communicative German –II

Time : 3 hrs.

Teaching hours : 60

Max Marks : 70

Learning Outcomes:

After the completion of the course, learners will be able to:

- Strengthen language reflections (To establish observance of rules, to acquire basic grammar, to make comparison with mother language/second language and to discuss similarities and differences).
- Understand simple texts/dialogue/ passage and use the knowledge acquired for effective written communication skills.
- Understand and enrich their Cultural Reflections by gaining information about German speaking Countries
- Understand and develop Inter cultural learning skills.
- Enhance their writing ability and to broaden possibilities of their expressions with higher level of Grammar knowledge.
- Understand the factors that influence use of advanced level of grammar and vocabulary in speech, reading and in writing.
- Apply advanced level of grammar skills to communicate
- To understand films/dialogues etc about German speaking countries
- To read and comprehend simple newspaper/magazine articles easy reader books for A2 level proficiency.
- Acquire knowledge equivalent to the A2 Exam of German Language prescribed as per the standard of European Union Language Proficiency

Course Content:

Unit-I Landeskunde of DACHL-Countries-

(Germany, Austria, Switzerland and Liechtenstein - 4 Countries) on the following Topics:-

(a) Germany-Schulsystem and Bildung	5	5
(b) Austria - Freizeit	5	
(c) Switzerland-Industrie and Wirtschaft.	5	5
(d) Liechtenstein - Geographie	5	

Unit-II (a) Passive Voice	4
(b) Indefinite Particles.	2
(c) Adjective with Verbs and Nouns.	3
(d) Future Tense (I & II)	4

Unit-III (a) Present Participle	2
(b) Perfect Tense of Modal & Semi Modal Verbs	3
(c) Temporal and Conditional Sentences (wenn-wie, wenn-als, usw)	3
(d) Subordinate Clauses (bevor, nachdem, während obwohl, ob, trotzdem)	5

Unit-IV (a) Relative Sentences (Nominative, Accusative, Dative & Genitive Cases)	6
(b) Infinitive Sentences	4
(c) Hin- and her- Sentences	2

Unit-V (a) Conjunctive - I	6
(b) Conjunctive – II	6

Text Comprehension and Written Expression

Time:3 hrs.

Teaching hours:60

Max. Marks : 70

USE OF DICTIONARY IS ALLOWED

Unit-I (a) Translation of 1 passage out of 2 from German to Hindi/English. 10

(b) Translation of 5 Sentences out of 8 into English or Hindi from German 10

Unit-II (a) Translation of any one passage out of 2 from English into German
10

(b) Translation of any 5 sentences out of 8 from English into German
10

Unit-III (a) Comprehension of an unseen passage 10

Unit-IV Narrative or Dialogue Writing. (Any 1 out of 3 given Topics) 10

Unit-V Letter writing (any one out of three given topics)
10

NOTE:- (a) Unit I & II The passages and sentences from German should be Unseen but strictly based on the Syllabus of the prescribed lessons.

(b) Dictionaries :-

(i) Langenscheidt's German-English/English German Dictionary

(ii) Collins Dictionary

(iii) Cassel's Dictionary.

Advanced Study of Language

Duration: 3 hrs.

Max Marks : 70

Learning Outcomes:

After the completion of the course, learners will be able to:

- Understand complex texts/dialogue/passage and will enable them to use their written competence in reporting , letters or Essay with ease.
- Translate difficult and complex unseen texts/passages with the help of a bilingual dictionary.
- Express themselves adequately in familiar, everyday situations and acquire ability to write a Paragraph on general topics .
- Put into use the idioms and phrases and also proverbs in receptive and productive usage
- Gain deep insight into different current topics/areas of Germany
- Get opportunities to avail scholarships/internships to study/to do internship/to get job in German speaking countries

Course Content:

- Unit-I**
- (a) Indirect speech/ Conjunctive I (5)
 - (b) Conjunctive II (5)
 - (c) Passive Voice (5)

- Unit-II (a) Synonyms (10 Pairs to be attempted) (10)**

1. Beschließen-sich entschließen-sich entscheiden.
2. Abschlagen-verweigern-sich weigern.
3. Hindern-behindern-verhindern.
4. Fürchten-befürchten-sich fürchten vor.
5. Bessern-verbessern-ausbessern.
6. Scheinen-erscheinen-vorkommen.
7. Ansehen-sich ansehen-besichtigen.
8. Betrachten-zusehen-beobachten.
9. Gehören-gehören zu-angehören.
10. Verneinen-leugnen-verleugnen.

(b) Idiomatic Redewendungen von A-Z (10 out of 15) (10)

1. Jemandem einen Bären aufbinden
2. Wenn man den Esel nennt, kommt er gerannt
3. Zwei Fliegen mit einer Klappe schlagen
4. Tauben Ohren predigt man vergebens
5. Wie ein Elefant im Porzellanladen

6. Auch ein blindes Huhn findet mal ein Korn

7. Sich in die Höhle des Löwen wagen
8. Mit jemandem Pferde stehlen
9. Hahn im Korb sein
10. Der Vogel schreit zu spät,wenn er gefangen ist
11. Hühner die viel gackern, legen wenig Eier
12. Die Katze im Sack kaufen
13. Frische Fische, gute Fische

14. Ein alter Hase sein

15. Mit den Wolfen heulen

Unit-III Wortbildung

a. Bildung von Substantiven (5)

b. Bildung von Adjektiven (5)

c. Bildung von Verben (5)

Unit-IV Essay on any one Topic out of 3 (General Topic) (10)

Unit-V Letter Writing on any one topic out of 3 topics.
(Formal/Informal) (10)

Literature

Duration : 3 hrs.

Max. Marks : 70

Unit-I 5 Selected Poems (Any 4 out of 5) (20)

- i) Die Bücherverbrennung - Bertolt Brecht
- ii) Die schlesischen Weber - Heinrich Heine.
- iii) Erlkönig – Johann Wolfgang von Goethe
- iv) Vorbei- Josef von Eichendorff
- v) Die Stadt- Theodor Storm

Unit-II and Unit-III (20)

5 Short Stories (Any 2 out of 4 questions to be attempted)

- (i) Wie in schlechten Romanen- Heinrich Böll
- (ii) Das Märchen vom Glück - Erich Kästner.
- (iii) Die drei dunklen Könige – Wolfgang Borchert
- (iv) Der Mantel des Ketzers - Bertolt Brecht
- (v) Das Obdach- Anna Seghers

Unit-IV Papa, Charly hat gesagt (Any one question to be attempted) (15)

- i. Die Reichen
- ii. Pressefreiheit

Unit-V Die Märchen (Question on any one to be attempted) (15)

- i. Der Frieder und das Katherlieschen
- ii. Frau Holle

German for Specific Puroposes

Duration 3 hrs

Max. Marks:- 70

- Unit-I** (a) Translation of any 1 passage out of 2 into English/Hindi from German (10)
(b) Translation of 5 sentences out of 8 into German from English (5)
- Unit-II** (a) Translation of any 1 passage out of 2 into German from English (10)
(b) Translation of 5 sentences out of 8 into English/Hindi from German (5)
- Unit-III** Application Writing (Applying for a post, for Scholarship etc. with Biodata) (10)
- Unit-IV** COMPREHENSION (10)
- Unit-V** Civilization (Landeskunde) of Germany :- (20)
From the following topics (Any 4 out of 6)
(1) Sports
(2) Technology
(3) Religion
(4) Festivals
(5) Geography of Germany
(6) Industries

Note : USE OF DICTIONARY IS ALLOWED in Paper III

Oral Expression

Max. Marks – 70

Recommended Reading:

- Deutsche Redensarten Quiz-und Übungsbuch von Richard Schmidt, Ernst-Klett Verlag
- Von A bis Z von Redewendungen
- Grammatik : Schulz-Griesbach
- 1000 idiomatische Redensarten Deutsch by Dr. Dora Schulz, Langenscheidt Verlag.
- Deutsche Sprichwörter für Ausländer eine Auswahl von Beispielen von Christa Frey, Annalies Herzog, Arthur Michael und Ruth Schütze
- Deutsche Erzählungen für Ausländer herausgegeben von Klier/Martin: 1.Band & 2.Band , Hueber Verlag
- Auslese-Ein Buch aus Büchern, RNC Publications, Arbeitsgruppe des DAAD, Indien
- Papa, Charly hat gesagt.....Text- und Arbeitsbuch von Wolf-Dietrich Zielinski by Langenscheidt Verlag
- Wörter zur Wahl- Klett & Goyal Verlag.
- Tatsachen über Deutschland
- Planet- Deutsch Für Jüenliche B1, Hueber Verlag
- Themen Aktuell 3, Hueber Verlag.
- Deutsch für Ausländer von Hermann Kessler, Verlag für Sprachmethodik.
- Deutsch für Studenten: Text- und Übungsbuch, Neubearbeitung von Heinrich Stalb, Verlag für DEUTSCH.
- Sprache and Presse
- Deutschland
- Sprach Illustrierte
- JUMA
- Vitamin

Suggested E-learning Material:

- **For antonyms and synonyms**

<https://www.thoughtco.com/german-thesaurus-synonyms-4069105>

<https://www.synonym.com/synonyms/german>

- **For idioms**

<https://www.fluentu.com/blog/german/common-german-idioms/>

<https://www.theintrepidguide.com/german-idioms-and-expressions/#.XFK4jNIzbIU>

<https://matterhornlanguages.com/german-idioms/>

- **For literary periods**

<https://blog.zeit.de/schueler/literatur/>

<https://www.frustfrei-lernen.de/deutsch/deutsch-literatur-epochen-ueberblick.html>

- **Die Bucherverbrennung**

<https://lesewelle.wordpress.com/2013/05/10/diese-literatur-muss-weg/>

<https://e-hausaufgaben.de/Hausaufgaben/D10950-Die-Buecherverbrennung-Bertolt-Brecht-Interpretation.php>

<https://norberto42.wordpress.com/2012/07/20/brecht-die-bucherverbrennung-zur-analyse/>

- **Die schlesischen Weber**

<http://www.schultreff.de/arbeiten/arb983.htm>

<https://lyrik.antikoerperchen.de/heinrich-heine-die-schlesischen-weber-the-silesian-weavers,textbearbeitung,437.html>

<https://norberto42.wordpress.com/2013/06/04/heine-die-schlesischen-weber-analyse/>

- **Erlkönig**

<https://lyrik.antikoerperchen.de/johann-wolfgang-von-goethe-erlkoenig,textbearbeitung,380.html>

<https://www.inhaltsangabe.de/goethe/erlkoenig/>

<https://ethosinterrupted.wordpress.com/2009/07/18/der-erlkoenig/>

- **Vorbei**

<https://lyrik.antikoerperchen.de/joseph-von-eichendorff-nachtzauber,textbearbeitung,400.html>

<https://e-hausaufgaben.de/Thema-167349-Gedichtanalyse-Eichendorff.php>

- **Die Stadt-Theodor Storm**

<https://lyrik.antikoerperchen.de/theodor-storm-die-stadt,textbearbeitung,213.html>

<https://www.mein=lernen.at/deutsch/gedicht-die-stadt-theodor-storm>

<https://www.jstor.org/stable/3198602?seq=2#metadata.info.tab.contents>

- **Der Frieder und das Katherlieschen**

https://www.grimmstories.com/de/grimm_maerchen/der_frieder_und_ das_kathaerlieschen

<http://www.maerchenatlas.de/deutsche-maerchen/grimms-marchen/der=frieder-und-das-katherlieschen/>

http://www.sagen.at/text/maerchen/maerchen_deutschland/brueder_grimm/derfrieder.html

https://www.maerchenteppeich.de/theaterstueck_37/der_frieder_und_ das_katherlieschen/

- **Frau Holl**

<http://www.maerchenapfel.de/frau=holle/interpretation.html>

<http://www.maerchenatlas.de/deutsch-maerchen/grimms-marchen/frau-holle/>

<http://www.artikel133.com/deutsch/1inhalt-von-frau-holle.php>

- **Die drei dunklen Könige**

<https://e-hausaufgaben.de/Hausaufgaben/D1716-Wolfgang-Borchert-Die-drei-dunklen-Koenige-Interpretation.php>

<https://lyrik.antikoerperchen.de/wolfgang-borchert-die-drei-dunklen-koenige,textbearbeitung,521.html>

http://www.schoolwork.de/kurzgeschichte/drei_dunklen_koenige.php

- **Der Mantel des Ketzers**

<http://www.litde.com/erzhlungen-der-gegenwart/der-mantel-des-keizers.php>

https://www.geschichte.ovh/allgemein/tab/de/Der_Mantel_des_Ketzers/d35207fd0c51ba956bfb2af959fce4cf9f74cec4

<https://www.zusammenfassung.info/der-mantel-des-keizers-zusammenfassung>

- **Das Obdach -Anna Seghers**

<http://www.artike133.com/deutsch/1/inhalt-von-frau-holle-php>

- **Application and E-mail writing**

<https://german.yabla.com/lesson-Writing-Letters-and-E-mails-in-German-1032>

<https://german.yabla.com/lesson-Writing-Letters-and-E-mails-in-German-1032>

- **Newspaper for Landeskunde**

<http://www.spiegel.de/>

<https://www.thelocal.de/>

<https://m.bild.de/>

- **Newspaper for Landeskunde**

- <http://www.spiegel.de/>
- <https://www.thelocal.de/>
- <https://m.bild.de/>
- **Basic German Phrases and Greetings**
- <https://www.thegermanproject.com/german-lessons/greetings-and-essentials>
- <https://www.iwillteachyoualanguage.com/learn/german/german-tips/basic-german-phrases>
- **German Listening practice**
- <https://www.dw.com/de/deutsch-lernen/nachrichten/s-8030>
- <https://www.zdf.de/#/hauptnavigation/startseite>
- <https://www.ardmediathek.de/ard/>
- **To practice translation of basic sentences**
- https://www.german-grammar.de/grammar/chapter_6/6_2_exercise.htm
- <http://www.goethe-verlag.com/tests/ED/ED.HTM>
- **To practice Grammar**
- https://www.german-course-vienna.com/en/excercises_a1,20873.html

Certificate Course in German for Conversation **(Elementary/Advanced)**

Objective : This course aims to help the students in speaking German in day-to-day situations. It is for those students who have knowledge of German language but lack practice in spoken German.

Eligibility :

1. A candidate who has passed the Certificate course in German with minimum 55% marks shall be eligible for admission to the **Elementary** level course.
2. A candidate who has passed the Diploma Course in German with minimum 50% marks shall be eligible for admission to the **Advanced** level Course.

N. B. : The admissions were be made after counselling.

3. The course of study for the examination shall extend over a period of one academic year.

Scheme of Examination :

Oral : Total 150 Marks [50 Marks (Continuous Assessment) 100 Marks (Annual Assessment)] Successful Candidate will be classified as follows:

1. 75% marks or above	Distinction
2. 60% marks or above	First Division
3. 50% marks or above	Second Division
4. 40% marks or above	Pass

Elementary level

Learning Outcomes:

After the completion of the course, learners will be able to:

- React to a certain degree in clearly structured conversation situations
- Possess the ability to communicate correctly, fluently, confidently and effectively within and about the discipline.
- Actively participate in conversation and prepare, organize and deliver their ideas due to the command over the language.
- Comprehend and reproduce the written texts through effective oral expressions

Course Content:

Unit-1 1. Greetings, Introduction (Gruessen, sich Vorstellen)

2. In the Classroom (Nach Name, Herkunft and Ziel Fragen)

3. Receiving and Seeing off (Sich Verabschieden).

Unit-2 1. In Hotel (sich anmelden und ausweisen, ein Zimmer suchen, usw).

2. In Restaurant (Einen Platz suchen, nach dem Weg fragen, Essen und Getränke bestellen, usw).

3. Shopping (einkaufen gehen).

Unit-3 1. Have an appointment (Einladung, zum Abendessen, Kino besuchen).

2. An appointment with a doctor (Ein Termin beim Arzt/In: über die Krankheit und Untersuchung sprechen).

3. Family(über die Familie sprechen)

Unit-4 1. Daily activities. (Mein Tagesablauf)

2. In the Library (In der Bibliothek).

3. At the Bus stand/Railway Station/Airport. (Am Flughafen/Bahnhof)

Unit-5 1. At the Bank.

2. In the Post Office

3. Describing a Photo/picture (Vater und Sohn I) (Bildbeschreibung)

Recommended Reading:

- Deutsches Gesprächsbuch für Ausländer von Werner Reinhardt, Claus Köhler und Arthur Michel, Veb Verlag Enzyklopädie.
- Tatsachen über Deutschland
- Netzwerk A1, Arbeitsbuch A 1
- Studio d A1
- Themen Aktuell 1
- Sprache und Presse
- Deutschland
- Sprach Illustrierte
- JUMA
- Vitamin

Suggested E-learning Material:

- Newspaper for Landeskunde

<http://www.spiegel.de/>

<https://www.thelocal.de/>

<https://m.bild.de/>

- **Basic German Phrases and Greetings**

<https://www.thegermanproject.com/german-lessons/greetings-and-essentials>

<https://www.iwillteachyoualanguage.com/learn/german/german-tips/basic-german-phrases>

- **German Listening practice**

<https://www.dw.com/de/deutsch-lernen/nachrichten/s-8030>

<https://www.zdf.de/#/hauptnavigation/startseite>

<https://www.ardmediathek.de/ard/>

- **To practice translation of basic sentences**

https://www.german-grammar.de/grammar/chapter_6/6_2_exercise.htm

<http://www.goethe-verlag.com/tests/ED/ED.HTM>

- **To practice Grammar**

https://www.german-course-vienna.com/en/excercises_a1,20873.html

Advanced Level

Learning Outcomes:

After the completion of the course, learners will be able to:

- Initiate questions based upon the task/lectures etc.
- Participate spontaneously on discussions about different topics.
- Have pronunciation that is readily understood by native speakers or have near-native pronunciation.
- Identify and understand verbal cues in speaker attitude and tone.
- Summarize an experience of a face to face conversation.
- Recognize and modify own pronunciation and intonation problem.

Course Content:

Unit 1 Hobby (über mein Hobby)

Holidays/Vacation (über die Ferien)

Sports

Unit 2 An excursion/Picnic.

Talking about Career/Future plans.

Searching a room, talking about the rent etc.

Unit 3 To apply for an post (Eine Bewerbung)

Talking about the City and about living

Talking about the Person.

Unit 4 At the employment office.

At the foreigners registration office

About the Parking, traffic etc.

Unit 5 Describing a photo/picture (vom Buch Vater und Sohn II) (Bild Beschreibung)

Description of scenery, showing the way, to formulate clichés.

Listening to the cassettes and to answer the questions. (small dialogues).

Recommended Reading:

- Deutsches Gesprächsbuch für Ausländer von Werner Reinhardt, Claus Köhler und Arthur Michel, Veb Verlag Enzyklopädie.
- Tatsachen über Deutschland
- Netzwerk A2 (Lehr- and Arbeitsbuch)
- Studio d A2 (Lehr- and Arbeitsbuch)
- Themen Aktuell A2 (Lehr- and Arbeitsbuch)
- Sprache and Presse
- Deutschland
- Sprnch Illustrierte
- JUMA
- Vitamin-D

Suggested E-learning Material:

• Alltagsleben:

<https://germanonlinegym.com/german-tv-online/>

<https://learnoutlive.com/top-10-german-movies-german-learners/>

<https://quizlet.com/subject/Goodbye-Lenin/>

<https://shop.multilingualbooks.com/pages/libraries-of-e-books-in-german>

<https://www.learning-german-online.org/>

- **German Grammar exercises:**

<https://www1.wdr.de/daserste/lindenstrasse/index.html>

<http://www.learn-german-online.net/en/learning-german-resources/free-german-grammar-exercises.html>

<https://www2.onleihe.de/goethe-institut/frontend/mediaList,0-0-0-102-0-0-0-400004-0-0.htm>

- **Landeskunde information:**

<https://www.goethe.de/ins/in/en/kul/ser/onl.html>

- **Current Affairs:**

online Newspapers i.e. *Frankfurter Allgemeine*, *Berliner Zeitung* etc

Deutsche Welle Nachrichten

<https://learnoutlive.com/easy-german-reading/>

<https://www.nachrichtenleicht.de/>

English for Conversation (Elementary)

Time Duration - 2 Hours

4 classes/week

July - November

Mode of Exam: Written for 70 marks (Semester end Exam) and External Viva for 50 marks.

Learning Outcomes:

After the completion of the course, students will be able to:

- communicate effectively.
- enhance effective communication and develop better social interaction.
- write grammatically correct sentences .
- comprehend literary and non-literary texts.
- read texts with all clarity.
- listen and appreciate both literary and non-literary texts.

Course Content

The course comprises the following items:-

1. Basic R.P. Sounds & Transcription
2. Identifying Tenses in Text and Context
3. Dialogues
4. Vocabulary Building
5. Role play
6. Etiquettes

Recommended Reading:

Sharma, R. C. & Krishna, M. (2002). *Business Correspondence and Report Writing*. New Delhi: Tata McGraw Hill.

Suggested E-Learning Material:

English Conversation:

<https://www.espressoenglish.net/everyday-english-speaking-course/>

Writing Skills:

<https://www.grammarbook.com/grammar/subjectVerbAgree.asp>

Listening Skills:

<https://www.skillsyouneed.com/ips/listening-skills.html>

Reading Skills:

<https://www.understood.org/en/learning-attention-issues/child-learning-disabilities/reading-issues/6-essential-skills-needed-for-reading-comprehension>

English for Conversation (Advanced)

Time Duration - 2 Hours

December-April

Exam in April 4 classes/week

Mode of Exam: Written for 70 marks (Semester end Exam) and External Viva for 50 marks.

Learning Outcomes:

After the completion of the course, students will be able to:

- develop grammatical and communicative competence .
- write grammatically correct sentences .
- comprehend literary and non-literary texts.
- read texts with all clarity.
- listen and appreciate both literary and non-literary texts.
- enhance effective communication and develop better social interaction.

Course Content

- Précis & Composition
- Presentation
- Group Discussion
- Debate
- Soft Skills

Recommended Reading

Sharma, R.C. & Krishna, M. (2002). *Business Correspondence and Report Writing*. New Delhi: Tata McGraw Hill.

Suggested E-Learning Material:

English Conversation:

<https://www.espressoenglish.net/everyday-english-speaking-course/>

Writing Skills:

<https://www.grammarbook.com/grammar/subjectVerbAgree.asp>

Listening Skills:

<https://www.skillsyouneed.com/ips/listening-skills.html>

Reading Skills:

<https://www.understood.org/en/learning-attention-issues/child-learning-disabilities/reading-issues/6-essential-skills-needed-for-reading-comprehension>

व्याकरण, कोश: अनुवादश्च

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- संस्कृत लेखन कौशल को प्राप्त करना।
- शब्द भण्डार में वृद्धि।

निर्देशः—यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम अन्विति— संज्ञा व अक्सन्धि प्रकरण (लघुसिद्धान्तकौमुदी)

- (1) संज्ञा प्रकरण चार प्रत्याहार व दो संज्ञाएँ
- (2) अक्सन्धि प्रकरण (इको यणचि" से "एङः पदान्तादति" तक) दो सूत्रों की सोदाहरण व्याख्याएँ व चार प्रयोग सिद्धियाँ।

द्वितीय अन्विति— अमरकोश, हल्सन्धि वे विसर्गसन्धि प्रकरण (लघुसिद्धान्तकौमुदी)

- (1) अमरकोश (प्रथम काण्ड, 1-2 वर्ग) पाँच शब्दों के अर्थ
- (2) हल्सन्धि ("स्तोःश्चुना श्चुः" से वा पदान्तस्य सूत्र तक, छेच तथा पदान्ताद्वा सूत्र तक) व विसर्ग सन्धि प्रकरण ("विसर्जनीयस्य सः" से "विप्रतिषेधे परं कार्यम्" सूत्र तक) दो सूत्रों की सोदाहरण व्याख्याएँ व चार प्रयोग सिद्धियाँ

तृतीय अन्विति— षड्तिङ्ग प्रकरण (लघुसिद्धान्तकौमुदी)

- (1) अजन्तपुल्लिङ्ग प्रकरण ("अर्थवदधातुरप्रत्ययः प्रातिपदिकम्" से "आदेशप्रत्यययोः" तक) एक सूत्र की सोदाहरण व्याख्या
- (2) राम, सर्व, विश्वपा, हरि, बहुश्रेयसी, क्रोष्टृ गो, रै, तामा, मति, नदी, त्रि, चतुर, ज्ञान, शब्दों के रूपों से सम्बद्ध 10 अनुवाद

चतुर्थ अन्विति— षड्लिङ्ग प्रकरण (लघुसिद्धान्तकौमुदी)

- (1) अ-अजन्तस्त्रीलिङ्गप्रकरण ("ओङ् आपः से "याडापः" तक)
ब-अजन्तनपुंसकलिङ्ग प्रकरण ("अतोऽम्" से "मिदचोऽन्त्यात्परः तक)
एक सूत्र की सोदाहरण व्याख्या
- (2) चतुर्, किम्, इदम्, राजन् युष्मद् अदस्, शब्दों से सम्बद्ध 10 अनुवाद

पंचम अन्विति— तिङन्त प्रकरण (लघुसिद्धान्तकौमुदी)

- (1) तिङन्त प्रकरण— ("लः कर्मणि च भावे चाऽकर्मकेभ्यः से "शेषे प्रथमः" तक, परोक्षे लिट्, अनद्यतने लृट्, लृट् शेषे च, लोट् च, आशिषि लिङ्लोटौ, अनद्यतने लङ्, विधिनिमन्त्रणाऽऽमन्त्रणाधीष्टसंप्रश्न-प्रार्थनेषु लिङ्, लुङ्, लिङ्निमित्ते लृङ्क्रियात्तिपतौ)
(अ) एक प्रश्न अथवा दो टिप्पणी
(ब) भू तथा कृ धातुओं के रूपों से सम्बद्ध 10 अनुवाद

संस्तुत पुस्तके—

1. वरदराज, लघुसिद्धान्त कौमुदी, ब्या. महेशसिंह कुशवाहा भाग 1 व 2, (2010), वाराणसी, चौखम्बा सुरभारती प्रकाशन।
2. वरदराज, लघुसिद्धान्त कौमुदी, ब्या. कपिल एवं द्विवेदी, (2002), संस्कृत व्याकरण एवं लघुसिद्धान्त कौमुदी, वाराणसी, विश्वविद्यालय प्रकाशन

E-Resources:

- चक्रधर शर्मा शास्त्री, अनुवाद चन्द्रिका
https://archive.org/details/AnuvadChandrikaChakradharsharmaShastri1954_201802/page/n1
- कपिलदेव द्विवेदी, प्रारम्भिक रचनानुवाद कौमुदी
https://archive.org/details/PrarambhikRachanaAnuvadKaumudiKDDwivedi1978_20180228
- कपिलदेव द्विवेदी, प्रौढ रचनानुवाद कौमुदी
<https://archive.org/details/PraudhaRachanaAnuvadKaumudiKDDwivedi1955>
- लघुसिद्धान्त कौमुदी— भीमसेन शास्त्री, 'लघुसिद्धान्त कौमुदी'
<https://archive.org/details/in.ernet.dli.2015.485702/page/n1>
- नरेन्द्रशर्मा, 'लघुसिद्धान्त कौमुदी'
<https://archive.org/details/VaradarajaLaghusiddhantakaumudi1937/page/n1>

संस्कारप्रयोज्या यजुर्वेदीयाः प्रमुख मन्त्रा :

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- संस्कार विधि का परिज्ञान

निर्देशः— यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम—अन्विति— गर्भाधान—पुंसवन—सीमन्तोन्नयन संस्कारों के मन्त्र

1. दो मन्त्रों का लेखन
2. दो मन्त्रों का अर्थ

द्वितीय अन्विति— जातकर्म— संस्कार के मन्त्र

1. दो मन्त्रों का लेखन
2. दो मन्त्रों का अर्थ

तृतीय अन्विति — नामकरण संस्कार के मन्त्र

1. दो मन्त्रों का लेखन
2. दो मन्त्रों का अर्थ

चतुर्थ अन्विति — निष्क्रमण—अन्नप्राशन संस्कारों के मन्त्र

1. दो मन्त्रों का लेखन
2. दो मन्त्रों का अर्थ

पंचम अन्विति — कर्णवेध एवं चूडाकरण संस्कारों के मन्त्र

1. दो मन्त्रों का लेखन
2. दो मन्त्रों का अर्थ

संस्तुत पुस्तकें—

1. गुरागाई, जगन्नाथ, (1994). *माध्यन्दिनीय संस्कार तत्वावलोकनम्*. वाराणसी, राज मन्दिर।
2. शास्त्री, पट्टाभिराम, (1984–85). *संस्कारविज्ञान*. वेद—मीमांसा अनुसंधान वाराणसी।
3. पाण्डेय, राजबलि (1995). *द हिन्दू संस्कार*, वाराणसी, चौखम्बा सुरभारती प्रकाशन।

शुक्लयजुर्वेदीय रुद्राष्टाध्यायी सस्वर भद्रसूक्त सहितम्

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- रुद्राष्टाध्यायी के मन्त्रों को सस्वर हस्तसंचालनपूर्वक पाठ का अवबोधपूर्वक अभ्यास कराना।

निर्देशः— यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम अन्विति — वेदाध्ययन हेतु आवश्यक नियम
(वेदोच्चारण एवं हस्त संचालन सम्बन्धी)

द्वितीयअन्विति — शुक्लयजुर्वेदीय—रुद्राष्टाध्यायी
प्रथम अध्याय (चार मन्त्रों का लेखन)

तृतीय अन्विति — शुक्लयजुर्वेदीय—रुद्राष्टाध्यायी
पुरुष सूक्त (चार मन्त्रों का लेखन)

चतुर्थ अन्विति — शुक्लयजुर्वेदीय—भद्रसूक्त
(आनोभद्राइट्यारभ्य शान्तिपाठ पर्यन्तम्)
(चार मन्त्रों का लेखन)

पंचम अन्विति — स्वर संचार —
(द्वितीय—तृतीय एवं चतुर्थ अन्वितियों में से किन्हीं चार मन्त्रों का स्वारांकन सहित लेखन)

संस्तुत पुस्तकें—

1. रुद्राष्टाध्यायी (2006), गोरखपुर, गीताप्रेस।
2. मिश्र, बिहारी लाल, (1988), नित्यकर्म पूजा प्रकाश, गोरखपुर, गीताप्रेस।
3. शास्त्री दुर्गाशंकर उमाशंकर. (1999), बृहद् नित्यकर्म समुच्चय, वाराणसी।
4. त्रिवेदी, हरिहर. (2004), कर्मकाण्ड पुष्पलता, ग्वालियर, ललिता प्रकाशन।

E-Resources:

<https://archive.org/details/NityaKarmaPujaPrakashGitaPressGorakhpur>

संस्कार प्रयोज्या यजुर्वेदीयाः प्रमुखा मन्त्राः

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- संस्कारों में प्रयुक्त मन्त्रार्थ का वर्तमान परिपेक्ष्य में अवबोधन।

निर्देशः— यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम अन्विति — विद्यारम्भ संस्कार के मन्त्र

1. दो मंत्रों का लेखन
2. दो मंत्रों का अर्थ

द्वितीय अन्विति — उपनयन व वेदारम्भ संस्कारों के मन्त्र

1. दो मंत्रों का लेखन
2. दो मंत्रों का अर्थ

तृतीय अन्विति — केशान्त व समावर्तन संस्कारों के मन्त्र

1. दो मंत्रों का लेखन
2. दो मंत्रों का अर्थ

चतुर्थ अन्विति — विवाह संस्कार के मन्त्र

1. दो मंत्रों का लेखन
2. दो मंत्रों का अर्थ

पंचम अन्विति — अन्त्येष्टि संस्कार के मन्त्र

1. दो मंत्रों का लेखन
2. दो मंत्रों का अर्थ

संस्तुत पुस्तकें—

1. गुरागाई, जगन्नाथ, (1994), *माध्यन्दिनीय संस्कार तत्वावलोकनम्*, वाराणसी, राज मन्दिर।
2. शास्त्री, पट्टाभिराम, (1984–85), *संस्कारविज्ञान*, वाराणसी, वेद-मीमांसा अनुसंधान केन्द्र।
3. पाण्डेय, राजबलि (1995), *द हिन्दू संस्कार*, वाराणसी, चौखम्बा सुरभारती प्रकाशन।

E- Resources

- हिन्दू संस्कार, राजबलि पाण्डेय

<https://archive.org/details/HinduSamskarasSamajikTathaDharikAdhyayanRajbaliPandeyMLBDSanskaraChowkambha>

शुक्लयजुर्वेद संहिता 32, 36, 40वाँ अध्याय सस्वर सम्पूर्ण

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- वेद मंत्रों के स्वरों का आरोह-अवरोह पूर्वक सस्वर पाठ की अभियोग्यता।
- वैदिक वाङ्मय के मूल संहिता साहित्य को संरक्षित करने सम्बन्धी चेतना का विकास।

निर्देशः—यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम अन्विति — वेदाध्ययन हेतु आवश्यक नियम
(वेदोच्चारण एवं हस्त संचालन सम्बन्धी)

द्वितीय अन्विति — शुक्लयजुर्वेद संहिता 32वाँ अध्याय (चार मंत्रों का लेखन)

तृतीय अन्विति — शुक्लयजुर्वेद संहिता 36वाँ अध्याय (चार मंत्रों का लेखन)

चतुर्थ अन्विति — शुक्लयजुर्वेद संहिता 40वाँ अध्याय (चार मंत्रों का लेखन)

पंचम अन्विति — स्वर संचार
(द्वितीय तृतीय एवं चतुर्थ अन्वितियों में से किन्हीं चार मन्त्रों का स्वारांकन सहित लेखन)

संस्तुत पुस्तक :

शुक्लयजुर्वेद संहिता

E-Resources:

- <https://www.jstor.org/stable/44144076?Search=yes&resultItemClick=true&searchText=yajnavalkya&searchUri=%2Faction>
- Dharmendra Kumar, 'Leading System in Yajnavalkyasmriti'
- <https://www.jstor.org/stable/44145453?Search=yes&resultItemClick=true&searchText=yajnavalkya&searchUri=%2Faction>

वनस्थली विद्यापीठ की संस्कृतोपाधि पत्र परीक्षा या अन्य मान्यता प्राप्त समकक्ष परीक्षा उत्तीर्ण छात्राएँ एक वर्षीय विशिष्ट संस्कृतोपाधि परीक्षा में सम्मिलित हो सकती हैं।

विशिष्ट संस्कृतोपाधि पत्र परीक्षा में निर्दिष्ट सभी प्रश्न पत्र अनिवार्य हैं; जिनकी लिखित एवं मौखिक दोनों परीक्षाएँ सम्पन्न होंगी। मौखिक परीक्षा में सभी प्रश्न पत्रों से सम्बद्ध प्रश्न पत्र पूछे जायेंगे। प्रत्येक लिखित प्रश्न-पत्र की कालावधि तीन घण्टे होगी।

वैदिक कर्मकाण्ड का प्रारम्भिक स्वरूप

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- वैदिक कर्मकाण्ड को वैज्ञानिक दृष्टि से अवगत कराना।

निर्देशः— यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम अन्विति — प्रातःकरदर्शनम्, भूवन्दनम्, स्नानकालेतीर्थावाहन — प्रार्थना, संध्यावन्दन, यज्ञोपवीत पूजन पूर्वक धारण विधि: संकल्पश्च।

द्वितीय अन्विति— भद्रसूक्तशान्तिपाठश्च, सुमुखश्चैकेत्यादि पौराणिक मंगलाचरण— पाठाभ्यासः, श्रीगणेशाम्बिका षोडशोपचार पूजनाभ्यास, आरती पुष्पांजलि पर्यन्तम्।

तृतीय अन्विति — कलश स्थापन क्रम वर्णन पूर्वक कलश का स्वरूप वर्णन एवं षोडशमातृका — सप्तधृत मातृका स्थापन पूजनं च।

चतुर्थ अन्विति — नवग्रह मण्डल स्थापन पूजनं च (ग्रह शान्तिः) स्थण्डिलवेदि निर्माण, संक्षिप्त हवन विधिः, यज्ञस्तुतिश्च।

पंचम अन्विति — वास्तु, योगिनी, क्षेत्रपाल, सर्वतोभद्र, लिङ्गतोभद्र मण्डल निर्माण एवं स्थापन विधिः पुरुषसूक्त एवं श्रीसूक्त पाठाभ्यासः।

संस्तुत पुस्तकें —

1. मिश्र, लाल बिहारी, (1988), *नित्यकर्म पूजा प्रकाश*, गोरखपुर, गीताप्रेस।
2. शास्त्री, दुर्गाशंकर उमाशंकर. (1999), *बृहद् नित्यकर्म समुच्चय*, वाराणसी, चौखम्बा सुरभारती।
3. त्रिवेदी, हरिहर. (2004), *कर्मकाण्ड पुष्पलता*, ग्वालियर, ललिता प्रकाशन।
4. मिश्र, लाल बिहारी, *नित्यकर्म पूजा प्रकाश*, गोरखपुर, गीताप्रेस।

E-Resources:

<https://archive.org/details/NityaKarmaPujaPrakashGitaPressGorakhpur>

भारतीय ज्योतिर्विज्ञानम्

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- ज्योतिर्विज्ञान, ज्योतिष, मुहूर्त एवं पंचांग का ज्ञान।

निर्देशः—यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम अन्विति — पंचांग — परिचय — तिथि, वार, नक्षत्र योग, करण आदि का सम्यक् परिचय, नामाक्षर से राशि ज्ञान।

द्वितीय अन्विति — पंचक एवं मूल विधायक नक्षत्र विचार और परिहार, भद्राविचार, दिक्शूल विचार और परिहार, ध्रुव, मृदु, चर नक्षत्र ज्ञान, चर, स्थिर एवं द्विस्वभाव लग्नविचार।

तृतीय अन्विति — विवाहमेलापकविधान, आकृष्ट मिलान, नाडीदोष, गणदोष, भकूटदोष, वर्णदोष, विचार परिहार मंगलीक विचार एवं परिहार।

चतुर्थ अन्विति — ग्रहों का उच्चनीच राशिवास व दृष्टि विचार, शुभ और पापग्रह मित्र-शत्रु भावविचार, अग्निवास एवं विविध मुहूर्त विचार।

पंचम अन्विति — राशियों के स्वामी, नक्षत्रों के स्वामी, शनि की साढे साती का विचार, द्वादश राशियों पर ग्रहों का भोगकाल एवं संक्षिप्त जन्माक्षर निर्माण विधान।

संस्तुत पुस्तकें —

1. द्विवेदी, विन्ध्येश्वरी प्रसाद, (1998), *मुहूर्तचिन्तामणिः* नई दिल्ली, चौखम्बा सुरभारती प्रकाशन।
2. व्यास, सोहनलाल, (1980), *मुहूर्तपारिजातः* वाराणसी, चौखम्बा सुरभारती प्रकाशन।
3. त्रिपाठी, ब्रह्मानन्द, (1984), *शीघ्रबोधः* नई दिल्ली, चौखम्बा सुरभारती प्रकाशन।
4. पाण्डेय, रामचन्द्र, (2013), *बृहदअवकहडाचक्र*, वाराणसी, चौखम्बा संस्कृत पुस्तकालय।
5. शास्त्री, भवानी शंकर, (2018), *निर्णयसागर* पञ्चाङ्ग, नीमच, निर्णय सागर प्रेस।
6. द्विवेदी, विन्ध्येश्वरी प्रसाद, (2014), *वास्तुरत्नाकर*, वाराणसी, चौखम्बा संस्कृत सीरीज ऑफिस।
7. मण्डन, *राजवल्लभवास्तु शास्त्रम्* व्या. श्री कृष्ण जुगनू, (2005), दिल्ली, परिमल प्रकाशन।
8. शलभ, नन्दकिशोर अग्रवाल, (2012), *वास्तुसूत्र*, दिल्ली, हिन्द वॉकेट बुक्स।
9. शास्त्री, विनोद, शर्मा सीताराम, (2008), *वास्तुप्रबोधिनी*, दिल्ली, मोतीलाल बनारसीदास।

भारतीय वास्तु विज्ञानम्

निर्गमः— पाठ्यक्रम के सफलतापूर्वक अध्ययन के पश्चात् विद्यार्थी निम्नलिखित में समर्थ होंगे।

- वास्तुशास्त्रीय सिद्धान्तों एवं पद्धति विज्ञान कला का अवबोध।
- वास्तुशास्त्रीय सिद्धान्तों के प्रति वैज्ञानिक दृष्टिकोण का विकास।

निर्देशः—यह प्रश्नपत्र पाँच अन्वितियों में विभक्त है। प्रत्येक अन्विति से उसके सामने अंकित संकेत के अनुसार प्रश्न पूछे जायेंगे।

प्रथम अन्विति — वास्तुपुरुष का परिचय एवं वास्तु का अर्थ, भूमिखाननारम्भ, शिलान्यास, गृहप्रवेश मुहूर्त विधान।

द्वितीय अन्विति — गृहप्रवेशविधिः, गृहवास्तु/प्रासाद वास्तुमूलक विविध— विचार।

तृतीय अन्विति — गृह का मुख्य द्वार दिशाविशेष ज्ञान, रसोई, पूजागृह, पानीटैंक मुखिया का शयनकक्ष घर के आसपास वृक्षारोपण आदि विविध वास्तुशास्त्रीय विचार व समाधान।

चतुर्थ अन्विति— वापी—कूप—तड़ाग निर्माण मुहूर्त, वृक्षारोपण एवं औषधि सेवन आदि के मुहूर्त विचार।

पंचम अन्विति — वास्तुशान्ति प्रयोग विधान एवं सर्वसामान्य हवन पूजन संभार सूची

संस्तुत पुस्तकें—

1. मय, *मयमतम्* व्या. शैलजा पाण्डेय, (2013), वाराणसी, चौखम्बा सुरभारती प्रकाशन।
2. भोज, समरांगणसूत्रधार, व्या. श्रीकृष्ण जुगनू, (2010), वाराणसी, चौखम्बा संस्कृत सीरीज।
3. राम, दैवज्ञ, *मुहूर्तचिन्तामणि* व्या० रामचन्द्र पाण्डेय, (2011), वाराणसी, चौखम्बा कृष्णदास अकादमी।
4. द्विवेदी, रामनिहोर, *बृहद्वास्तुमाला*, सम्पा. ब्रह्मानन्द त्रिपाठी रवि शर्मा, (2016), वाराणसी, चौखम्बा सुरभारती प्रकाशन।
5. विश्वकर्मा, *विश्वकर्माप्रकाश*, टीका. गणेशदत्त पाठक, (2001), वाराणसी, श्री ठाकुरप्रसाद पुस्तक भण्डार।
6. भवानी, शंकर, (2018), *निर्णयसागरपंचांग*, नीमच छावनी, निर्णय सागर प्रेस।

Certificate Course in Statistical Techniques & Applications

Theory - 80 hr

Practical - 80 hr

Objective:

To develop research methodology with statistical techniques and software packages.

Section A (20 hr)

Concept of variable, attribute. Statistical population and sample, Sample survey versus census survey. Treatment of data-collection of primary and secondary data, Representation of data (tabular, diagrammatic and graphical methods), Measure of central tendency, dispersion, shape & peakedness of distribution.

Section B (20 hr)

Curve fitting through Principle of least squares: Fitting of straight line, parabola, exponential and power curves, Growth curve. Bi-variate distribution-correlation and regression. Fitting-Binomial, Poisson and normal distributions with their applications.

Odds ratio, logistic regression, Reliability and validity of attributes, Factor Analysis.

Section C (20 hr)

Testing of hypothesis - Meaning and need, one tail and two tail tests, large and small sample tests, tests of significance of mean, variance, proportion and correlation coefficient,

Chi-square test of independence of attributes,

ANOVA : One way and two way (one observation per cell),

Design of experiment - layout and analysis of completely randomized design (CRD) and randomized block design (RBD).

Lab Work Excel (30 hr)

- Karl Pearson's Correlation
- Spearman Rank Correlation Coefficient
- Regression & Logistic Regression
- ANOVA-one way, two way.
- CRD, RBD

SPSS (30 hr)

- Measure of central Tendency
- Measure of Dispersion
- Factor Analysis
- Testing of Mean-Single & 2 Sample
- Testing of Variance-Single & 2 Sample
- Testing of Proportion-Single & 2 Sample
- X² (Chi-Square) Test of Goodness of fit & Independence of attributes.

Note: (i) In continuous assessment of practical examination students, are required to submit primary data based project associated with their fields.

(ii) Scientific Calculator is permissible in exams.

Certificate Course in Actuarial Sciences

Theory –100 hrs.

Objectives: To acquaint the students with various statistical/financial and economical methodologies and prepare them for the Actuarial Society's examination.

Section A

Review of basic concepts in Linear Algebra and Calculus, Concept of Compound interest theory, payments, interest rates, loans, investment projects appraisal. Force of interest, accumulated value of a stream of equal or unequal payments. Flat rates and Annual effective rates. Annuities certain, discrete (due and immediate) and continuous, with and without deferment, with m-thly payments, discounted cash flow techniques.

Economic theory of interaction between supply and demand, elasticity and its calculations, Utility theory, utility function, cost and revenue, national income; GDP, GNP, NNP.

Section B

Summarizing data, Probability, Random variables and probability distributions, joint distribution, generating functions (p.g.f., c.g.f., m.g.f., c.f.), Law of large numbers and central limit theorems. Concepts of sampling and statistical inference: point and interval estimation, Confidence intervals, testing of hypothesis problems.

Section C

Correlation analysis and Regression analysis, Analysis of variance (ANOVA). Decision theory: Loss distributions, calculating probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements, optimum strategies under theory of games, decision function and risk functions. Bayesian Statistics: fundamental concepts of Bayesian statistics and use these concepts to calculate Bayesian estimators. Simulation methods.

Diploma in Actuarial Sciences

Duration : One Session (T-6 hrs/week)

Theory –120 hrs.

Minimum eligibility : B.A./B.Sc. III year (Mathematics/Statistics/Computer Science/Economics/Management)*

M.A./M.Sc. (Mathematics/Statistics/Computer Science/Economics/Management)*

*Candidates who have not studied any course in Statistics during their graduate or post-graduate level, they must join certificate course in Actuarial Sciences before applying for diploma in the same.

Section A

Reinsurance, Risk model, construct risk models involving frequency and severity distributions, moment generating function and the moments for the risk models both with and without simple reinsurance arrangements.

Principles of actuarial modeling, its applications, benefits and limitations. General principles of stochastic processes and their classification into different types. Markov chain, its essential features, Chapman Kolmogorov equations, Two state markov model.

Section B

Time homogeneous Markov jump process, time inhomogeneous Markov chain process and its simple applications: simple survival models, sickness models and marriage models. Survival models: Gompertz and Makeham laws of mortality, estimation procedures for lifetime distributions (Kaplan Meier estimate, Nelson-Aalen estimate), Cox model for proportional hazards.

Section C

Binomial model of mortality, MLE for the probability of death, estimate transition intensities depending on age, exactly or using the census approximation, Test crude estimates for consistency with a standard table or a set of graduate estimates, and describe the process of graduation. Test for smoothness of a set of graduate estimates, Generalized Linear Models, Time series models.

Certificate Course on IT Localization

Theory – 24 hrs.

Practical - 72 hrs.

Objectives:

To acquaint the student with the process of IT Localization and issues involved in it with special emphasis in the context of Indian Languages.

- Localization - Introduction, Computing in Indian Languages, scope in Information Technology, Fonts. (3 hrs.)
- Encoding Schemes - ISCII, UNICODE (3 hrs.)
- Indian Languages in Office Automation Tools, mailing Applications etc. (2 hrs.)
- Introduction to Indian languages on WEB, Web based fonts, dynamic fonts, development of static and dynamic contents, tools supporting Indian languages. (4 hrs.)
- Indian languages and Databases, storage issues using ISCII and UNICODE (3 hrs.)
- Introduction to GNU-LINUX, Speech Applications, Machine Translation, Cross Lingual Information Retrieval, OCR in Indian Language. (7 hrs.)
- Introduction to emerging technologies and challenges. (2 hrs.)

Lab Work

- Demo of existing multilingual Applications Developed at Banasthali University, Hindi Keyboard familiarity, Working with MS Word using Akruti & ISM. (4 hrs.)
- Working with MS Office using Akruti & ISM, Unicode (4 hrs.)
- Enabling Indian language at Database level (8 hrs.)
- Web Page development in Indian Language (8 hrs.)

Project (48 hrs.)

Diploma in Computer Hardware and Maintenance

Theory – 80 hrs.

Practical – 80 hrs.

Objectives:

To enable the student to assemble a Personal Computer, to diagnose problems and perform trouble shooting, repair and maintenance including simple networking.

An inside look at PC. Enclosures, power supplies, mother board and related parts. Sockets and slots, form factors.

Overview of various ports, I/O devices, video/HD/FD controllers, various adaptor boards.

External connectivity, opening and closing the system, Tips for working inside a PC.

I/O expansion slots, System resources, bus arbitration logic, types of buses.

CPU identification. Features of Intel CPU's (8088 to P4). CPU cooling. Understanding chipsets.

The PC hierarchy: hardware, BIOS OS, applications. Motherboard BIOS, POST, CMOS setup routine and configuring, CMOS backup battery.

Essential memory concepts. Memory organisation (XMS, EMS/UMA/HIMEM). Memory packages and modules. Logical memory organization. Parity principles.

Features and functioning of display adaptors, various kinds of display adaptor boards.

An inside look at monitors: CRT, raster, power supply, controls, Tips for working with a monitor.

ADVANCED: Construction of a monitor, Pixels/resolution, H/V scanning, raster, retrace, interlacing, bandwidth. Video signal. Fly-back. Monitor repairs.

Floppy disk drive. Magnetic storage concepts. Drive construction, FDD installation and replacement. LS-120 drive concept.

Backup devices overview, CD-ROM, CD-R, CD-RW, creating a bootable (T).

Hard Disk Drives, Basic Drive concepts.

Drive construction, platters, media, motors, heads and actuators. Data density characteristics. Tracks, cylinders, and sectors. Zoned recording, landing zone, interleave, precomp, servo techniques. Drive installation and replacement, configure the CMOS.

Overview of HDC. IDE/ATA/UDMA concepts and data transfer modes. Drive partitioning, formatting and FAT basics. SCSI and RAID basics.

Keyboard and pointing devices. Modems/Fax card. USB. Serial port/parallel port signals and operation. Windows configuration.

Overview of plug-and-play and hot-swap. Fans and cooling. Power protection and battery backup.

Various printers : impact and non impact. Overview of dot matrix printer, laser printer, ink-jet printer and line printer.

Overview of all electronics component and symbols and measuring instruments like analog & digital Multimeter and CRO.

Electronic component testing technique, fault finding and types of cables, connector and testing.

Overview of different types PCB, circuit design, layout design, negative and positive making technique and Etching process.

SMPS construction and repairs. Soldering and desoldering techniques.

Printer repairs : DMP, Laser, Ink-jet.

A closer look at OS and boot process, understanding popular OS features, creating BOOT disk for DOS and Windows. Windows issues for startup and shutdown problems, device management and properties.

Arranging the pre-service checkup. Identify and isolate, Repair or replace, retest, Virus and anti virus. Preventive maintenance.

Diagnostic utilities. Overview of Disk Manager and Norton Disk Doctor.

Dealing with hardware conflicts and software conflicts. Data recovery tips. Recovery of files and folders. FAT and directory damage. Understanding CHKDSK and SCANDISK. Recovering MBR. Using FDISK.

Overview of optical fiber cable and losses measurement, types of optical fiber cable and construction, tools of optical fiber, use of optical fiber, advantage and disadvantage.

Networking process, IP addressing and IP allotment, overview of different types Hubs and switches, UTP cable and connectors.

Lab Work :

1. Inside look at PC
2. Various ports, I/O devices, Video/HD/FD controllers and various adaptor boards.
3. CPU identification, Features of Intel CPU's (8088 to P4). CPU cooling and Understanding chipsets.
4. CRT, raster, power supply, controls, working of monitor. Construction of a monitor, Pixel/resolution and Monitor repair.
5. BIOS, OS, Applications. Motherboard BIOS, POST, CMOS setup routine.
6. Configuring, CMOS backup battery. Essential memory concepts and Memory organization (XMS, EMS/UMA/HIMEM).
7. Floppy disk drive, Magnetic storage concept, Drive construction, FDD
8. Construction of CD-ROM, CD-R, CD-RW and creating a bootable CD.
9. Drive construction, Platters, media, motors and heads actuators.
10. Various Printers: Impact and Non impact. Overview of dot matrix printer, Laser printer, ink-jet printer and line printer, Printer: DMP and Laser Ink-Jet.
11. Study of various types of measurement equipment like Analog & Digital Multimeter and CRO.
12. Identify of all electronic Components and Testing of Components and fault finding.
13. Testing of different types of cable and Power Supply.
14. Study of different types of Transformer.
15. Overview of PCB Design and Soldering.
16. SMPS power supply construction, repair and fault finding.
17. Diagnostic utilities. Overview of Disk Manager and Norton Disk Doctor. Dealing with hardware conflicts and software conflicts, Data recovery tips, recovery of files and folders, FAT and directory damage. Understanding CHKDSK and SCANDISK, Recovering MBR, Using FDISK
18. PC Assembling.
19. Networking lab IP addressing, IP allotment and Overview of Banasthali Vidyapith Networking.
20. UTP cable preparation and Connectors.
21. Testing of Optical and losses measurement.
22. Revision Lab

Diploma in Internet and Web Applications

Theory – 80 hrs.

Practical – 80 hrs.

Objectives:

- (i) To know about Internet & its services.
- (ii) To be able to design web-pages using Java programming & HTML.

Internet

Computer Networks concepts, Overview of OSI model, Introduction to TCP/IP, Structure of Internet, Concepts of IP Addressing, Naming services, and Domain name server, Various services of Internet, e-mail, Search Engines, Downloading, Chatting, Video Conferencing,

Web Page Designing

Web Server and Browsers, Web Documents, HTML and its feature, Embedding of Images, Audio and Video, Web Designing Tools (Front Page., Express, Visual InterDev, etc.), Concept of Dynamic Web Pages using , JavaScript and VB Script, Server side ,programming and Database Interfacing, Introduction to ASP.

Java Programming

OOP Concepts, Basic features of Java, Variables and Data Types, Operation and Expression, Control Constructs, Objects and Classes in Java, Essential Java Classes and packages, Vector, I/O, Exception Handling, Threads and programming with Threads.

Lab Work

Demonstration of Network, Internet and its services

Web Page Designing:

1. Create different types of list using HTML
2. Create different types of tables using HTML
3. Create different types of image maps using HTML
4. Create pages with internal and external linking using HTML
5. Create pages with different frame formats using HTML
6. Display HTML pages using CSS
7. Creation of different forms with validation using JavaScript
8. Introduce different dynamic effects using JavaScript
9. Creation of different forms with validation using VBScript
10. Simple problem using ASP
11. Database handling problems using ASP

Java Programming:

1. Basic Java Programming (problems based on operators, conditional statements, loop statements, arrays etc.
2. Problems based on Inheritance.
3. Problems based on Package and Interface
4. Problems based on Exception handling

5. Problems based on Applets.
6. Problems based on Graphics(GUI component)
7. Problems based on Event Handling
8. Problems based on Threads

Project Based on Web Page Designing

Diploma in .NET (C#, ASP .NET)

Theory-80 hrs

Objectives:

Practical-80 hrs

At the completion of this course, you will be able to:

- Describe the meaning of web application.
- Describe the key differences between ASP and ASP.NET.
- Separate page code from content by using code-behind pages, user controls, and components.
- Display dynamic data from a data source by using ADO.NET and data binding.
- Create an ASP.NET Web application by using Visual Studio .NET.
- Use a Web service to enhance a Web application.
- Add configuration, authentication, and state management to an ASP.NET Web application.
- Use the trace feature of ASP.NET to obtain information about executed requests.
- Use the Visual Studio .NET debugger to debug ASP.NET Web applications.
- Access databases in an ASP.NET Web application by using ADO.NET.
- Implement Forms-based authentication in an ASP.NET Web application.

Web Architecture

The Way the Web works. The Asp.net difference, Client-Side Processing, How Asp.net Ties It Together

Setting up and Installing ASP.NET

Installing Internet Information Server, US Manager, Creating virtual/home directory. Folder Settings, Adding a virtual directory to your neighborhood. Installing .Net Framework SDK

Overview of the ASP.NET Framework

Asp.net and the .NET Framework, Common Language Runtime,.Net Framework Class Library Understanding Namespaces, The Structure of asp.net Page, Directives, Code Declaration Blocks Code Render Block, C# fundamentals

Using the Standard Controls

Displaying information. Label Controls, Literal Controls, Accepting User Input, Textbox controls Radio Button And Radio Button List Controls, Check Box And Check Box List Controls, Submitting Form Data, Button controls. Link Button Control, Image Button Control, Displaying Images Image Control, Using Panel Control, Using Hyperlink Control

Using the Validation Controls

Required Field Valuator Control, Regular Expression Valuator Control, Compare Field Valuator Control, Range Validator Control, Validation Summary Control, Custom Validator Control Disabling Validation, Creating a Length Validator Control, Creating a Ajax Validator Control

Using the Rich Controls

Accepting File Uploads, Saving files to file system, Saving files to database, Uploading Large files, Displaying a calendar, Creating a popup date picker, Rendering a calendar from a database table, Displaying advertisements, Storing advertisements in XML files. Storing advertisements in database tables. Displaying Different Page views. Displaying a Tabbed Page View. Displaying a wizard

Designing Websites with master pages

Creating master pages. Creating default contents, nesting master pages, Using images and hyperlinks in master pages, registering master pages in web configuration

Designing websites with Themes

Creating Themes, Adding skins to themes, creating named skins, Themes versus Style Sheet Themes, Disabling Themes, Registering Themes in web configuration file

Microsoft SQL Server 2005 Express

Overview of SQL Server 2005 Express, Installation of SQL Server 2005 Express, Features of SQL Server Express, SQL Server 2005 Express management tools, Server databases versus Local Databases

Using SQL Data Source Control

Creating database connections, Storing connection String in web configuration file, Executing Database Commands, Executing inline SQL Statements, Executing Stored Procedures, Using ASP.NET parameters with SQL DataSource Control .Programmatically Executing Sql Data Source commands. Adding ado.net parameters. Executing Insert, Update and Delete commands Executing select commands.

Using List Controls

Overview of the List Controls, Declaring List Items, Binding to a Data Source, Working with the RadioButtonList control, Working with the ListBox control. Working with the CheckBoxList control, Working with Bulleted List control

Using the Grid View Control

Grid View Control fundamentals. Displaying Data, Selecting Data, Using Data Keys, Sorting Data, Paging through Data, Editing Data, Displaying Empty Data, Formatting the Grid View Control

Using the Details View and Form View Controls

Using the Details View control, displaying data with the DetailsView control, Using Fields with the DetailsView control. Using the Form View Control, Displaying Data with the Form View control Paging through Data with the Form View control

Using Repeater and Data List Controls

Using Repeater Control, Displaying data with the Repeater Control, Using Templates with the Repeater Control, Using the Data List Controls, Displaying Data with the Data List Control.

Using Navigation Controls

Understanding Site Maps, Using the Site Map Path Control, Using the Menu Control, Using Tree View Control

Using the Login Control

Overview of Login Controls, Using Login Controls, Authenticated Users, Using a Template with Login Control, Performing Custom Authentication with Login Control, Using Login Status Control Using Login Name Control, Using Change Password Control, Using Password Recovery Control

Caching Application Pages and Data

Overview of Caching, Using Page Output Caching, Varying the Output Cache by Parameter

Creating an XML Web Services

Overview of XML Web Services, Creating a simple XML Web Services(3+2)

AJAX (Asynchronous JavaScript and XML)

About Ajax, Server Side Ajax, Client Side Ajax, Ajax Toolkit

Sending Emails

Designing email panel, How to send an email to various users. Sending auto emails

Books Recommended :

1. Mastering ASP .Net BPB Publication
2. ASP.net - The Complete Reference Tata McGraw Hill
3. Beginning Visual C# 2005, by Kari Watson et al, Wrox Press
4. Beginning Active Server Pages 3.5 by Wrox Press

Diploma in Medical Image Processing

Theory-80 hrs

Practical-80 hrs

Section A

Introduction: Basics of Digital Image Processing (DIP), Computer Vision, scope of image processing in Medical Science, introduction to Matlab, ImageJ and MIPAV.

Image and Signal Processing: Sampling theory, interpolation methods including nearest-neighbour, linear, cubic & higher-order, and Fourier (using the FFT); implementation of spatial image transformations (rigid and non-rigid).

Sources of Medical Images: Briefly discussion of the physics of X-ray, CT, PET, MRI, and ultrasound; discussion of the properties of the resulting images, and of the advantages and disadvantages of each imaging modality.

Section B

Image Enhancement: Contrast adjustment, de-noising (convolution, FFT), deblurring (solving an ill-conditioned sparse linear system), edge detection (numerical approximation to a partial derivative), anisotropic diffusion (numerical solution of partial differential equations), super-resolution.

Image Registration (alignment): Discussion of intensity-based methods, including a variety of cost functions (correlation, least squares, mutual information, robust estimators), and optimization techniques (fixed-point iteration, gradient descent, Nelder-Mead simplex method, etc.). Implementation of registration for rigid and non-rigid transformations. MRI motion compensation.

Section C

Image Segmentation (tissue classification): Discussion of simple methods such as thresholding, region growing and watershed. In-depth coverage on the method of snakes (adaptive mesh), level set method (numerical solution of partial differential equations), and clustering (classifiers).

Reconstruction Methods: Reconstruction techniques for CT (filtered back projection) and MRI (using the FFT) and its applications. Coverage of the theory of the Radon transform, the Fourier transform, and how they relate to each other.

Books and References:-

1. Atam P Dhawan, H K Huang, Dae-Shik Kim, "Principles And Advanced Methods In Medical Imaging And Image Analysis", 2008, by World Scientific Publishing Co. Pte. Ltd.
2. John L. Semmlow, "Biosignal and Biomedical Image Processing: MATLAB-based Applications", 2004, Marcel Dekker INC, USA.
3. Yaochu Jin and Lipo Wang, "Fuzzy Systems in Bioinformatics and Computational Biology", 2009, Springer-Verlag Berlin Heidelberg.
4. James A. Green, "Medical image processing: The mathematics of medical imaging", Greenwood Research, 2002.
5. Geoff Dougherty, "Medical Image Processing: Techniques and Applications", 2011 Springer.
6. I. N. Bankman, "Handbook of Medical Image Processing and Analysis", 2009 Elsevier Inc.
7. Jiří Jan, "Medical image processing, reconstruction, and restoration: concepts and methods", Taylor & Francis, 2006.
8. <http://mipav.cit.nih.gov>
9. <http://rsbweb.nih.gov/ij/>

Advanced Diploma in Networking

Minimum contact hours: 200

Objectives:

To learn basic concepts of Computer Network and Internetworking, so as to troubleshoot network problems.

Unit I Computer Basics, OSI model and Industry Standards, LAN, Network topologies, IP addressing, including subnet masks, Networking components and Collision Domain, Structured Cable, Routing and Addressing, Basic Network design.

Unit II WANs and Routers, Router CLI, Router Components, Router Startup and Setup, Beginning Router configuration, IOS, TCP/IP, Routed and Routing Protocols, Network Troubleshooting.

Unit III Advanced router configuration, LAN switching theory, VLANs, Advanced LAN and LAN switched design, Novell IPX Case studies.

Unit IV WAN theory and Design, WAN technology, PPP, Frame Relay, ISDN, Network trouble shooting, Case studies.

Lab Work

I. To demonstrate the competencies in a TCP/IP based network using Ethernet LAN media:

- Build and test a Category 5 UTP Straight-through patch cable.
- Understand and IP addressing and subnet masking scheme for all class of network.
- Configure routers for login and enabled passwords for console.
- Physically connect Layer 1 and Layer 2 devices to router Ethernet interface.
- Configure router Ethernet interfaces for IP.
- Configure a workstation for TCP/IP communications for showing full connectivity to the router interface.
- Physically connect router serial interfaces in a back-to-back lab configuration using DCE/DTE cable combination.
- Configure routers to route IP traffic using RIP and IGRP protocol.
- Configure router serial interface using PPP encapsulation.
- Configure switch and creation of VLANs.
- Design and applied IP ACL for network security.
- Monitor network traffic using router debug commands.
- Monitor and troubleshoot network traffic using Ping, Telnet, Trace route, and debug commands.

Certificate in Radio Production- Rjing and Anchoring

Course Duration: 12 months

Theory (T)-40hrs

Practical (P)-60hrs

Total Instruction Hrs. : 100

1. **Introduction to Media** 4 hrs.
 - 1) What is media
 - 2) Print media
 - 3) Electronic media
 - 4) Difference between print and electronic media.
2. **What is Radio** 4 hrs.
 - 1) Introduction to radio
 - 2) Technicalities of radio
 - 3) Community radio station
 - 4) Commercial radio
 - 5) Difference between Community and Commercial radio
3. **Researching & writing for radio** 4 hrs.
 - 1) Research for the program
 - 2) What is script?
 - 3) Script sense
4. **Radio text and content** 4 hrs.
 - 1) Various types of scripts
 - 2) Effective script writing
 - 3) Outdoor Broadcast
 - 4) Recorded data
5. **Radio anchoring** 4 hrs.
 - 1) Basic qualities of an anchor
 - 2) Importance of language
 - 3) Modulation and punches
 - 4) Talking with audience
6. **Live broadcast** 4 hrs.
 - 1) Introduction to live programs
 - 2) Handling live show
 - 3) Anchoring for live programs
 - 4) Difference between live and recorded programs
7. **RJing (Radio Jockey)** 8 hrs.
 - 1) Anchoring in live programs with handling other technical operations like handling Audio console, Recording, Editing and play listing.

8. Radio production skills

8 hrs.

- 1) Pre production
- 2) Production
- 3) Post Production
- 4) Audio Editing software's i.e. Adobe audition, Wavelab etc.....
- 5) Outdoor Recording

9. Final projects (Practical Assignments)

60 hrs.

- 1) Anchoring pre-recorded programmes(talks,discussion,interviews)
- 2) Anchoring live phone-in programmes (talks,discussion,interviews)
- 3) Participating in radio plays/feature/dramas/skit
- 4) Scripting for radio programmes
- 5) RJ-ing the programmes

Practical approach by participating in the programs of Radio Banasthali

Evaluation-Evaluation will be done on the basis of quality of the final programs produced and mixed by the students.

Detailed Syllabus

(i) Introduction to media.....

Media is a source of entertainment and information. It has two major divisions, one is Electronic Media and the other is Print Media. Electronic Media is further divided into two parts, Television and Radio. During this course students will be introduced to media and will be having a focused study of Radio Broadcasting.

(ii) What is Radio..?????

In This part students will be having a close interaction with radio. They will learn how radio works on different frequencies and mediums and will also come to know have basic different between community and commercial radio stations. After this LEARNERS WILL TREAT RADIO LESS AS AN INSTRUMENT RATHER MORE AS A FRIEND.

(iii) Researching and writing for radio....

This part of learning will introduce students to the particular demands of writing & researching for radio. They will learn the roles of scripting in both recorded & live programs. Students will learn how to write & structure for different formats and audiences.

On completion of this part students should be able to demonstrate that they can:

- (a) Interpret and perform research tasks.
- (b) Exercise appropriate judgment in the selection, evaluation & ordering of wide range of source material during research.
- (c) Employ a range of techniques in the presentation and adaptation of research and other material for differing radio audiences.
- (d) Write, amend and annotate script for performance for a range of audiences and formats.

- (e) Exercise appropriate judgment in the use of script in feature packages.
- (f) Apply effectively a wide range of formats in response to editorial briefs

(vi) **Radio text and Contents....**

Students will be made to learn how the radio text works to create meaning, how material is selected, scheduled and contextualized by staff with an editorial or production function. They will examine in detail the form and function of talk on the radio and will explore how this acts to bind together broadcaster and listener.

After completing this part students should listener.

- (a) Communication skills, oral and written.
- (b) Independent and co-operative learning skills.
- (c) Research skills.

(v) **Radio anchoring....**

Induction of radio anchoring module in this course will make the students to know the basic qualities of a radio anchor. They will get a clear vision of their strengths and weaknesses related to radio anchoring by focusing on language, punches, modulation etc.

After completing this part students must be :

- (a) Able to conduct and carry a recorded program.
- (b) Able to carry a live program, talking with audience.
- (c) Able to get an interactive approach.
- (d) Able to add required flavor in the program.

(vi) **Live broadcast....**

This module brings together the students' radio production skills and knowledge into the context of live broadcasting\ . Emphasis will be placed on team working to produce a live broadcast.

On completion of the module students be able to :

- (a) Demonstrate effective working in a live broadcast environment.
- (b) Effectively employ professional standard studio broadcast equipment and software packages.
- (c) Originate an innovative response to audience demands.
- (d) Demonstrate excellent organizational, interpersonal and time management's skills.
- (e) Demonstrate a high level of self discipline, self-direction and accountability in the delivery of the broadcast.
- (f) Make use of a range of advanced editing and presentation techniques.
- (g) Employ a range of marketing techniques to attract a target audience.

(vii) **RJing (Radio Jockey)**

This module will examine in detail how a student can command the technical operations during anchoring the live programs.

On completion of this part students should be able to demonstrate that they:

- (a) Have developed a high level of skills for being a RJ (Radio Jokey)
- (b) Have developed a sense of commanding all the technical operations during the live programs.

(viii) **Radio production skills....**

This part introduces the basic technical & creative skills of radio production. Students will be introduced to sound recording, digital editing & mixing, interviewing, scripting, voicing and packaging techniques.

On completion of this part students should be able to demonstrate that they can :

- (a) Successfully record interviews on location.
- (b) Perform basic computer edits & mixes using computer editing software.
- (c) Prepare a range of written material including cues, links, running orders, front and back announcements and scripts.
- (d) Set up & use a mixing desk with microphones.
- (e) Plan & produce a short radio features using a range of treatments.
- (f) Perform basic computer editing including cut & paste, normalization, fades, and multi – track mixing. g) Work to deadlines. h) Work independently or as part of a group with efficiency.

ix) **Final projects....**This part allows students to demonstrate the full extent of their production skills in a substantial single production of their own devising.

On completion of the module students would be able to demonstrate:

- (a) Working professionally as part of a team with a high level of personal motivation.
- (b) Application of current audio technology to produce material of the highest professional standard.
- (c) High level of critical analysis of radio form and content.
- (d) Successfully working with individuals outside of the immediate production team.
- (e) Production of original material, within time constraints, successfully fulfilling and identified market need.

Suggested readings:

- Paul Chantler & Peter Stewar (2003) *Basic Radio journalism*, Oxford.
- Boyd, Andre (1997) *Broadcast Journalism: Techniques of Radio and TV News (Media Manuals)*, Landon : Focal Press.
- Thomas, Pradip Ninan (2010) *Political Economy of communication in India, : The Good, the bad and the ugly*, Delhi : sage.
- Bandopadhyay, PK (2010) *Radio Communication at close Range* : BR Publishing Corporation.
- Paravala, Vinod and Malik, Kanchan K. (2007) *Other Voices: The struggles for community Radio in India*, New Delhi : Sage.
- Hendy, David (2000) *Radio in the Global Age*, Combridge : Polity Press.

E-Learning Material:

FORMATS OF RADIO PROGRAMMES

<http://download.nos.org/srsec335new/ch11.pdf>

Writing for Radio - The Basics

<http://bolhyd.commuoh.in/wp-content/uploads/2014/10/writingforradio.pdf>

Diploma in Audio Engineering

I. Theory of sound

Classification of sound, Sound waves, characteristics and properties, propagation, pitch, intensity, speed, audible spectrum, threshold of hearing,

II. Microphones

Audio signal, classification, working principle of various types of microphone, phantom power, pick-up/polar pattern, characteristics and properties of microphones, wireless microphones, protection devices.

III. Cables & connectors

Balanced and unbalanced configuration, anatomy of cables, connectors, design, applications

IV. Analog/Digital Sound recording/audio production

Audio production chain, audio mixing console, analog audio, analog recording, analog to digital conversion, digital audio signal, digital recording formats, professional sound card, two track/multi track recording software, digital recording media, background music editing and mixing.

V. Multitrack recording

Concept of 2 track and multi track, multitrack sound card, multitrack recording and editing software, MIDI.

VI. Acoustics and studio design

Room acoustics, reverberation, echo, acoustic treatment, studio acoustics, and various types of studio design.

VII. Sound reproduction

Sound reproduction chain, Studio monitors Active and passive Audio monitors, room acoustics, selection of monitors, placement of monitors

VIII. FM Transmission technology

AM and FM, typical radio system, FM transmitter, frequency deviation, modulation index, bandwidth, RF signal, radio wave propagation, FM band, transmission and reception, AM v/s FM

Practical:

1. Two track (stereo) recording
2. Multi – track recording
3. Two track (stereo) editing
4. Multi –track editing and mixing.
5. Mastering & mixing of audio programmes.

Suggested Readings:

- Awasthy, GC (1965) *Broadcasting in India*, Bombay : Allied.
- Luthra, HK (1987) *Indian Broadcasting*, New Delhi : Publication Division.
- Mehra, Masani (1958) *Broadcasting and the people*, NBT, New Delhi.
- Mcleish, Robert (2005) *Radio Production* : Focal Press oxford.
- Thomson Rick (2010) *Writing for broadcast journalists*, New York : Routledge.

E-Learning material:

Fundamentals of Audio and Music Engineering: Part 1 Musical Sound

<https://www.coursera.org/learn/audio-engineering>

7 Free Resources to Learn About Sound Engineering

<https://www.makeuseof.com>

Audio Engineering Lesson 1 - Intro to Sound and Hearing

<https://www.recordingconnection.com/courses/audio-engineering/audio-lesson-01/>

Physics Tutorial: Introduction to Waves - YouTube

<https://www.youtube.com/watch?v=KWzyQKcJBYg>

Diploma in Broadcast Journalism (radio)

I. Communication & Mass Communication

Meaning of Communication. Importance of Communication. Functions of communication. Types of Communication. Barriers of Communication. Essential of Communication. Communication process .Definition of Mass Communication. Function of the Mass Communication .Difference between Communication and Mass Communication .Elements of Mass Communication.

II. Tools of Mass Communication

Newspapers. Magazines. Radio. Television, Films. Folk and Traditional Media

III. Print Journalism (Print media)

What is journalism? Tabloid and Yellow journalism. News and its values. Role of Journalist. Professional and Ethical Standards. What to Bring for News Reporting? Reporter's Role in Newspaper. Reporting Skill. Planning and Conducting Interview. Interpretative Reporting. Types of Reporting. Sports Reporting. Major reporting Department News Agency. International News Agency. Syndicates News Agency Magazine Article Writing.

V. News Writing

Basic Structure of news story, methods of news writing, feature, editorial, comments, column, types of Lead, news organization, news gathering, news agencies.

VI. Broadcast Journalism (Electronic Media)

History of Broadcasting. Radio and mass Communication. Radio Broadcasting. Radio Station. How to Start a FM Radio Station in Indian. Radio Production .Using sound Mixing and Audio Effects. Digital Audio Production. Digital Audio Player. Voice Modulation. Radio Journalism. Writing for Radio. Radio features Production.

Radio Interviews .Radio Discussion. Radio Dialogue .Radio news bulletin. Radio news packaging.

VII. Advertising

What is advertising? Forms of Advertising. Advertising Objectives. Advertising Approach. Advertising Effects. Advertising in India. Publicity. Propaganda. Types of Propaganda. Sales promotion. Advertising and Promotion. Advertising Strategy. Advertising planning. Advertising Media Planning. Advertising Appeals. Advertising Copy. Print Advertising .Elements of a good Advertising Regulation.

VIII. Public Relations

Goals of Public Relation. Areas of public Relations. Role of Public Relation. Advertising vs. Public Relation. Meaning of public Relation .Role of Public Relation in Corporate Image Building. Development of public Relation. Function of Public. Role of public Relation in Contemporary Business Climate. Elements of PR Programme.

Practical:

Working for Electronic Media (FM radio station)-Radio news reporting, writing, field interviews, editing, news anchoring & producing radio news bulletin,

Suggested readings:

- Joseph, A. DeVito (2008) *Communication: Concepts and Process*, New Jersey: Prentice-Hall.

- McLuhan, Marshall (1964) *Understanding Media*, Canada, London: Routledge and Kegan Paul.
- Broadcast Technology – A Review, Dr. H.O. Srivastava, Gyan Publishing House, New Delhi.
- Sharma, K.C., Journalism in India: History, Growth & Development, Regal Publications, New Delhi.
- Agrawal, Veerbala Gupta, V.S. (2001) *Handbook of Journalism and Mass Communication*, New Delhi : Concept Publishing Co.
- Aspinall, Richard (1971) *Radio Programme Production: A Manual for Training*, UNESCO, Paris.
- Messere, Hausman Benoit & Wadsworth O' Donnell (2010) *Modern radio production : Production, programming and performance* : Boston.
- Sengupta, Subroto (1982) *Brand Positioning*, New Delhi : Tata McGraw Hill Publishing Co.
- Rege, G.M., (1972) *Advertising Art and Ideas*, Mumbai : Kareer Institute.

E-Learning Material:

Introduction to Communication

http://www.scert.kerala.gov.in/images/2014/HSC_Textbook/25_Journalism-unit-01.pdf

Types and forms of communication

http://www.zainbooks.com/books/mass-communication/introduction-to-mass-communication_6_types-and-forms-of-communication.html

Basics of News Writing

<https://www.slideshare.net/ArielDizon/basics-of-news-writing>

Writing for Print Media

<http://www.manage.gov.in/studymaterial/printmedia.pdf>

chapter 1. introduction to advertising - Shodhganga

shodhganga.inflibnet.ac.in/bitstream/10603/75863/6/06_chapter%201.pdf

Music – Vocal/Instrumental

Prathama (Theory)

Duration 3 hrs.

Maximum Marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- One will get the better understanding in a sequenced way of music and its basic components.
- One might be able to perform at the level one in his/her stream of music.
- Will be able to handle the instruments carefully and maintain them by his/her own.
- Introduce the students to the world of Music by make them learn the fundamental terms of music and its components including theoretical terms of raga and taal.
- Study of basics like scale(s), main informations to be given in introduction of a raga, classification of instruments and Taal system.

Content -

Unit-1

- a) Definition of Music, Naad, its types & characteristics, Name and knowledge of Shrutis.
- b) Natural (Shuddha) and Converted (Vikrit) notes, Octave and its type, definition of raag and thaats.

Unit-2

- a) Definition of Aroh-Avroh, Pakad, Vadi-Samvadi, Anuvadi & Vivadi swaras.
- b) Definition of Alankar, Sargam, LakshanGeet, Gat and Khayal.

Unit-3

- a) Name & knowledge of 10 Thaats and their scales.
- b) Brief knowledge of prescribed raagas in reference to – Doha, Aroh-Avroh, Pakad, Thaats, Vakraswaras, Gayansamay, Vadi-Samvadi etc.

Unit-4

- a) Types and classification of the Instruments.
- b) Brief knowledge of opted instrument and its physical parts.

Unit-5

- a) Introduction and notation writing of taal- Teental, Dadra and Keharwa.
- b) 10 Alankars in Bilawal and Kalyan thaats.

Note:- Prescribed raagas in the syllabus- **Yaman, Bhoopali and Alhaiya Bilawal.**

Taals- **Teentaal, Dadra, Keharwa.**

Prathama (Practical)

Maximum Marks: 90

Learning Outcomes:

- A formal training initiate to students about basic terms like types of notes, different patterns of notes (Alankaars), rhythm and its components with an initial start of learning ragas.
- Encourage students to play/sing with zeal to get improved at beginning level and heading towards pro level.
- Will be able to handle the instruments carefully and maintain them by his/her own.

Content -

1. Practical knowledge of Natural (Shudhha) & Converted (Vikrit) notes of the prescribed ragas.
2. Recitation of taals with marking time signature on hands.
3. Practical knowledge of Aroh-Avroh and Pakad in prescribed ragas.
4. One ChhotaKhayal with 4 alaps and 4 taans or Razakhani/drut gat with 4 taans in any 2 ragas from the prescribed ragas.
5. Singing/playing ability to perform 10-10 alankars in all 10 thaats.
6. Name of the prescribed ragas- **Yaman, Bhoopali and AlhaiyaBilawal**. (For sarod, raag Kafi should be considered in place of raga Bhoopali.)
7. Prescribed taal- **Teentaal, Keharwa and Dadra**.
8. One Bhajan or National Song (National Anthem for Instrumental music students).
9. Sargam in any 2 ragas.

Suggested E-Learning Material:

Yaman

RaagYaman | Ustad Rashid Khan | Jashn-e-Rekhta 4th Edition 2017

<https://www.youtube.com/watch?v=xZbcMHiE7XM>

Vilayat Khan Raga Yaman

<https://www.youtube.com/watch?v=tGBKs7swowk&t=2239s>

AlhaiyaBilawal

padmatalwalkaralhaiyabilawalja re ja rejakagavatarana

<https://www.youtube.com/watch?v=UjLQvDXxVpY>

Vilayat Khan Raga AlhaiyaBilawal

<https://www.youtube.com/watch?v=77vtFARtAso>

Bhoopali

RaagBhoopali (Khayal&Tarana) -byLegendary Duet of Nazakat~Salamat

<https://www.youtube.com/watch?v=e95HDnxKf3g>

UstadShahidParvez Khan - RaagBhopali - (Sitar And Tabla)

<https://www.youtube.com/watch?v=UHXXyYV3cpQ>

Madhyama Music

(Vocal/Instrumental – Sitar, Violin, Sarod, Guitar)

This program, which is known as Madhyama-Music, offers one step advance learning of music and its intricacies. After completion of Prathama, Madhyama makes a bridge from advance level training to professional level. It is designed to make one, from a learner to a performer at initial level and earn the ability to move forward for pro level.

Programme Objective/Aim

- The main purpose of this program is, to provide a curricular framework with extended skill and depth of music for learners.
- Be benefitted to a practitioner who plans to acquire advance training in future, in any stream of music by demonstration of the most important elements about theory and practical.

Programme Outcomes:

- One may have more potential after having firm basic knowledge of music and performance.
- Better command over his/her stream of music.
- More creativity and improvisations in the performances.
- More exposure for commercial music institutions and public performances.

Madhyama (Theory)

Duration 3 hrs

Maximum Marks 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- The main purpose of this program is, to provide a curricular framework with extended skill and depth of music for learners.
- Be benefitted to a practitioner who plans to acquire advance training in future, in any stream of music by demonstration of the most important elements about theory and practical.
- One may have more potential after having firm basic knowledge of music and performance.
- Better command over his/her stream of music.
- More creativity and improvisations in the performances.
- More exposure for commercial music institutions and public performances.

Content -

Unit-1

- a) Descriptive study of thaat and raag and their comparative study.
- b) Elements of Geet (Composition), Sthaa, Antara, Sanchari and Abhog.

Unit-2

- a) Definition of Alap, Meend, Murki, Khataka, Gamak.
- b) Basic knowledge of Khayal, Dhrupad, Razakhani Gat, Masitkhani Gat, Keertan, Bhajan, Folk songs, Patriotic songs.

Unit-3

- a) Knowledge of Taal, Laya-Vilambit, Madhya, Drut, Matra, Vibhaag, Khali-Bhari, Sam, Avartan, Theka etc.
- b) Knowledge of prescribed ragas (Aroh-Avroh, Pakad, Thaata, Jaati, Gayansamay, Vadi-Samvadietc).

Unit-4

- a) Writing practice of Taal- Teental, Jhaptaal, Ektal in Thaah and Dugun.
- b) One ChhotaKhayal or Razakhani/Drut gat in any raga out of prescribed ragas.

Unit-5

- a) Contribution and life sketch of Pt. VishnunarayanBhatkhande and Pt. Vishnugambar Paluskar.
- b) Definition of Taan and its five varieties.

Note:- Prescribed ragas of syllabus- **Khamaj, Kafi, Bhairav, Bihag and Bhimpalasi.**

Taal- Teentaal, Rupak, Jhaptaal.

Madhyama (Practical)

Maximum Marks: 90

Learning Outcomes:

- Students may have a thorough knowledge of the main structural degrees in the construction of a Raga.
- Technical actions in rendition of a Raga & Taal. Ability to write notation of the same (Raga n Taal).
- Make the students know about the valuable contribution by eminent artists.
- Delivering deliberately the method of execution/rendition of type of notes, taals and notation in the prescribed Ragas of the curriculum.
- Bring the slight professional touch in the performance of a student in the practical aspect of music, as a part of preparation to make them able to face the concerts and pursue a career in music.

Content -

1. Practical knowledge of usage of Natural (Shuddha) and Converted (Vikrit) notes of in prescribed ragas.
2. Recitation of taals with marking time signature on hands.
3. Practical knowledge of Aroh-Avroh, pakad in prescribed ragas of syllabus.
4. One Bada Khayal or Masitkhani/Vilambit gat with 2 taans minimum, in any raga from the prescribed ragas.
5. Chhota Khayal or Razakhani/Drut gat in all prescribed ragas.
6. Alankar practice in all prescribed ragas of syllabus.
7. One Bhajan or Folk song (for students of Sitar, Sarod and Violin- one Dhun).

Prescribed ragas- **Khamaj, Kafi, Bhairav, Bihag and Bhimpalasi.**

Prescribed taals- **Teental, Rupak and Jhaptal.**

Suggested E-Learning Material:

Bhairav

Prabhaatre-Raagbhairav

<https://www.youtube.com/watch?v=R34akeCzJIU>

Bismillah Khan Raga Bhairav

<https://www.youtube.com/watch?v=uqNV2eo1OII&t=1020s>

Bihaag

Vidushi late Smt Veena Sahasrabuddhe Raag, Bihag

<https://www.youtube.com/watch?v=j6DlmUaxnhQ&t=1514s>

Raag Behag by Pandit Budhaditya Mukherjee and Anindo Chatterjee (Tabla) LIVE IN Winterthur, Zurich

<https://www.youtube.com/watch?v=mSn4dqe7SLw&t=3058s>

Kafi

Pt. Jitendra Abhisheki - Raag - Kafi

<https://www.youtube.com/watch?v=qxc8oNcQr4k>

Pandit D K Datar-Raga Mishra Kafi

https://www.youtube.com/watch?v=LL_qEVrisyc

Niladri Kumar plays Raag Mishra Kafi on the iconic sitar

<https://www.youtube.com/watch?v=VY6XqXnMC0g>

Bhimpalasi

Bharat Ratna Pandit Bhimsen Joshi sings Raga Bhimpalasi.

<https://www.youtube.com/watch?v=-IzurpNhpIQ>

Kishori Amonkar - Raag Bhimpalasi Live

<https://www.youtube.com/watch?v=ddimw49-waw>

Pt. Nikhil Banerjee - Raga Bhimpalasi (complete)

<https://www.youtube.com/watch?v=YdHe4dTc4Dw>

Khamaj

Ustad Vilayat Khan Raga Khamaj @ Berlin fest

<https://www.youtube.com/watch?v=QFHXRxUh9oM&t=1551s>

Koyelia Kuk Sunawe (Raag Khamaj) - Ajoy Chakrabarty

<https://www.youtube.com/watch?v=WgraHwKbGNw>

Diploma in Visharad

(Vocal/Instrumental – Sitar, Violin, Sarod, Guitar)

A complete musician is the sum total of all aspects of arts; be it performance as a Vocalist, an Instrumentalist, or a Dancer, be it as a music critic, a researcher, or a sound system expert; a basic knowledge of all and specialization in any of these, later helps in identifying the student as a presenter/performer, a teacher, a student, a researcher or just an audience.

Apart from all the basic education required in this field, Visharad syllabi mostly focuses on the detail and complex aspect, of Music.

Hence, this curriculum has identified all the essential competencies in the respective areas, for which practical & professional training will be provided to the students specializing in any of the above said.

Programme Objective/Aim

- To introduce the students with complex ragas and a step higher from the basic level & so on.
- To prepare them for Stage Performances and boost confidence.
- To set up a comprehensible, enriching, higher, yet achievable standard for the students.
- To increase the students' understanding and grip over swaras .
- To enhance the knowledge of Taal Paksh and Layakaris

Programme Outcomes:

P.O1 - Music Knowledge - Enhance knowledge regarding Prachalit and Aprachalit Ragas, thus helping & encouraging the students to perform and introduce them with Techniques of Presentation.

P.O2 - Planning a syllabus and pedagogical techniques - Demonstrate effective planning abilities including Art Appreciation and Guided Listening as well as time management, resource management, and organizational skills.

P.O3 - Modern Tool Usage - Learn, select and apply appropriate methods and procedures to understand the Basics of sound Production including Human Voice Culture and techniques of Instrumental handling, and tuning.

P.O4 - Professional Identity - Understand and analyze the value of their professional roles in society as, a student, a performer, or a researcher; to fulfill which, Learning professional presentation techniques is a must.

P.O5 - Ethics and Values - Honor personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural & personal variability in values, communication & lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

P.O6 - Life-long learning - Recognize the need for, and have preparation & ability to engage in independent and life-long learning in the broadest context of Riyaz and Performance as well as Technological changes. Self access and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

Visharad I (Theory)

Duration 3 hrs.

Maximum Marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- Understand and write the alankaras of complex ragas with ease and expertise, as well as differentiate between shuddh, mishra and sankeerna jati ragas.
- Understand and write the chalan of vakra swaras more easily, with an understanding of Raag Swaroop.
- Understand and write the alankaras in layakari patterns of dugun, tigun, chaugun, etc. along with taal, theka thus improving the command over swaras and taal both at the same time.
- Recognize ragas after reading a certain phrase of the same and explain the difference between two samprakritik ragas.
- Understand and explain the basics of taal paksh while understanding Gambhir Gayaki or conventional & traditional styles of singing such as Dhrupad, Dhamar, Padam, Kirtanam with Gamak, Meend etc. as well as popular styles of singing such as khayal, tarana, Tillana, Jawali etc. of North Indian and Carnatic Classical Music.
- Take motivation from the icons of the field and their journey, for improving work ideas, patterns, ethics and creativity.

Content -

Unit-1

- a) Styles of singing North ICM – Dhamar, Thumri, Trivat, Chaturang.
- b) Styles of singing Carnatic ICM — Padam, Kirtanam, Kriti, Varnam, Jawali, Tillana.

Unit-2

- a) Knowledge of your own instrument - Tanpura, Tabla, Sitar, Violin, Sarod
- b) Short Notes on — Gram Murchana, Rag Jati, Sandhiprakash Kal\ Rag, Parmelpraveshak Rag.

Unit-3

- a) History of Indian Music with special reference to Modern Period
- b) Definitions — Avirbhav, Tirobhav, Alpatva, Bahutva, Shuddh, Chhayalag and Sankeerna Rag.

Unit-4

- a) Short Description of Ragas of in the syllabus.
Prescribed Ragas- Asavari, Bageshri, Kedar, Vrindavani Sarang, Des, Jaunpuri.
- B) Notation of any Chota Khayal\Drut Gat in any 1 of the Ragas from the syllabus.

Unit-5

- a) Practice of writing, the Layakaris of the following Taals in Thah, Dugun, Chaugun, Teental, Jhaptal, Ektal, Chautal.
- b) Life sketch and contribution to Music of the following Musicians—Pt.Ravishankar, Ustad Bismillah Khan, Vidushi Kishori Amonkar, Dr. N. Rajam.

Suggested Book References

1. Sharma, Prof. Swatantra (2014). Bhartiya Sangeet ek Etihashik Vishleshan, Prayagraj (UP), Anubhav Publishing House.
2. Sharma, Prof. Swatantra (2017). Bhartiya Sangeet : Vaigyanik Vishleshan, Prayagraj (UP), Anubhav Publishing House.
3. Sharma, Prof. Swatantra (2015). Saundarya, Rasa evam Sangeet, Kottayam (Kerala), Pratibha Publications Pvt. Ltd.
4. Sharma, Prof. Swatantra (2012). Pashchatya Swarlipi Paddhati evam Bhartiya Sangeet, Prayagraj (UP), Anubhav Publishing House.
5. Chandra, Pt. Satish (2016). Bhatkhande Swarlipi Sangrah Bhag 1-2, Hathras (UP), Sangeet Karyalaya.

Visharad I (Practical)

Maximum Marks: 90

Learning Outcomes:

- Sing/play alankaras of complex ragas with ease and expertise, as well as differentiate between shuddh, mishra and sankeerna jati ragas.
- Sing/play vakra swaras more easily, with an understanding of Raag Swaroop.
- Sing/play alankaras in layakari patterns of dugun, tigon, chaugun, etc. along with taal theka, thus improving the command over swaras and taal both at the same time.
- Recognize ragas after listening to a certain phrase of the same and explain the difference between two samprakritik ragas.
- Sing Dhrupad/ Dhamar as well as Khayals with ease.

Content -

1. Knowledge of the Prescribed Ragas in the syllabus - Asavari, Bageshri, Kedar, Vrindavani Sarang, Des, Jaunpuri.
2. Knowledge and Practice of marking with hands, the Prescribed Talas in the syllabus, in Thah, Dugun - Teental, Jhaptal, Ektal, Chautal.
3. Practical knowledge of Aroh, Avaroh, Pakad in any 4 Ragas from the syllabus.
4. Practice of Alankars and patterns in any 4 Ragas from the syllabus.
5. Ability to sing Slow Khayals/Masitkhani Gat with at least two Tanas/Todas from any two Ragas from the syllabus.
6. Ability to sing/play Fast Khayals/Rajakhani Gats with Taans/Todas in any four ragas of the syllabus.
7. Practice of singing a Bhajan/Folk Song or playing any Dhun.

Suggested E-Courses and Online Tutorials

1. www.itcsra.org

Raga Online, Raga Samay online, Upcoming Recitals, Admission Procedure for the course, with Full time scholarships

2. www.sharda.org

Online classes (Total 252) (Vocal, Sitar, Harmonium & Music Theory)

3. www.musicclassonline.in

Vocal music lessons for both Hindustani & Carnatic Music

4. www.gandharvapune.org

Learn classical music online (Vocal, Tabla, Harmonium, Kathak, Bharatnatyam)

www.raaghindustan.com

A step by step introduction to all the basic concepts of Indian Classical Music with notations, Audio-Visual demonstrations and performances

5. <http://omenad.net>

Browse and contribute articles, references, and theories

E-Resources:

www.youtube.com

Visharad II (Theory)

Duration : 3 hrs.

Maximum Marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- Understand and frame alankaras of complex ragas with ease and expertise, as well as differentiate between shuddh, mishra and sankeerna jati ragas.
- Understand vakra swara chalan more easily, with an understanding of Raag Swaroop.
- Understand and frame alankaras in layakari patterns of dugun, tigun, chaugun, etc. along with taal theka, thus improving the command over swaras and taal both at the same time.
- Recognize ragas after listening to a certain phrase of the same, and explain the difference between two samprakritik ragas.

Unit-1

- a) Introduction of the 40 basic principles of Hindustani Music.
- b) Place of Music in Fine Arts.

Unit-2

- a) Brief introduction of Gharana system.
- b) Detail knowledge of Harmony, Melody.

Unit-3

- a) Short notes on –Avirbhav, Tirobhav, Poorva Rag - Uttar Rag, Nayak-Gayak.
- b) Importance of music in Modern Period.

Unit-4

- a) Comparative study of the Ragas in the syllabus
- b) Notation of any Chota Khayal\Drut Gat in any 1 of the Ragas from the syllabus.

Unit-5

- a) Practice of writing, the Layakaris and comparative study of the prescribed Taals in Thah, Dugun, Tigun, Chaugun
- b) Life sketch and contribution to Music of the following Musicians—Ustad Allahuddin Khan, Ustad Vilayat Khan, Ustad Allahdiya Khan, Vidushi Moghubai Kurdikar.

Suggested Book References

1. Sharma, Prof. Swatantra (2014). Bhartiya Sangeet ek Etihashik Vishleshan, Prayagraj (UP), Anubhav Publishing House.
2. Sharma, Prof. Swatantra (2017). Bhartiya Sangeet : Vaigyanik Vishleshan, Prayagraj (UP), Anubhav Publishing House.
3. Sharma, Prof. Swatantra (2015). Saundarya, Rasa evam Sangeet, Kottayam (Kerala), Pratibha Publications Pvt. Ltd.
4. Sharma, Prof. Swatantra (2012). Pashchatya Swarlipi Paddhati evam Bhartiya Sangeet, Prayagraj (UP), Anubhav Publishing House.
5. Chandra, Pt. Satish (2016). Bhatkhande Swarlipi Sangrah Bhag 1-2, Hathras (UP), Sangeet Karyalaya.

Visharad II (Practical)

Maximum Marks: 90

Learning Outcomes:

- Sing/play alankaras of complex ragas with ease and expertise, as well as differentiate between shuddh, mishra and sankeerna jati ragas.
- Sing/play vakra swaras more easily, with an understanding of Raag Swaroop.
- Sing/play alankaras in layakari patterns of dugun, tigon, chaugun, etc. along with taal theka, thus improving the command over swaras and taal both at the same time.
- Recognize ragas after listening to a certain phrase of the same and explain the difference between two samprakritik ragas.
- Sing Dhrupad/ Dhamar as well as Khayals with ease.

Content -

1. Practical knowledge of Aroh, Avaroh, Pakad and chalan of Komal, Teevra swaras in any 4 Ragas from the syllabus.
2. Knowledge and Practice of marking with hands and comparative study of the Prescribed Talas in the syllabus in Thah, Dugun, Tigon, Chaugun – Jhoomra, Punjabi, AdaChautal, Sooltal.
3. Ability to sing/play two Slow Khayals/Masitkhani Gat in any two ragas from the syllabus with at least three Tanas/Todas.
4. Knowledge of any four ragas from the Prescribed Ragas in the syllabus - Malkauns, Jaijaiwanti, Miya Malhar, Bahar, Shankara, Tilakkamod, Marva.
5. Ability to sing/play Fast Khayals/Rajakhani Gats with Taans/Todas in chosen four ragas from the syllabus.
6. Practice of Alankars and patterns in any 4 Ragas from the syllabus.
7. Practice of singing a Bhajan/Folk Song or playing any Dhun.

Suggested E-Courses and Online Tutorials

1. www.itcsra.org
Raga Online, Raga Samay online, Upcoming Recitals, Admission Procedure for the course, with Full time scholarships.
2. www.sharda.org
Online classes (Total 252) (Vocal, Sitar, Harmonium & Music Theory).
3. www.musicclassonline.in
Vocal music lessons for both Hindustani & Carnatic Music.
4. www.gandharvapune.org
Learn classical music online (Vocal, Tabla, Harmonium, Kathak, Bharatnatyam).
5. www.raaghindustan.com
A step by step introduction to all the basic concepts of Indian Classical Music with notations, Audio-Visual demonstrations and performances.
6. <http://omenad.net>
Browse and contribute articles, references, and theories.

Visharad III (Theory)

Duration : 3 hrs.

Maximum Marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- Understand and frame alankaras of complex ragas with ease and expertise, as well as differentiate between shuddh, mishra and sankeerna jati ragas.
- Understand and frame komal, shuddh and teevra swaras more easily, with an understanding of Raag Swaroop.
- Understand and write alankaras in layakari patterns of dugun, tigon, chaugun, etc along with taal theka, thus improving the command over swaras and taal both at the same time.
- Recognize ragas after listening to a certain phrase of the same, and explain the difference between two samprkritik ragas.
- Understand Gambhir Gayaki or conventional & traditional styles of singing such as Dhrupad, Dhamar, with Gamak, Meend etc. as well as popular styles of singing such as khayal, tarana, etc.

Content -

Unit-1

- a) Comparative study of swaras and major principles of North Indian and South Indian Classical Music.
- b) Knowledge of the major 7 Talas of South Indian Classical Music.

Unit-2

- a) 72 melas by Pt. Vyekantmakhi.
- b) 32 Thaats of Pt. Bhatkhande.

Unit-3

- a) Recognising and Knowledge of the structure of the ragas from the prescribed syllabus.
- b) Notation of any one Slow khayal & Chota Khayal\ Maseetkhani Gat & Drut Gat in any 1 of the Ragas from the syllabus.

Unit-4

- a) Practice of writing, the Layakaris and comparative study of the prescribed Taals in Thah, Dugun, Tigon, Chaugun, Chhagun - Tilwada, Deepchandi, Teevra, Dhamaar
- b) Brief knowledge of the concept of Rag & Ras.

Unit-5

- a) Interrelationship of Folk music & Classical Music.
- b) Life sketch and contribution to Music of the following Musicians—Pt. V.G. Jog, Ustad Ali Akbar Khan, Ustad Faiyyaz Khan, Pt. Nikhil Banerjee, Pt. Lalmani Mishra.

Suggested Book References

1. Sharma, Prof. Swatantra (2014). Bhartiya Sangeet ek Etahasik Vishleshan, Prayagraj (UP), Anubhav Publishing House.
2. Sharma, Prof. Swatantra (2017). Bhartiya Sangeet : Vaigyanik Vishleshan, Prayagraj (UP), Anubhav Publishing House.
3. Sharma, Prof. Swatantra (2015). Saundarya, Rasa evam Sangeet, Kottayam (Kerala), Pratibha Publications Pvt. Ltd.
4. Sharma, Prof. Swatantra (2012). Pashchatya Swarlipi Paddhati evam Bhartiya Sangeet, Prayagraj (UP), Anubhav Publishing House.
5. Chandra, Pt. Satish (2016). Bhatkhande Swarlipi Sangrah Bhag 1-2, Hathras (UP), Sangeet Karyalaya.

Visharad III (Practical)

Maximum Marks: 90

Learning Outcomes:

- Sing /play alankaras of complex ragas with ease and expertise, as well as differentiate between shuddh, mishra and sankeerna jati ragas.
- Sing/play komal , shuddh and teevra swaras more easily, with an understanding of Raag Swarop.
- Understand and sing swaras in bol alaps, bol tans and bol baants form.
- Sing/play alankaras in layakari patterns of dugun, tigan, chaugun, etc along with taal theka, thus improving the command over swaras and taal both at the same time.
- Recognize ragas after listening to a certain phrase of the same, and explain the difference between two samprakritik ragas.
- Understand Gambhir Gayaki or conventional & traditional styles of singing such as Dhrupad, Dhamar with Gamak, Meend etc. as well as popular styles of singing such as khayal, tarana, etc.

Content -

1. Practical knowledge of Aroh, Avaroh, Pakad, and chalan of Komal, Teevra swaras in any 5 Ragas from the syllabus.
2. Knowledge and Practice of marking with hands, and comparative study of the Prescribed Talas in the syllabus, in Thah, Dugun, Tigan, Chaugun, Chhagun – Tilwada, Deepchandi, Teevra, Dhamar.
3. Practical knowledge of Swar Vistar, and chalan of Komal, Teevra swaras in any 5 Ragas from the syllabus.
4. Ability to sing/play two Slow Khayals/ Maseetkhani Gat in any two ragas from the syllabus with alaps & Tanas/Todas OUT OF THE CHOSEN 5 Ragas from the syllabus .
5. Knowledge and Practice of marking with hands, and comparative study of the Prescribed Talas in the syllabus, in Thah, Dugun, Tigan, Chaugun – Jhoomra, Punjabi, AdaChautal, Sooltal.
6. Ability to sing One Dhrupad or Dhamar with Dugun, Tigan, Chaugun, Layakaris in one raga from the syllabus.
7. Ability to sing a Tarana in any one of the chosen five ragas from the syllabus.
8. Ability to sing/play Fast Khayals/Rajakhani Gats with Taans/Todas in chosen five ragas from the syllabus. The Raga with Dhrupad/Dhamar, needs not to be covered with chota khayal compulsorily.

-Practice of singing a Bhajan/Folk Song or playing any Dhun .

Prescribed Ragas (any 5)-

Darbari Kanhara, Adana, Hameer, Hamsdhwani, Rageshri, Bhinnashadaj, Bhairavi.

Prescribed Taals - Tilwada, Deepchandi, Teevra, Dhamaar

Suggested E-Courses and Online Tutorials

1. www.itcsra.org

Raga Online, Raga Samay online, Upcoming Recitals, Admission Procedure for the course, with Full time scholarships.

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5. www.raaghindustan.com

A step by step introduction to all the basic concepts of Indian Classical Music with notations, Audio-Visual demonstrations and performances.

6. <http://omenad.net>

Browse and contribute articles, references, and theories.

Music – Tabla (Instrumental)

Prathama (Theory)

Time – 3hrs

Maximum marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- To introduce the student to the basics of tabla playing such as taal and laya.
- It is only when these concepts are strong that the learner can take her next steps confidently.
- To introduce the basic knowledge of Sum, Matra, Tali, Khali etc.
- To introduce the student basic knowledge of Tala and Laya.
- To prepare them to perform and boost confidence.

Content -

Unit-1

- a) Knowledge of ten alphabets in Tabla and definition of Tabla.
- b) Pictorial description of Tabla.

Unit-2

- a) Explain of the following with example
Sam, Matra, Theka, Tali, Khali, Vibhag, Avartan, Bole.
- b) Define the Laya and explain with example.
Tha, Dugun, Tigun and Chaugun.

Unit-3

- a) Explain the origin of Tabla instrument.
- b) Explain of the following with example
Kayada, Palta, Mukhda, Tukra, and Tihai.

Unit-4

- a) Explain the Tentak, Kaharwa, Rupak and Dadra and write Thah, Dugun and Chaugun Layakari.
- b) The ability to write learned boles.

Unit-5

- a) Describe Bhatkhande Notation System in detail.
- b) Life Sketch
Samta Prasad (Gudai Maharaj) 2. Allarakha Khan.

Suggested Readings :

1. Mishra, Pt. Chotelal (2012). Taal Prasun, New Delhi, Kanishka Publications.
2. Garg, Dr. Laxmi Narayan (2013). Taal Parichaya, Hathras, Sangeet Karyalaya.
3. Srivastava, Girish Chandra, (2017). Taal Kosh, Allahabad, Rubi Prakashan.

Prathama (Practical)

Maximum marks: 90

Learning Outcomes:

- Definition of terminology such as Sam, Kaal, Khanda, Maatra, laya etc.
- General information about the origin of tabla.
- Definition of terminology such as Kayada, Palta, Mukhra, Tukra etc.
- Basic knowledge of Bhatkhande notation system.

Content -

1. Ability to play ten alphabets in Tabla.
2. Ability to play Teen Taal, Kaharwa Taal, Dadra Taal and Rupk Taal in Tha, Dugun and Chaugun Laya.
3. Ability to play Two Kayada and his four Prastar with his Tihai.
4. Ability to play two Theke ke Prakar and two Tukda and two Mohara and two Tihai.
5. Ability to recognize.

Madhyama (Theory)

Time – 3hrs

Maximum marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- To give them detailed study of Nad and his types.
- To give them the detailed definition of Paran, Chakradar, Tihai etc.
- To give them basic knowledge of Pt. Bhatkhande and Pt. Vishnu Digambar Notation System.
- To introduce the students with complex Tall's and a step higher from the basic level.
- To take the student a step ahead and introduces different laya and some basic embellishments of the taals studied before.
- To invoice of the knowledge of Pt. Vishnu Digambar Paluskar notation system.

Content -

Unit-1

- a) Define the Nad and his pattern.
- b) Explain the Following- Paran, Chakradar Tihai, Laggi, Lari, Mohara, Peshkar, Graha.

Unit-2

- a) Knowledge of Pt. Vishnu Digambar and Bhatkhande notation system.
- b) Knowledge of Tabla Gharana (Delhi Gharana, Lucknow Gharana) .

Unit-3

- a) Signify the important of accompaniment of the Tabla in the music elements Gayan, Vadan, Nritya.
- b) Ability to write Notation System to learn bole.

Unit-4

- a) Instrument and his classification.
- b) Knowledge of Folk Instrument.
Dholak, Nagara, Nal, Kartal, Dafali, Tasha, RavanHattha.

Unit-5

- a) Knowledge of Layakari with Notation - Tha, Dugun, Chaugun.
Teental, Jhaptaal, Ektaal, Tilwara,
- b) Life sketch
Ustad Ahamad Jaan Thirakwa 2) Pt. Anokhelal Mishra.

Suggested Readings :

1. Srivastava, Girish Chandra (1996). Taal Kosh, Allahabad, Rubi Prakashan.
2. Singh, Dr. Jogindar (1994). Bharatiya Sangeet ki Utpatti evam Vikas, Jalandhar, A.B.S. Prakashan,
3. Mistri, Dr. Aban A, Pakawaj Avam Table ke Gharane avam paramparaye, (1984). Mumbai, Pt. k.k.s. jijana swar sadhana samiti

Madhyama (Practical)

Maximum marks: 90

Learning Outcomes:

- The students is Advance bols that are played on tabla.
- Students will be ready to play Teental, Rupak, jhaptal, Ektal, Rupak, Tilwara.
- The students should be able to show these taals with the hands through claps, showing the taali and khali.
- The student should be recognize Vilambit, Madhya and Drut laya when played.
- The students play theka of taals learnt in the previous course in single as well as double tempo.

Content -

1. Two Kayada with Prastar and Tihai in Tal TinTal and Jhaptal. Also Two chakradar and four Tihai in each Tal.
2. Show Tali khali in hand.
3. Ability to accompaniment (Tal Kaharwa, Tal Dadra, Tal TinTal Madhaya Laya)
4. Reading ability to Kayada, Prastar and Tihai.
5. Recommended Tal (Tal Trital, Tal Jhaptal, Tal Ektal, Tal Rupak, Tal Tilwada)

Visharad I (Theory)

Time – 3hrs

Maximum marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- This set of course equips the student with a study foundation on which the student of tabla can build her instrumental skill.
- To give the absorb a sense of rhythm to students.
- Percussion instrument is important both as accompaniment as well as for solo performances. Thus, from this course onwards, the student is expected to start giving solo Tabla presentations.

Content -

Unit-1

- a) Merits and demerits of Tabla Player.
- b) Rules of correct practicing of Tabla.

Unit-2

- a) Describes the Five Jatis in Tabla.
- b) Comparative description of the parts of Tabla and Pakhavaj.

Unit-3

- a) Definition - Sangeet, Gat, Chakradar, Paran, Bedam Tihai, Laggi, Uthan, Daya Baya, Sahai, Chanti.
- b) Technique and impotents of tunning Tabla.

Unit-4

- a) Tha, Dugun, Chougun in prescribe Tals -
Tal Tintal, Ektal, Adachartal, Chartal, Tivra.
- b) Ten Pran of Tabla.

Unit-5

- a) Knowledge of Bhatkhande Notation System.
- b) Life Sketch -Pt. Samta Prasad (Gudhi maharaj), Ust. Alla Rakha Khan

Suggested Readings:

1. Godbole, Ganesh Madhukar (1999). Tabla Shastra, Allahabad, Ashok Prakashan Mandir.
2. Mayankar, Sudhir (1969). Tabla Vadan Kala aur Shastra, Sri Balav Joshi, Gandarv Mandal Miraz.

Visharad I (Practical)

Maximum marks: 90

Learning Outcomes:

- Understand the Layakari.
- student to aware which gharana is tabla she is learning belong to
- To assess this, the student will be asked to make references to her gharana at various points.

Content -

1. Tha, Dugun, Chougun in prescribe Tals in Hand (Tali Khali)
2. Tal Rupak- One Kayada, Two Tukda, one Paran Sadi and One Chakradar Paran.
3. Tintal- Uthan or Peshkar, Three Kayada (Ajrada Gharana), Delhi and Purab Baj, Four sada and Two chakradar Tukda, One Gat, Tihai and Mukhdas.
4. Method of Tuning of Tabla and ability to accompaniment.
5. Tal Teental, Ektal, Adachartal, Chartal, Tivra.

Visharad II (Theory)

Time – 3hrs

Maximum marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- To recognize, what is Gharana.
- The objective of practical is to convey the one step advance understanding of recitation and presentation of taal.
- Practical knowledge of handling and tuning the instruments.
- To give the student detail and comparative study of the development of tabla.

Content -

Unit-1

- a) Definition- Peshkar, Laggi-Ladi, Bant, Chakradar, Farmaishi chakradar, Bedam Tihai, Rela, Rau, Farmaishi Paran, Gat, Kayada.
- b) Detail Study of Taal.

Unit-2

- a) Define the Baj. Difference between Delhi and Purab Baj.
- b) Study of North Indian and South Indian Taal System.

Unit-3

- a) Comparative Study -
Jhaptaal - Sultaal, Ektaal - Choutaal, Rupak - Tivara.
- b) Define the Layakri with example.

Unit-4

- a) Describe Dhawani and Naad (Tarta, Tiwra and Quality).
- b) Short History of Indian Music.

Unit-5

- a) Ability to write Notation system Taal Dhamar, Taal Pancham Sawari, Taal Addha, Taal Depchandi.
- b) Life sketch of Musician. 1. Pt. Kanthe Maharaj 2 Ustd. Karamatulla Khan.

Suggested Readings:

1. Sharma, Bhagwati Sharan (1996). Taal Prakash, Hathras, Sangeet Karyalaya.
2. Mishra, Pt. Chotelal (1996). Taal Prasun, New Delhi, Kanishka Prakashan.
3. Mulgaonkar, Arvind (199...). Tabla, Mumbai, Ramdas Bhatkall, Popular Prakashan.

Visharad II (Practical)

Maximum marks: 90

Learning Outcomes:

- Develop appreciation for the art form.
- Knowledge of tuning your own instrument.
- The student should be able to play kaaydas and rela in Teental and Rupak taal solo for fifteen minutes with the accompaniment of the lehara.
- The students also being able to read and play bols written on paper is an important skill that has to be mastered her.

Content -

1. Taal on syllabus

Taal Dhamar, Taal Panchamsawari, Taal Adadha, Taal dipchandi, Taal Teental, Jhaptaal, Taal Ektaal.

2. Solo performance in Jhaptaal and Ektaal.
3. Ability to play Tha, Dugun, Chougun in Hand.
4. Ability to accompaniment and tune your Instrument.
5. Repetition of previous Taals.

Visharad III (Theory)

Time – 3hrs

Maximum marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- To give the student concept of Taal and use of Taal Vadya in modern time.
- To give the student comparative study of ancient and modern Taal system.
- To give the student critical study of the different Gharanas and Baj of Tabla.
- To strengthen the student creative skill in live performance and strong hold over rhythm, laya and Taal.
- To give the student knowledge of Taal Prastar form given number of Matras.

Content -

Unit-1

- a) Interpretation of Tabl's origin and development.
- b) Details study of Tabla Gharana

Unit-2

- a) Detailed study of North Indian and South Indian Notation System.
- b) Comparative study of Sampadi and Vishampadi Tals.

Unit-3

- a) Ability to write Tha laya, Dugun laya, Tigun laya and Chaugun laya. Taal Gajajhampa, Taal dhamar, Taal Rudra, Taal Laxmi and use the mathematics, know the starting place of layakaris (Adi and Kuadi).
- b) Ability to write down, prescribe bols.

Unit-4

- a) Definition
Adi, Kuadi, Pharmaishi, Chakradar, Kamali Paran, Rela, Tippali, Choupalli.
- b) Importance of musical electronic instruments in modern time.

Unit-5

Life Sketch -

- a) Ustd. Zakir Husain b) Pt. Swapan Choudhury.

Suggested Readings:

1. Sharma, Bhagwati Sharan (1996). Taal Prakash, Hathras, Sangeet Karyalaya.
2. Mishra Pt. Chotelal (1996). Taal Prasun, New Delhi, Kanishka Prakashan.
3. Mulgaonkar, Arvind (199). Tabla, Mumbai, Ramdas Bhatkall, Popular Prakashan.

Visharad III (Practical)

Maximum marks: 90

Learning Outcomes:

- The students able to play various thekas at both ati vilambit as well as drut laya.
- The students should have the expertise of playing both common taals such as Teental, Jhaptal, Ektal, Rupak.
- The students also be able to show with the hands the same kayada of a gharana in different taals.
- The students able to make a comparative study of the styles of playing of different gharanas.
- The students will be taught some kayadas that begin with the left hand.

Content -

A) Taal Tentaal -

1. One difficult Uthan or Peshkar.
2. Peshkar with difficult layakari.
3. Dhir dhir Rela.
4. One Gat
5. One Tippali and one Choupalli Gat.
6. One Kayada in difference Baj
7. Sada and chakradar Tukda and paran.
8. Some difficult Tihai.

B) Pancham Sawari Taal -

1. Uthan
2. Peshkar
3. Two kayada
4. One Rela
5. Some Kayada

C) Dhamar Taal

1. Uthan
2. Two sada and Two chakradar paran
3. Four Tihai
4. In Trital ability to play Solo.
5. Confidence in Laya with different Layakari.
6. Ability to tune your instrument and knowledge of accompaniment.
7. Ability to Tali Khali in hand (Taal Gajajhampa, Dhamar, Rudra Laxmi)

MANIPURI DANCE

Prathama (Theory)

Duration : 3 hrs.

Max Marks : 50

Note : Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

1. Get a brief introduction of Manipuri Dance.
2. Practically learn the Pada-bhed, Kara-karan and Hasta mudras.
3. Learn the specially and importance of the dance as well as in the society of Manipur.
4. Learn about the other Indian Classical Dances about the ancient Gurus of Manipuri Dance.

Content:

Unit-1

a) Khongtha Makhal-Paribhasa: (Padabhed)

1. Samapada (Khongpak)
2. Anchitapada (Khuning)
3. Kunchitapada (Khongchep)
4. Suchi pada (Khudol)
5. Agratala Sanchar (Khongdol)

b) Khongchat - Paribhasa : Chari (Pada Sanchalan)

1. Rasantika (Leinet)
2. Sampluta (Achongbi)
3. Upabistha (Aphambi)

c) Areibi - Bhramari (Tandav & Lashya)

Unit-2

a) Khutcha Makhal : Karakaran

Avesthitam, Uddhesthitam, Vyavartitam, Parivartitam

b) Asanyukta basta Mudra

Unit-3

Types of Nartan (dance)

Unit-4

Characteristic of Manipuri dance and types of Tandav Lashya

Unit-5

Importance of music and dance in the Manipuri society

Suggested Book:

1. Shastriya Manipuri Nartan : Jhavery Darshana, Devi Kalavati.
2. Manipuri Nartan Kala : Singh Banamali

MANIPURI DANCE

Prathama (Practical)

Max Marks : 90

Learning Outcomes:

1. Learn practically the activities of Padabhed, Kara Karan, Bahubhed etc. and Asangyukta Mudras.
2. Learn Chali and Charee, which will give them the basic ideas and foundation of classical Manipuri dance and make physically fit to perform in the both dance style of Tandav and Lashya.
3. Learn singing song and saying Bols will gather confidence.

Content:

1. Practice of Pada bheda Khongtha Makhal, Bahubhed (Pambom Makhal).
2. Rasantika Charree (Khongchat) (leinet) Sampluta (Achongbi) Upabistha (Aphambi) Bhramari (Areibi) karakaran (Khutcha Makhal)
3. Show the given Taal with the help of Taali and Bol - Tanchap, Menkup, Chali
4. Preliminary Chali and Alangkar Nupi Chali (Lashya), Nipa Chali (Tandav)

E-Resources:

https://youtu.be/_DYlwz4FMHM

<https://youtu.be/YpGjHKcJBP8>

<https://youtu.be/dNq-U979G1k>

https://youtu.be/VHL5y_ED-3M

https://youtu.be/eGgG7SfLC_o

<https://youtu.be/Cq5Bveg-ah8>

Bharatnatyam

Prathama (Theory)

Time – 3 Hours

Maximum marks- 50

Note :- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Learn about Indian classical Dance styles and their origin.
- Able to understand technical terms used in Bharatnatyam.
- Know the importance of hasta mudra, shiro, drishti and greva bheda.
- Able to play adavus in different taal and laya.

Content-

Unit-I

What is Dance? Name Indian Classical Dance Styles and its States.

Unit-II

Define the following terms in Bharatnatyam. Adavu , Samapada, Taal, Laya, Swara, Aavartanam, Panchajati (Tishram, Chatushra, Khanda, Mishram, Sankirna), Saptala (Dhruv, Mathya, Rupak, Jhampa, Triputa, Ata, Ek taal) .

Unit-III

Drishti Bheda and Grevva Bheda according to Abhinaya Darpan.

Unit-IV

Asamyukta Hasta shloka according to Abhinaya Darpan.

Unit-V

Samyukta Hasta shloka according to Abhinaya Darpan.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror of Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

Prathama (Practical)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- Have the ability to demonstrate the adavus in three layas and basic posture.
- Have the ability to learn the shlokas according to abhinaya darpan.
- To understand the concept taala and laya.

Content-

Unit-I

Warm up exercises.

Unit-II

Study of 10 Adavus (basic lessons) in Vilambit and Madhya laya.

Unit-III

Study of Pada bheda, Mandala bheda, Shiro bheda shlokas.

Unit- IV

Study of Drishti bheda, Greeva bheda and Shiro bheda shlokas.

Unit-V

Playing Panchjati in Aadi taal and Rupak Taal.

E- Resources:

<https://youtu.be/1JZqHTDyigM>

<https://youtu.be/WOHsR07LSdk>

<https://youtu.be/8UTYliMkzKg>

<https://youtu.be/REt9xXY2VzE>

https://youtu.be/Qm_TrMGbdk

<https://youtu.be/xHk1xHfVfSg>

Kathak Dance

Prathama

(Theory)

Time – 3 Hours

Maximum marks- 50

Note: - Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Learn about Indian Classical Dance and their origin.
- Understand technical terms used in Kathak and introduction of Kathak Gharanas.
- Learn the importance of notation in music and dance.

Content:

Unit-I

What is dance? Name of the Indian Classical Dances with their respective states where their dance Forms prevail: Kathak, Bharatnatyam, Kathakali, Manipuri, Kuchipudi, Odissi, Mohiniattam, Satriya.

Unit-II

Define the technical word which is used in Kathak dance Taal, Matra, Laya, Sam, Taali, Khaali, Theka, Thah (barabar), Dugan, Chaugan, Avartan, Palta, Padhant, Gat, Tukda, Salami, Amad, Chaal, Baant.

Unit-III

Taal Lipi: It's importance in Music.

Unit-IV

Knowledge of Gharanas. (Lucknow, Jaipur, Banaras), and give the name of famous artists

Unit-V

Write the notation of Thah, Dugun, Chaugun of the following Taals: Teentaal, Jhaptaal, and also write the notation of all bols learnt by the student.

Suggested Readings:

1. 'Azad'. Pt. Tirathram (2013). Kathak Praveshika, Nateshwar Kala Mandir, New Delhi
2. Dadhich, Dr.Puru (2016) Kathak Nritya Shiksha, Part-1 Bindu Prakashan, Indore
3. 'Azad'. Pt. Tirathram (1963). Kathak Shringar, Nateshwar Kala Mandir, New Delhi

Kathak Dance
Prathama
(Practical)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- Perform Tatkar in Thah, dugun and Chaugun Laya.
- Carry out with hand-movements and Tatkar
- Perform Amad, Salami and some basic Tukdas with Padhant.
- Do Spins in slow Speed.

Content:

Taal-Tritaal

- (1) Tatkaar, Initial foot work (barabar, dugun, Chaugun)
- (2) Ten Palta of tatkar.
- (3) Basic hand movements with tatkar.
- (4) Ten initial tukde.
- (5) Rang-manch ka Tukda (salami)
- (6) Two Amad
- (7) Practice of Chakkars
- (8) Two nikas gat with chaal.
- (9) Practice of Padhant of all bols learnt by the student.

E-Resources:-

www.learnkathakonline.com

(Online Kathak lessons by Guru Pali Chandra)

www.sangeetamujumder.com

(Online Kathak Classes by Sangeeta Mujumder)

MANIPURI DANCE

Madhyama

(Theory)

Duration: 3 hrs.

Max marks: 50

Note:-Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcomes:

- Improve knowledge about the Manipuri language and by learning the terms like – Pareng, Paring, Akhaiba, Athaba, Ghattaba, Ghat etc.
- Learn about the various festivals and its related dances and to know the how much reach Manipuri Culture is.
- Learn about the History of Manipur from the study and the contribution and importance of Maharaja Bhagya Chandra in Manipuri dance.

Content:

Unit-1

Short Note : Taal, Matra, Loy, Alangkar.

Unit-2

Practice of Notation writing of Chali, Tanchap, Menkup

Unit-3

Life history of Maharaja Bhagyachandra and his contribution to the Manipuri dance.

Unit-4

The dances that are performed in the various festivals of Manipur.

Unit-5

Terminological word: Paring, Pareng, Akhaiba, Athaba, Ghattaba, Ghat.

Suggested Reading:-

1. Classical dance of India : Vatsayan Kapila
2. Manipuri Nritya ka Itihas : Rai Jyotirmoy
3. Manipur ka Itihas : Singh R.K. Jaljit
4. Sastriya Manipuri Nartan : Jhavery Darshana, Devi Kalavati
5. Manipur ka Adhyayan : Singh N. Tombi

MANIPURI DANCE

Madhyama (Practical)

Max marks: 90

Learning Outcomes:

- Learn the rhythmic sense and improve knowledge of Chali and Tanchap and Nritta Hasta
- Kriya with Pung.
- Improve the rhythmic sense with singing and dancing together, the dances like Krishna
- Abhisar, Radha Abhisar, Gopi Abhisar which are basically based on song.
- Learn Maibi Jagoi and their skill on folk dance will gain.
- Playing Manjira with singing song and saying the Bols together will improve their confidence.

Content:

- Lashya Nritta Bandha (Punglol Jagoi) based on Taal Tanchap,
- Prabandha Nartan (Eshei Jagoi)
- Chali (NupiChali) Lashya : Nipa Chali (Tandav)
- Maibi Jagoi (Leisem Jagoi) or Thabal Chongba
- Habit to show the Taals with Taali and Kahli- Teora, Choutaal, Chartaal.

Practice of Hasta Mudras (Khutlon)

- a) Sangyukta Hasta Mudra and Nritta Hasta Kriya
- b) Krishna Abhisar or Gopi and Radha Abhisar

E- Resources:

<https://youtu.be/QnjkwliSCFw>

<https://youtu.be/3RISY7LU3u0>

<https://youtu.be/gc2iJqi6tlU>

Bharatnatyam

Madhyama (Theory)

Time – 3 Hours

Maximum marks- 50

Note :- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Perform adavus in three layas and also the first items of Bharatnatyam repertoire.
- Will gain theoretical knowledge about Bharatnatyam dance.
- Will know about some Bharatnatyam exponents and their contribution in the field of Bharatnatyam.

Content-

Unit-I

- (A) General information about Bharatnatyam.
- (B) Detailed study about Lord Natraj.

Unit-II

- (A) Explain Natya, Nritya and Nritta.
- (B) Detailed study about Abhinaya and its 4 types.

Unit-III

- (A) The story of Natya Utpatti according to Abhinaya Darpan.
- (B) Detailed information on Sapta Taal.

Unit-IV

Life Sketches :

- (A) Tanjore Brothers
- 1. Mylapore Gauri Amma.

Unit-V

- (A) Main shloka of samyukta hasta mudras according to abhinaya darpan.
- 2. Notations writing of alarippu and pushpanjali according to the syllabus.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror of Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

(Practical)

Maximum marks – 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Execute the basic dance skills.
- Demonstrate and perform adavus and the items.
- Understand taal well and also to perform on it.

Content-

- Adavus in three layas.
- Demonstration of Pushpanjali and Alaripuu.
- Sollakuttu and Adavus playing in taal.
- Five Viniyogas of Samyukta hasta shloka according to Abhinaya Darpan.
- Sabhapati Lakshan according to Abhinaya Darpan.

E- Resources:

<https://youtu.be/1JZqHTDyigM>

https://youtu.be/lGK6_f3shU4

<https://youtu.be/BGRV1pL9qP4>

Kathak Dance

Madhyama

(Theory)

Time – 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Understand about Hastmudras and their use in Kathak Dance.
- Attain knowledge of technical terms which is used in Kathak Dance.
- Learn about some eminent Kathak Dancer's
- Improve notation skills.

Content:

Unit-I

Definition of Hasta Mudras: study of following Asanyukta Hastmudra according to Abhinaya Darpan – Pataka, Ardhpataka, Kartarimukh, Mayur, Ardhchandra, Araal, Shuktund, Mushti, Shikar, Suchi, Chandr-kala, Padmkosh.

Unit-II

Music: Importance and Place of dance in music.

Unit-III

Definition of the following technical terms which is used in Kathak Dance:-

- (a) Nritya, Natya, Nritya, Salami, Amad, Gat bhav, Paran, Tihai
- (b) Types of ghunghroo's and its importance and Place in Kathak dance.

Unit-IV

Life-Sketch and Contributions- Bindadin Maharaj, Thakur Prasad, Sundar Prasad.

Unit-V

- (a) Write the notation of all bols learnt by the student.
- (b) Write the notation of Thah, Dugun, and Chaugun of following prescribed Taals. Dadra, Kaherva, Dhamar, Roopak.

Suggested Readings:

1. 'Azad'. Pt. Tirathram (2013). Kathak Praveshika, Nateshwar Kala Mandir, New Delhi
2. 'Azad'. Pt. Tirathram Kathak Darpan. Nateshwar Kala Mandir, New Delhi
3. Dadhich, Dr.Puru (2016). Kathak Nritya Shiksha, Part-1 Bindu Prakashan, Indore
4. 'Azad'. Pt. Tirathram (1963). Kathak Shringar, Nateshwar Kala Mandir, New Delhi

Kathak Dance

Madhyama

(Practical)

Maximum Marks- 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Execute basic dance skills.
- Demonstrate Tatkar in Drut-Laya and also understand Amad, Sada Tukda, Paran and Tihai etc.
- Perform Kathak Nritya in Jhaptaal.

Content:

Taal -Trital:

- (1) Tatkar-Thah, dagun, Chaugun, Athagunn
- (2) Four Amad.
- (3) Ten simple Tukde.
- (4) Four Chakkardaar Tukde.
- (5) Five simple tihai
- (6) One simple paran
- (7) One Chakkardaar Paran.
- (8) Three nikas and one Gagar gat with Chaal.
- (9) Practice of padhant of all bols learnt by the students

Jhaptal

- (1) Tatkar, barabar, dugun, Chaugun & tihai
- (2) Rangmanch ka Tukda.
- (3) Two aamad.
- (4) Four simple Tukde.
- (5) Two Chakkadar Tukde.
- (6) Practice of padhant.

E-Resources:-

www.learnkathakonline.com

(Online Kathak lessons by Guru Pali Chandra)

www.sangeetamujumder.com

(Online Kathak classics by Sangeeta Mujumder)

MANIPURI DANCE

Uttama- I (Theory)

Duration: 3 hrs.

Max marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Study the terminological words like Punglol Jagoi and Eshei Jagoi will improve their knowledge about language.
- Learn about the sequence of Raas Leela and various costumes about classical and folk dance.
- Learn the mythological knowledge about Manipur and Lai Haraoba.
- Make a comparative study of the Manipuri, Odissi and Kathak dance and get a good concept about the classical dances of India.

Content:

Unit-1

Definition : Pung lol Jagoi, Eshei Jagoi

Unit-2

- a) Knowledge of Raas Leela perform in Manipuri dance.
- b) Preliminary knowledge of Raas Leela

Unit-3

The mythology (Lok Katha) of origination of Manipuri Names, Mythological story.

Unit-4

The dance sequences of Lai Haraoba

Unit-5

The knowledge of the Indian classical dances- Manipuri, Odissi, Kathak, Bharatnatyam, Kathakali, Kuchipudi, Satriya, Mohiniyattam.

Suggested Reading:-

1. Sastriya Manipuri Nartan : Jhavery Darshana, Devi Kalavati
2. Dance of Manipur : Marg Publication
3. History of Manipur : Singh J. M. Tombi
4. Manipuri Culture : Singh E Nilakant

MANIPURI DANCE

Uttama- I (Practical)

Max marks: 90

Learning Outcome:

- Study the terminological words like Punglol Jagoi and Eshei Jagoi will improve their knowledge about language.
- Learn about the sequence of Raas Leela and various costumes about classical and folk dance.
- Learn the mythological knowledge about Manipur and Lai Haraoba.
- Make a comparative study of the Manipuri, Odissi and Kathakdance, the students will get a good concept about the classical dances of India.

Content:

1. Nritta Bandha Punglol Jagoi in Menkup Taal(Tandav, Lashya)
2. Show the Taal with Taali and Khali with Bols- Meithei Surphak, Tintaal Macha, Rajmel
3. Khambathoibi Jagoi
4. The knowledge of the Mudras used in Raas Leela and Lai Haraoba dance(Maibi)
5. Raas Nritya : Krishna Nartan, Radha Nartan
6. Gostha Bhangi Pareng(Pratham Ghat)

E- Resources:

<https://youtu.be/aNjRT-2JbDc>

<https://youtu.be/DT6HVKuClbW>

<https://youtu.be/oFXWEkepEbk>

MANIPURI DANCE

Uttama- II

(Theory)

Duration: 3 hrs.

Max marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Improve their knowledge by the study of the Gaudiya Vaishnavism and Nat Pala.
- Learn Expression according to the religious Sastras.
- Learn the interesting stories of Bashanta Raas and Maha Raas as well as the importance of Bhangi Pareng in Raas.
- Improve the knowledge of Anga Pran and Manipuri Taal system and gain the skill in the field of new composition in future.

Content:

Unit 1

Relation between Gaudiya Vaishnavism with NatpalaNritya and the sequence of Natpala.

Unit 2

Description of the Abhinaya as per the Sastras and its types

Unit 3

- a) The stories of the MahaRaas and BasantaRaas
- b) Importance of Bhangi Pareng in Raas Leela.

Unit 4

Contribution of the three Gurus of Manipuri dance - Guru Amubi Singh, Guru Atomba Singh and Guru Amudon Sharma

Unit 5

- a) Specialty of Manipuri Taal system
- b) Anga Pran.

Suggested Reading:

1. Manipuri Taal Prakash : JhaveriDarshana, Devi Kalavati
2. Vaishnav Sangeet Sastra : Singh Guru Bipin
3. Natya Sastra : Bharat Muni
4. Dance of Manipur : Marg Publication
5. Manipuri Culture : Singh E NilaKanta
6. Sastriya Manipuri nartan : Jhaveri Darshana, Devi Kalavati

MANIPURI DANCE

Uttama- II

(Practical)

Max marks: 90

Learning Outcome:

- Learn the dances like Krishna Nartan, GopaNartan and Brinda Nartan and the students will go one step ahead to perform the Leela.
- Learn the reach volume of steps on the Nritta Bandhas like Rajmel, Teora, Choutaal, and the students will become confident to be a composer.
- Learning regular Make-up classes their skill in make-up will improve.

Content:

1. Nritta Bandha(Punglol Jagoi) in Taal (Teora) or Taal Choutal, Prabandha Nartan(Eshei Jagoi, Nritta, Nritya)
2. Gostha Bhangi Pareng (Complete)
3. Raas Nritya : Brinda Nartan, Krishna Nartan
4. Gostha Leela : Gop Nartan
5. Writing of Notation of the following Taals - Rajmel Taal, Teora Taal, Choutal/ Tanjao

E- Resources:

<https://youtu.be/aNjRT-2JbDc>

<https://youtu.be/DT6HVKuClbW>

<https://youtu.be/oFXWEkepEbk>

MANIPURI DANCE

Uttama- III

(Theory Paper- I)

Duration: 3 hrs.

Max marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Study of Gostha Leela and Nitta Raas they will learn the sequences of the Raas.
- Study of history of Manipur they will get an idea about the social and cultural life of Manipur and the involvement of the Manipuri people in the Vaishnavic religion.
- Study mythological study and they will be introduced the various characters like Nongpok Ningthou, Panthoibi, Maibi, Sanamahi and Pakhangba.
- Learn about the contributions of past Guru Bipin Singh and Guru Amubi Singh to the Manipuri dance.

Content:

Unit 1

Knowledge of Religious and social history of Manipur

Unit 2

- a) Sequence of GosthaLeela(Sansenba)
- b) Sequence of Nitta Raas

Unit 3

Terminological word : Alangkar, Naitom, SlokPunglol, Phibam, Saikonnabi

Unit 4

Contribution of Guru Amubi Singh and Guru Bipin Singh in Manipuri dance

Unit 5

Write short notes on : Nongpok Ningthou Panthoibi, Maibi ,Sanamahi, Pakhangba

Suggested Reading:

1. Dance of Manipur : Marg Publication
2. Religious Develope MeitteiPuran : L. Mangi Singh, L. Moni Singh
3. History of Manipur : R.K. Jaljit

MANIPURI DANCE

Uttama- III

(Theory Paper- II)

Duration: 3 hrs.

Max marks: 35

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Learn how to write the Notation of Manipuri Taal system.
- Learn about the recent Gurus like Jhaveri Sisters and Singhajit Singh.
- Get the knowledge of folk culture of Manipur through the study of Laibou Jagoi along with Nava Rasa and five prime and seven secondary Rasas.

Content:

Unit- 1

Write the Notation of Rajmel Taal of Gostha Bhangi.

Unit- 2

Contribution of Jhaveri Sisters and Guru Singhajit Singh in Manipuri dance

Unit- 3

Knowledge of the song of Krishna BalaramNartan

Unit- 4

The knowledge of the dance sequence of Laibou Jagoi in the traditional Lai Haraoba .

Unit- 5

Knowledge of the Nava Rasa and 5 Prime and 7 secondary Rasa.

Suggested Reading:

1. Dance of Manipur : Marg Publication
2. Religious Developments MeiteiPuran : L. Mangi Singh, L. Moni Singh
3. History of Manipur : R.K. Jaljit

MANIPURI DANCE

Uttama- III

(Practical Paper -I)

Max marks: 90

Learning Outcome:

- Learn Achouba Bhangi Pareng and the students will learn how to give presentation with devotion and dedication.
- Learn Jugal Nartan, Krishna Balaram Nartan and the students will be able to perform Raas Leela.
- Learn the dance Laibou Jagoi and the students will learn that the root of the Manipuri dance is in Lai Haraoba.
- Make revision, which will remind the previous courses.
- The Pung lol Jagoi which will increase the composition skill and the Make-up demonstration to make them more confident.

Content:

- 1) Nritta Bandha(Punglol Jagoi) , Prabandha Nartan (Eshei Jagoi)
- 2) Achouba Bhangi Pareng – up to Taal Rajmel
- 3) Raas Nrtiya, Jugal Nartan, Krishna Balaram Nartan
- 4) Maibi Jagoi, Laibou Jagoi
- 5) Saying the Taal with clapping hands

E- Resources:

<https://youtu.be/aNjRT-2JbDc>

<https://youtu.be/DT6HVKuClbW>

<https://youtu.be/oFXWEkepEbk>

MANIPURI DANCE
Uttama- III (Practical Paper -II)
(Stage Performance)

Max marks: 36

Learning Outcome:

- Understand the audition and selection process.
- Understand the roles of warm-up class, “spacing”, lighting and dress rehearsals.
- Come to know what they personally need to prepare for performance.
- Apply makeup properly.

Kathak Dance

Uttama Part-I

(Theory)

Time – 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Understand the Greeva and Shiro Bheds.
- Recognize and explain the Hast Mudras and Eyebrow movements.
- Formulate the notation.

Content:

Unit- I

- (a) Greeva Bhed according to Abhinaya Darpan: it's use in Kathak Dance
- (b) Knowledge of Technical Terms which is use in Kathak Dance: - Haav – Bhav, Kasak – Masak, Kataksh, Andaaz, Laya

Unit- II

- (a) Shiro Bhed according to Abhinaya Darpan: it's use in Kathak Dance.
- (b) Description of Patra – Lakshan according to Abhinaya Darpan.

Unit- III

- (a) Bhru- Sanchalan according to Nattyashastra: it's uses in Kathak Dance.
- (b) Knowledge of Asamyukta Hast-Mudra Sarpsheersh, Mrigsheersh, Singhmukh, Kangul, Hansasya, Hanspaksh, Sandansh, Mukul, Tamra choorna, Trishul, Vyaghra Ardhsuchi, Katak, Palli.

Unit- IV

- (a) Life Skech and Contribution: - Narayan Prasad, Jayalaal.

Unit- V

- (a) Notation of all the bols learnt by Students.
- (b) Notation of Prescribed taals – Thah (Barabar) Dugan and Chaugun: - Ektaal, Chartaal, Teevra, Sool Taal, Adachartaal.

Suggested Readings:

1. 'Azad'. Pt. Tirathram (2013). Kathak Pravesika, Nateshwar Kala Mandir, New Delhi
2. Dadhich, Dr.Puru (2016) Kathak Nritya Shiksha, Part-1, Bindu Prakashan, Indore
3. Dadhich, Dr.Puru (1948) Kathak Nritya Shiksha, Part-1I, Bindu Prakashan, Indore
4. Bhatnagar Chaya(1981). Bharat Ke Shastriya Nritya, Youngman Fund Company, Delhi

Kathak Dance
Uttama Part-I
(Practical)

Maximum Marks- 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Execute the etiquettes of dance.
- Understand the time-management and enhance concentration power.
- Execute the padhant.

Content:

Tritaal

1. Ten advanced Paltas
2. That
3. Four Amad
4. Four Simple Tukdas
5. Two Chakkardar Tukdas
6. Paran (Two Simple)
7. Chakkardar Paran (Two)
8. Gat-Bhav-Panghat
9. Four Tehai
10. Practical of Padhant

Jhaptaal

1. Four Simple Paran
2. Two chakkardar Paran
3. Four Tehai
4. Practical of Padhant

Dhamar

1. Tatkar – Thah (Barabar, Dugan, Chaugun)
2. Rangmanch Ka tukda (Salami)
3. Four Simple Tukdas
4. Paractical of Padhant

E-Resources:-

www.learnkathakonline.com

(Online Kathak lessons by Guru Pali Chandra)

www.sangeetamujumder.com

(Online Kathak classics by Sangeeta Mujumder)

www.dancelassonline.in

(Online dance lessons and certificate course for biggners on skype by Divya Dance School)

Kathak Dance

Uttama Part-II

(Theory)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Understand the importance and place of Sangeet in Kathak Dance
- Compare the Gharanas.
- Understand the Indian Classical Dance.

Content:

Unit- I

Detailed Discription of Taal: - Importance and Place in Dance and Music

Unit- II

- (a) Sanyunkta Hast- Mudra, according to Abhinaya Darpan: (and their uses also) Anjali, kapot, Swastik, Dola, Pushput, Utsang, Shivling, Katkawardhan, Kartariswastik, Shakat, Shankh, Chakra.
- (b) Knowledge of Ang, Pratyang and Upang and Knowledge of eight Types of Drishti Bhed.

Unit- III

- (a) Knowledge of Indian classical Dance; Kathak and Bhartnatyam.
- (b) Life Sketch and Contribution: Krishan Kumar, Damyanti joshi

Unit- IV

Knowledge of differentiating characteristics of school of Gharanas (Lucknow, Jaipur, Banaras)

Unit- V

- (a) Notation and practice of prescribed taals: - Ashtmangal, Sawari, Gajjhampa
- (b) Notation of all the bols learnt by Students.

Suggested Readings:

1. Dadhich, Dr. Puru (1948). Kathak Nritya Shiksha, Part-1I, Bindu Prakashan, Indore
2. Bhatnagar, Chaya (1981). Bharat Ke Shastriya Nritya, Youngman Fund Company, Delhi

Kathak Dance
Uttama Part-II
(Practical)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- Execute the musicality and various forms of dance.
- Formulate the harmony between Taal and laya.
- Perform live performance.

Content:

Tritaal

1. That (With kasak – Masak)
2. Two Amad (Traditional Paran Judi)
3. Some Tukde
4. Four Simple Paran
5. Two Chakkardar Paran
6. Gat with Chal – Bansuri
7. Various Types of Ghoonghat (with chal)
8. Gat – Bhav – Holi
9. Some Tehaies
10. Shlok (Guru-Vandana)

Dhamar

- (1) Two Amad (2) Two sadi paran (3) One Chakkardar Paran
(4) Chakkardar Tukde (5) Some Tehaies.

Chautaal

1. Tatkar – Thah (Barabar) , Dugun and Chaugun.
2. Rangmanch ka Tukda
3. Two Amad
4. Four Simple Tukde
5. Practice of Padhant

E-Resources:

www.learnkathakonline.com

(Online Kathak lessons by Guru Pali Chandra)

www.sangeetamujumder.com

(Online Kathak classics by Sangeeta Mujumder)

www.dancelassonline.in

(Online dance lessons and certificate course for biggners on skype by Divya Dance School)

Kathak Dance

Uttama Part-III

(Theory –I)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Recognize and explain the Hastmudras.
- Understand the origin of Dance.
- Understand and write the notation of Taal and bols.

Content:

Unit- I

- (a) Sanyukt Hast- Mudra according to Abhinaya Darpan , pash , Kilak , Matsya, Koorma, Varah, Garud, Naagbandh, Khatwa, Bherund.
- (b) Technical terms which is use in Kathak Dance. Pramelu, Tandav, Lasya, Natwari.

Unit- II

Origin of Dance according to Natyashastra.

Unit- III

Knowledge of Prevalant to Indian Classical Dance forms: - Kathakali and Manipuri

Unit- IV

Life Sketch and Contribution Achhan Maharaj, Lachhu Maharaj, Shambhu Maharaj

Unit- V

- (a) Notation and Practice of Prescribed taals Deepchandi, Jhoomra, Shikhar, Matt Taal (Thah, Barabar, Dugun and Chaugun.)
- (b) Notation of all bols learnt by students.

Kathak Dance

Uttama Part-III

(Theory-II)

Time: 3 Hours

Maximum marks- 35

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Understand and recognize the Hastmudras.
- Develop the knowledge of Nav-Ras in depth.
- Understand the knowledge of Nayak-Bhed and Abhinaya

Content:

Unit- I

Description of Nayak – Bheda according to Natyashastra

Unit- II

Types of Abhinaya :- (Angik, Vachik, Aaharya, Satwik) according to Abhinaya Darpan.

Unit- III

Ras: Describe the Types of Ras and their Practical importance

Unit- IV

Knowledge of all Hast-Mudra which are used in Dance according to Natyashastra

Unit- V

Technical terms of which are used in dance: Anghar, Karan.

Suggested Reading:-

1. 'Azad', Pt. Tirathram (2015). Kathak Gyaneshwari, IInd Edition Nateshwar Kala Mandir, New Delhi
2. Dadhich, Dr.Puru (1948). Kathak Nritya Shiksha, Part-1I, Bindu Prakashan, Indore
3. Bhatnagar, Chaya (1981). Bharat Ke Shastriya Nritya, Youngman Fund Company, Delhi

Kathak Dance
Uttama Part-III
(Practical-I)

Maximum Marks- 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Execute the Layakaris.
- Understand the complex Taal.
- Execute the knowledge of musicality and expression in Abhinaya.
- Give solo performance.

Content:

Tritaal

1. That (with Kasak-Masak)
2. Two Pramelu
3. Paran-Tisra Jati
4. Simple Paran
5. Chakkardar Paran
6. Two advance gat-nikas
7. Gat-Rukhsar
8. Tigun of Tatkar

Abhinaya

- (1) Shlok
- (2) Makhan Chori
- (3) Thumari
- (4) Bhajan

Chautal

1. Two Chakkardar Tukda
2. Two simple Paran
3. One Chakkardar Paran
4. Some Tehaies

Ashtmangal

1. Tatkar-Thah (Barabar) Dugun, Chaugun,
2. Rangmanch ka Tukda
3. Two Amad
4. Four Tukde
5. Practice of Padhant

E-Resources:-

www.learnkathakonline.com

(Online Kathak lessons by Guru Pali Chandra)

www.sangeetamujumder.com

(Online Kathak classics by Sangeeta Mujumder)

www.dancelassonline.in

(Online dance lessons and certificate course for biggners on skype by Divya Dance School)

Practical-II
(Stage Performance)

Maximum Marks- 35

Learning Outcomes:

After completion of this course, the students will be able to:

- Perform as an Artist.
- Do spin in fast speed.
- Identify and understand the sense of audience
- Produce the Choreographies for Classical and Folk Dance

Bharatnatyam

Uttama Part-I

(Theory)

Time – 3 Hours

Maximum marks- 50

Note :- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Have live performance by the students.
- Enhance the aesthetic sense and value system.
- Understand the comparative study between the dance forms.

Content-

Unit-I

Explain Abhinaya and its types.

Unit-II

(A) Explain Tandav, Lasya Nritya and its types.

(B) Asamyukta hasta mudra shloka along with the viniyogas according to Abhinaya Darpan.

Unit-III

(A) Detailed knowledge about the indian classical dance styles Kathak and Bharatnatyam.

(B) Contributions and biographies of famous personalities like Mylapore Gauri Amma and Rukmini Devi Arundel.

Unit-IV

Define Taal and Explain the Carnatic Taal System.

Unit-V

Notation writing of learned items and songs according to the syllabus.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

(Practical)

Maximum marks – 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Understand the swaras and the concept of korvai.
- Understand the time management and concentration.
- Execute the taal.

Content-

- Kauthuvam
- Alarippu
- Jatiswaram
- Asamyukta hasta mudra shloka along with the vinyogas according to Abhinaya Darpan.
- Notation playing in Taal.

E- Resources:

https://youtu.be/w3_kyZfiCSs

<https://youtu.be/6R-jUeSdxd4>

<https://youtu.be/dDyFtWMFN4Q>

https://youtu.be/___bOyh3NrKA

Bharatnatyam

Uttama Part-II

(Theory)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Enhance the aesthetic sense and value system.
- Understand the comparative study between the dance forms.

Content-

Unit-I

- (A) History of Indian classical dance.
- (B) Indian classical dance styles kuchipudi and mohiniattam.

Unit-II

- (A) Detailed study of “Bhava and Rasa”.
- (B) Life sketches:
 - Bala Saraswati
 - Meenakshi Sundaram Pillai.

Unit-III

- (A) Introduction to Devdasi parampara in Bharatnatyam Dance.
- (B) Repertoire of Bharatnatyam.

Unit-IV

- (A) Explain the story of Natya Utpatti according to Abhinaya Darpan.
- (B) Information on the different styles in Bharatnatyam.

Unit-V

- (A) Shiro, Drishti and Greeva bheda shlokas along with viniyogas according to Abhinaya Darpan.
- (B) Utplavana, Bhramari shloka along with the viniyogas according to Abhinaya Darpanam

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2

Uttama Part-II

(Practical)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- Execute and perform the abhinaya item “shabdam” and “keertanam”.
- Learn and demonstrate the shiro, drishti and greeva bheda along with its usages in dance.
- Perform live.

Content-

- Shabdam
- Keertanam
- Asamyukta hasta vinyogas (from Suchi to Trishula) according to Abhinaya Darpan.
- Samyukta hasta main shloka according to Abhinaya Darpan.
- Shiro, Drishti and Greeva bheda shlokas along with viniyogas according to Abhinaya Darpan.
- Natuvangam playing for the learned items according to the syllabus.

E- Resources:

<https://youtu.be/BqCKgf5Ayv0>

<https://youtu.be/BKLSrb6JzU4>

https://youtu.be/_bOyh3NrKA

https://youtu.be/lGK6_f3shU4

<https://youtu.be/KEiPpausEj4>

Bharatnatyam

Uttama Part-III

(Theory –I)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Have live performance by the students.
- Enhance the aesthetic sense and value system.
- Understand the comparative study between the dance forms.

Content-

Unit-I

- (A) History and Development of Bharatnatyam.
- (B) Indian classical dance styles Odissi and Kathakali (History, Development, Costume, Makeup).

Unit-II

- (A) Detailed information about Ashtanayika.
- (B) Biographies on:
 - Tyagaraja (Composer of Carnatic music)
 - Jayadev (Sanskrit Poet).

Unit-III

Sapta taal according to gati and jati bheda.

Unit-IV

- (A) Prekashagruha according to Natyashastra.
- (B) Samyukta hasta mudra vinyogas according to Abhinaya Darpan.

Unit-V

- (A) Jathi hasta according Abhinaya Darpan.
- (B) Write the notation of tirmanam (jati) according to the syllabus.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

(Theory –II)

Time: 3 Hours

Maximum marks- 35

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- An ability to have live performance by the students.
- Capability to enhance the aesthetic sense and value system.
- Ability to understand the comparative study between the dance forms.

Content-

Unit-I

Detailed study of Nayak and Nayika bheda.

Unit-II

Study of Abhinaya Darpan and Natyashastra.

Unit-III

Detailed study of Vritti, Pravritti, Lokadharmi and Natyadharmi.

Unit-IV

Mandala bheda, Sthanaka bheda and Navagraha hasta mudra shlokas along with vinyogas.

Unit-V

Dance Drama choreography.

- Sita Haran
- Draupadi Vastraharan.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

(Practical-I)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- Perform the abhinaya item.
- Execute different Rasa in Dance.
- The skill of reciting jati.
- The knowledge of taal and also the ability to distinguish it.

Content-

- Padam
- Varnam
- Samyukta hasta mudra shloka along with the vinyogas according to Abhinaya Darpan.
- Jathi hasta vinyogas according Abhinaya Darpan.
- Notation playing of trikaal jaati according to the syllabus.

E- Resources:

<https://youtu.be/xP73cZcW3EI>

<https://youtu.be/jbNLnk3nurM>

https://youtu.be/lGK6_f3shU4

Practical-II (Stage Performance)

Maximum marks- 35

Learning Outcomes:

After completion of this course, the students will be able to:

- Ability to perform the abhinaya item.
- Ability to execute different Rasa in Dance.
- The skill of reciting jati.
- The knowledge of taal and also the ability to distinguish it.

Content-

1. Padam
2. Varnam
3. Samyukta hasta mudra shloka along with the vinyogas according to Abhinaya Darpan.
4. Jathi hasta vinyogas according Abhinaya Darpan.
5. Notation playing of trikaal jaati according to the syllabus.

E- Resources:

<https://youtu.be/xP73cZcW3EI>

<https://youtu.be/jbNLnk3nurM>

https://youtu.be/lGK6_f3shU4

Bharatnatyam

Nishnat Part-I

(Theory –I)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate technical proficiency and artistic expression in Bharatnatyam Dance.
- Learn movement skills and be aware about the impact of dance on health.
- Familiar with the history and cultural significance of Dance.
- The techniques related to dance.

Content-

Unit-I

- (A) History of indian classical dance.
- (B) Natya Utpatti according to Natya Shastra.

Unit-II

- (A) Detailed information about Bharatnatyam.
- (B) Comparative study in south indian taala system and north indian taala system.

Unit-III

- (A) The importance of Guru-Shishya parampara.
- (B) Detailed information about the Indian classical dance styles.

Unit-IV

- (A) The Devdasi Parampara and its importance in Bharatnatyam.
- (B) Importance of Puranic stories related to Bharatnatyam dance.

Unit-V

- (A) Detailed study of the Folk Dances of India.
- (B) Biographies of:
 - Swathi Tirunal
 - PurandarDasa

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

Bharatnatyam

Nishnat Part-I

(Theory –II)

Time: 3 Hours

Maximum marks- 35

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate technical proficiency and artistic expression in Bharatnatyam Dance.
- Learn movement skills and be aware about the impact of dance on health.
- Familiar with the history and cultural significance of Dance.
- Learn all the techniques related to dance .

Content-

Unit-I

- (A) Nayak and Nayika Bheda.
- (B) Dashataala Prana.

Unit-II

- (A) Detailed information about Navarasa.
- (B) Pushpanjali and Rangadidevata shloka according to Abhinaya Darpan.

Unit-III

- (A) Explain types of abhinaya.
- (B) Patra Lakshana and Kinkini Lakshana according to Abhinaya Darpan.

Unit-IV

- (A) Samyukta hasta mudra shloka along with the vinyogas according to Abhinaya Darpan.
- (B) Mandala and Sthanaka bheda shlokas along with the vinyogas.

Unit-V

- (A) Navagraha hasta shlokas along with the vinyogas.
- (B) Notation writing of the jati, korvai in aadi taala according to syllabus.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.

- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

(Practical-I)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate adavus in three layas.
- The knowledge about the nritta and nritya through dance.
- The ability to use shlokas in dance.

Content-

- Adavus in three layas
- Thodaya Mangalam
- Jatiswaram
- Shabdam
- Ashtapadi
- Drishti, Shiro and Greeva bheda shlokas along with viniyogas according to Abhinaya Darpan.
- Mandala and Sthanaka pada bheda shloka.

E- Resources:

<https://youtu.be/1JZqHTDyigM>
https://youtu.be/Z_7VLAVkapo
<https://youtu.be/dDyFtWMFN4Q>
<https://youtu.be/FbnT7ibenF4>
<https://youtu.be/lh2qftLcv-M>
<https://youtu.be/KEiPpausEj4>
<https://youtu.be/8UTYliMkzKg>
<https://youtu.be/e7GdlVxxkrw>

Practical-II (Stage Performance)

Maximum Marks-35

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate adavus in three layas.
- The knowledge about the nritta and nritya through dance.
- The ability to use shlokas in dance.

Content-

- Adavus in three layas
- Thodaya Mangalam
- Jatiswaram
- Shabdham
- Ashtapadi
- Drishti, Shiro and Greeva bheda shlokas along with viniyogas according to Abhinaya Darpan.
- Mandala and Sthanaka pada bheda shloka.

E- Resources:

<https://youtu.be/1JZqHTDyigM>
https://youtu.be/Z_7VLAVkapo
<https://youtu.be/dDyFtWMFN4Q>
<https://youtu.be/FbnT7ibenF4>
<https://youtu.be/lh2qftLcv-M>
<https://youtu.be/KEiPpausEj4>
<https://youtu.be/8UTYliMkzKg>
<https://youtu.be/e7GdlVxxkrw>

Bharatnatyam

Nishnat Part-II

(Theory –I)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate technical proficiency and artistic expression in Bharatnatyam Dance.
- Learn movement skills and be aware about the impact of dance on health.
- Familiar with the history and cultural significance of Dance.
- Learn all the techniques related to dance .

Content-

Unit-I

General information about Acharya Bharat or Natyashastra.

Unit-II

Detailed study about 10 Karanas according to Natyashastra.

Unit-III

General information about dance in paintings and sculptures (caves, temples and excavation).

Unit-IV

Detailed information on classical dances of India.

Unit-V

Brief information about the instruments used in bharatnatyam.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2

Bharatnatyam

Nishnat Part-II

(Theory –II)

Time: 3 Hours

Maximum marks- 35

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate technical proficiency and artistic expression in Bharatnatyam Dance.
- Learn movement skills and be aware about the impact of dance on health.
- Familiar with the history and cultural significance of Dance.
- Learn all the techniques related to dance .

Content-

Unit-I

Prekshagruha according to Natyashastra.

Unit-II

Explain Lokadharmi and Natyadharmi.

Unit-III

Detailed study on Vrutti and Pravrutti.

Unit-IV

(A) Patra Lakshana and Varjaniya Patra shlokas according to Abhinaya Darpan.

(B) Devta hasta and Dashavatar hasta shlokas along with the vinyogas according to Abhinaya Darpan.

Unit-V

Notation writing of jaati, korvai and sangeet according to the syllabus.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

(Practical-I)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- The ability to demonstrate adavus in three layas.
- Perform the abhinaya items.
- The ability to recite devta hasta and dashavatar hasta according to abhinaya darpan.
- The capability to present taal on Nattuwangam.

Content-

- Adavus
- Pushpanjali
- Padam
- Keertanam
- Devta hasta and Dashavatar hasta shlokas according to Abhinaya Darpan.
- Nattuwangam playing in Taal.

E- Resources:

<https://youtu.be/1JZqHTDyigM>

https://youtu.be/bEZfJ_f2D2Y

https://youtu.be/2B_bs_pj8Ks

<https://youtu.be/USXnVNmqLfc>

<https://youtu.be/oonVMA718L8>

<https://youtu.be/DM5zhpRM20E>

<https://youtu.be/jbNLnk3nurM>

<https://youtu.be/Ll1Nl5wF2l8>

<https://youtu.be/3Fj88lamUU0>

<https://youtu.be/WJIHVrA9a3U>

Practical-II
(Stage Performance)

Maximum marks- 35

Learning Outcomes:

After completion of this course, the students will be able to:

- The ability to demonstrate adavus in three layas.
- Perform the abhinaya items.
- The ability to recite devta hasta and dashavatar hasta according to abhinaya darpan.
- The capability to present taal on Nattuwangam.

Content-

- Adavus
- Pushpanjali
- Padam,
- Keertanam
- Devta hasta and Dashavatar hasta shlokas according to Abhinaya Darpan.
- Nattuwangam playing in Taal.

E- Resources:

<https://youtu.be/1JZqHTDyigM>
https://youtu.be/bEZfJ_f2D2Y
https://youtu.be/2B_bs_pj8Ks
<https://youtu.be/USXnVNmqLfc>
<https://youtu.be/oonVMA718L8>
<https://youtu.be/DM5zhpRM20E>
<https://youtu.be/jbNLnk3nurM>
<https://youtu.be/L11Nl5wF2l8>
<https://youtu.be/3Fj88lamUU0>
<https://youtu.be/WJIHVrA9a3U>

Bharatnatyam

Nishnat Part-III

(Theory –I)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate technical proficiency and artistic expression in Bharatnatyam Dance.
- Learn movement skills and be aware about the impact of dance on health.
- Familiar with the history and cultural significance of Dance.
- Learn all the techniques related to dance .

Content-

Unit-I

Dance in relation to the epics from the stories of Purana, Ramayana and Mahabharata.

Unit-II

Detailed study on Devdasi parampara in India.

Unit-III

Study on Abhinaya Darpan and Acharya Nandikeshwar.

Unit-IV

- (A) Gati and Jaati according to Saptataala.
- (B) Explain Tandav and Lasya.

Unit-V

General knowledge in subject related to dance.

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror O Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.
- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

Bharatnatyam

Nishnat Part-III

(Theory –II)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate technical proficiency and artistic expression in Bharatnatyam Dance.
- Learn movement skills and be aware about the impact of dance on health.
- Familiar with the history and cultural significance of Dance.
- Learn all the techniques related to dance .

Content-

Unit-I

The Rasa Siddhanta, Bhava and Navarasa according to Acharya Bharat Muni.

Unit-II

- (A) Introduction to the Shilappadikaram text.
- (B) General information about Acharya Sharada Tanay and her text publications.

Unit-III

- (A) Utplavana pada bheda shloka along with the vinyogas according to Abhinaya Darpan.
- (B) Notations writing of Tirmanam and Korvai according to the syllabus.

Unit-IV

- (A) Bandhav hasta shlokas along with the vinyogas according to Abhinaya Darpan.
- (B) Jaathi hasta according to Abhinaya Darpan.

Unit-V

Choreography of Dance

- (A) Daksha Yajna
- (B) Sita Swayamvar (story, characters, makeup, music etc).

SUGGESTED READINGS:

- P. Ramachandrasekhar, Dance Gestures (Mirror of Expressions), Abhinaya Darpanam.
- Amit Kumar , Famous Dancing Gurus.
- P. Tirtharam Azad , Kathak Gyaneshwari.
- Dr. Puru Dadhich , Kathak Nritya Shiksha.
- Vachaspati Gairola, Chokhamba Sanskrit Prathisthan, Delhi, Bharatiya Natya Parampara and Abhinaya Darpan.
- Kali Prasad Goswami, Devadasi : Dancing Damsel.
- Manjula Pant and Meera Mathur, Text Book of Bharatnatyam.
- Pt. Sitaram Chaturvedi , Bhartiya Tatha Paschatya Rangamancha.
- Dr. Laxminarayan Garg, Abhinaya Darpan and Geet Govind.

- Dr. Laxminarayan Garg, Bharatnatyam Part 1 and 2.

(Practical-I)

Maximum Marks-90

Learning Outcomes:

After completion of this course, the students will be able to:

- Perform the varnam, the important item in bharatnatyam.
- Capability to perform thillana.
- The ability to experiment jaathi hasta and navagraha hasta.
- The ability to present tirmanam and korvai in taal.
- The ability to perform the utplavana bheda.

Content-

- Varnam
- Tillana.
- Dance Choreography.
- Jaathi hasta
- Navagraha hasta.
- Utplavana pada bheda.
- Playing Tirmanam and korvai in taal.

E- Resources:

https://youtu.be/2B_bs_pj8Ks

<https://youtu.be/izDfYpsiI78>

<https://youtu.be/jbNLnk3nurM>

<https://youtu.be/Ll1Nl5wF2l8>

<https://youtu.be/3Fj88lamUU0>

<https://youtu.be/WJlHVrA9a3U>

Practical-II (Stage Performance)

Maximum marks- 35

Learning Outcomes:

After completion of this course, the students will be able to:

- The ability to perform the varnam, the important item in bharatnatyam.
- Capability to perform thillana.
- The ability to experiment jaathi hasta and navagraha hasta.
- The ability to present tirmanam and korvai in taal.
- The ability to perform the utplavana bheda.

Content-

- Varnam
- Tillana.
- Dance Choreography.
- Jaathi hasta
- Navagraha hasta.
- Utplavana pada bheda.
- Playing Tirmanam and korvai in taal.

E- Resources:

https://youtu.be/2B_bs_pj8Ks

<https://youtu.be/izDfYpsiI78>

<https://youtu.be/jbNLnk3nurM>

<https://youtu.be/Ll1Nl5wF2l8>

<https://youtu.be/3Fj88lamUU0>

<https://youtu.be/WJlHVrA9a3U>

MANIPURI DANCE

Nishnat- I

(Theory Paper – I)

Duration: 3 hrs.

Max marks: 50

Note:- Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Study about of Pung Cholom and Kartaal Cholom, which will grow their knowledge about Sankirtan.
- Study of sequence of Basanta Raas and Gostha Raas and will get a clear picture of both the Raases.
- Study about the instruments that used in Manipuri dance.
- Improve the mythological knowledge through the study of the mythological characters like Khamba Thoibi and Chandrabali.
- Get knowledge about Sringar Rasa through the study of Sastras of Gaudiya Vaishnavism.

Content:

Unit-1

Importance of the Sangkirtan in Gaudiya Vaishnavism Write Short Note :
Pung Cholom, Kartaal Cholom,

Unit-2

Sequence of Bashanta Raas.

Unit-3

Musical instruments used in Manipuri dance: Tantra, Ghana, Sushir, Anaddha and specially the role of Pung (Mridang)

Unit- 4

According to the Sastras, knowledge of the Nava Rasa and the importance of the Sringar Rasa in Gaudiya Vaishnavism

Unit- 5

Story: Khamba Thoibi

Suggested Reading:

1. Dances of Manipur : Marg Publication
2. Sastriya Manipuri Nartan : Jhaveri Darshana, Devi Kalavati
3. Meithei Puran : Singh Mangi.

MANIPURI DANCE

Nishnat- I

(Theory Paper – II)

Duration: 3 hrs.

Max marks: 35

Note: - Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Gather a good creative skill in dance, through the frequent practice of various Nritta Bandhas.
- Learn how to use Nritta and Nritya in Eshei Jagoi.
- Learn to write the Notation of the complicated Taals like TintaalAchouba.
- Study about the sequence of GosthaLeela, where they will get detail knowledge of GosthaLeela.

Content:

Unit-1

Terminology: Nritta Bandha (Pung lol Jagoi)

Unit-2

Description of Eshei Jagoi with Nritta and Nritya

Unit-3

Write the Notation of Rajmel Taal, Tin taal Achouba.

Unit-4

Short Note : RaasNritya, Phagu Khel , Importance of Chandrabali

Unit-5

Sequence of GosthaLeela.

Suggested Reading:

1. Dances of Manipur : Marg Publication.
2. Sastriya Manipuri Nartan : Jhaveri Darshana, Devi Kalavati
3. MeititeiPuran : Singh Mangi

MANIPURI DANCE

Nishnat- I (Practical Paper –I)

Max marks: 90

Learning Outcome:

- Learn the use of various Nritta bandhas in new composition and their composition skill will be stronger.
- Get an idea about the Bashanta Raas through Raas Nritya, Phagu Khel, Chandrabali Nritya.
- Get the taste of the Vatsalya Rasa of lord Krishna through the dance Kanduk Khel.
- Improve and smoothen Lashya style by the practice of the complete item of Achouba Bhangi Pareng.

Content:

1. Nritta Bandha (Punglol Jagoi)
2. Prabandhanartan (Eshei Jagoi) Nritta and Nritya
3. RaasNritya, Phagu Khel, ChandrabaliNartan
4. Any dance from the GopaRaas
5. Knowledge of Taal – Kokilpriya Taal
6. Achouba Bhangi Pareng (Complete)

E- Recourses:

<https://youtu.be/QBCozlAwBKw>

<https://youtu.be/Q-09ZSz4VxM>

<https://youtu.be/oFXWEkepEbk>

MANIPURI DANCE

Nishnat- I

Practical Paper –II

(Stage Performance)

Max marks: 35

Learning Outcome:

- Demonstrate an understanding of dance technique, dress and process.
- Be familiar with classical techniques and be able to demonstrate that knowledge with physical clarity.
- Understand the use of space, line, placement, and musicality.

MANIPURI DANCE

Nishnat- II

(Theory Paper –I)

Duration: 3 hrs.

Max marks: 50

Note: - Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Learn the mythological stories of the initiation of the name Manipur.
- Enhance the knowledge of Gostha Leela and Udukhal Raas.
- Get knowledge of the Naat Mandap in Manipur and Nayika bhed from the study of Vaishnavite literature.
- Get the opportunity to study the Sangeet sastra of the Vaishnavism to know its importance in Manipuri dance.
- Study the Vaishnavic literature, which will help the students to research in the field of Manipuri dance.

Content:

Unit-1

Initiation of the name Manipur and the others name description

Unit-2

Gostha Leela and UdukhalRaas

Unit-3

Description of Nat Mandap

Unit-4

Description of Nayika bhed according to Vaishnav literature

Unit-5

Importance of Sangeet Sastra of Vaishnavism in Manipuri dance.

MANIPURI DANCE

Nishnat- II

(Theory Paper –II)

Duration: 3 hrs.

Max marks: 35

Note: - Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Get the knowledge of the influence of the Vaishnavic songs, poets and language.
- Study the Gostha Bhangi Pareng and they will learn what it is and how and where to be performed and its Taal system.
- Enjoy the story through the description of the song Khandita Nayika and Kanduk Khel.
- Write the complicated Taals like Kokilpriya Taal and Brahma Taal.

Content:

Unit-1

Importance of language and books of Vaishnav literature and knowledge about the poets

Unit-2

Importance of Gostha Bhangi Pareng (with Taal and Ghat)

Unit-3

Write short note on KhanditaNayika with the song

Unit-4

Describe Kanduk Khel with the song

Unit-5

Write the Notation of Kokil priya Taal, Brahma Taal

Suggested Reading:

1. Vaishnav Sangeet Shastra : Singh Guru Bipin
part 1/part 2
2. Sastriya Manipuri Nartan : Javeri Darshna and Devi Kalavati
3. Meitei Puran : Singh L. Mani.
4. Classical dance of India : Vatsyayan Dr.Kapila

MANIPURI DANCE

Nishnat- II

(Practical Paper –I)

Max marks: 90

Learning Outcome:

- Learn the Lashya Brindavan Bhanghi Pareng, which will make their knowledge much more confident about the art form.
- Learn to express the Nava Rasa through devotion as devotion is the soul of Manipuri dance.
- Gain about the Maha Raas through the learning of the dance Eka Gopi Eka Shyam.
- Make revision of the previous course to make their teaching and presentation skill stronger.

Content:

1. Nritta Bandha (Pung lol Jagoi)
2. Eshei Jagoi with Nritya and Nritta
3. Dance about with any two Nayika
4. Eka Gopi Eka Shyam in the sequence of Maharaas
5. Laishya [Nupi] Brindavan Bhanghi Pareng(Half)
6. Knowledge of Bols' Taals' and song already learnt like Kokilpriya Taal and Brahma Taal

E- Recourses:

<https://youtu.be/QBCozlAwBKw>

<https://youtu.be/Q-09ZSz4VxM>

<https://youtu.be/oFXWEkepEbk>

MANIPURI DANCE

Nishnat- II

Practical Paper –I (Stage Performance)

Max marks: 35

Learning Outcome:

- Demonstrate the technical proficiency and artistic expressiveness to effectively detect and understand the choreography's stylistic demand.
- Understand the roles of warm-up class, "spacing", lighting and dress rehearsals.
- Inventiveness and creativity in movement material.

MANIPURI DANCE

Nishnat- III

(Theory Paper –I)

Duration: 3 hrs

Max marks: 50

Note: - Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Get the theoretical knowledge of Pung, Achouba Bhangi and Astha Nayika.
- Learn the sequence of Maha Raas.
- Know how to write the Notation of various Taals of Manipuri dance.
- Get the idea of the Nava Rasa according to the Bhakti Rasa.

Content:

Unit-1

Nritya and Nritta in Eshei Jogai- give example with song

Unit-2

Importance of lather instrument Pung in Manipuri dance and the description of its division

Unit-3

Speciality of the Indian classical dances- Manipuri, Katahak, Kathakali, Bharat Natyam, Mohiniattam, Kuchipuri, Odissi and Satriya.

Unit-4

Names of Poet of the VaishnavPadawali and its language and Books that used in Manipuri dance.

Unit-5

Inspiration of 10th chapter of the BhagavatPurana in Manipuri dance.

Suggested Reading:

1. The Pre- world war-II Form of RaasLeela : Ibomcha Haobam
2. A History of Manipuri Literature : Singh Manihar
3. Manipuri Dance Asst on History : Dr.Sruti Bandopadhyay. And Presentation

MANIPURI DANCE

Nishnat- III

(Theory Paper –II)

Duration: 3 hrs.

Max marks: 35

Note: - Each unit has two questions. Students must attain at least one question out of each unit.

Learning Outcome:

- Get the theoretical knowledge of Pung, Achouba Bhangi and Astha Nayika.
- Learn the sequence of Maha Raas.
- Know how to write the Notation of various Taals of Manipuri dance.
- Get the idea of the Nava Rasa according to the Bhakti Rasa.

Content:

Unit-1

Importance of Achouba Bhangi

Unit-2

Short Note : AshtaNayikabhed.

Unit-3

Dance sequence of Maha Raas

Unit-4

Description of Nava Rasa according to the Bhakti Rasa in Manipuri dance

Unit-5

Write Notation with Matra, Bibhag, Taal – Rudra Taal, Kankan Taal

Suggested Reading:

1. The Pre- world war-II Form of Raas Leela : Ibomcha Haobam
2. A History of Manipuri Literature : Singh Manihar
3. Manipuri Dance Asst on History : Dr.Sruti. Bandopadhyay And Presentation

MANIPURI DANCE

Nishnat- III

(Practical Paper –I)

Max marks: 90

Learning Outcome:

- Learn and practice the Lashya Brindavan Bhangi Pareng, which will improve their Tandav style and stamina.
- Learn the Karun Rasa through the teaching of the sad situation during the disappearance of lord Krishna.
- Gain the knowledge about the Nayika Bhed through the dances of various Nayikas and from the learning Nani Churi, they will get the taste of the supreme Vatsalya Rasa of lord Krishna.
- Learn to show the Rudra Taal and Kankan Taal with Taali and Khali.

Content:

1. Lashya Brindavan Bhangi Pareng - 3 - Ghat
2. Ability to perform – any two Nayika Bhed
3. Disappearance of Lord Krishna in the MahaRaas.
4. Makhani Churi
5. Rudra Taal, Brahma Taal- with Matra and Tali(clapping)

E- Resources:

<https://youtu.be/QBCozlAwBKw>

<https://youtu.be/Q-09ZS4VxM>

<https://youtu.be/oFXWEkepEbk>

MANIPURI DANCE

Nishnat- III

Practical Paper –II

(Stage Performance)

Max marks: 35

Learning Outcome:

- Knowledge of movement structure and of musicality in relation to music.
- Students will demonstrate an understanding of aesthetics and craft of Indian classical dance choreography.
- Students will gain confidence in the field of choreography, performance, teaching and composition of classical dance with creativity and own intelligence.

Kathak Dance

Nishnat Part-I

(Theory –I)

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Understand between North & South Indian Taal systems.
- Develop the knowledge about famous Gurus of Kathak dance.
- Write the notation.

Content:

Unit -I

Comparative Study of Northern and southern Taal system.

Unit-II

Description of Das Pran of Taal.

Unit-III

Study of following terms: - Aad, Kuaad and Biaad

Unit-IV

Life Sketch, Sitara Devi, Roshan kumari, Mohan Rao Kalyanpurkar, Birju Maharaj.

Unit-V

Ability to write notation of learnt bols.

Nishnat Part-I

(Theory-II)

Time: 3 Hours

Maximum marks- 35

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Understand and explain the Nayika-Bheda of Nattyashastra and have understanding of 'Laya' and its application.
- Understand other Indian classical dance forms.
- Develop the writing skills on dance related topics

Content:

Unit-I

Brief study of nayika Bhed according Natty Shastra

Unit-II

Description of 'Laya' in Kathak Dance.

Unit-III

Knowledge of Kuchipudi and oddisi dance as in Indian Classical dance form.

Unit-IV

- (a) Knowledge of Mohini Attam Dance as or Indian Classical dance from.
- (b) Detailed study of Indian Classical dance forms (Kathak, Bharatnatyam, Manipuri, Kuchipudi, oddissi, Mohiniattam).

Unit-V

Essays:-

- (1) Kathak Dance: Origin and Development
- (2) Kathak Dance: Importance of Thumri
- (3) Kathak Dance: Place of Kavitta
- (4) Kathak Dance: Guru Shishya Parampara

Suggested Reading:-

1. 'Azad'. Pt. Tirathram Kathak Darpan. Nateshwar Kala Mandir, New Delhi
2. Bakshi Dr. Km. Jyoti (2000). Kathka Aksharon Ki Arsi, Hindi Granth Akdamy, Madhya Pradesh
3. Sen Arun Kumar (2005). Bhartiya Shastriya Taalon Ka Shastriya Vibechan, Hindi Granth Akdamy, Madhya Pradesh
4. Khokar, Mohan. (1984). Traditions of Indian Classical Dance. New Delhi: Clarion Books.
5. Kumar, Amit. (2014). Famous Dancing Gurus. New Delhi: Cyber Tech Publications.
6. 'Azad'. Pt. Tirathram Kathak Darpan. Nateshwar Kala Mandir, New Delhi

Kathak Dance
[Nishnat Part-I]
(Practical-I)

Maximum marks- 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Perform Thaats with Kasak-Masak.
- Gain proficiency in ABHINAYA aspect
- Demonstrate the Taal Savari and Ashtamangal.

Content:

TEENTAAL:-

- (1) Thaats (Kasak-Masak)
- (2) One Aamad (Tisra jati)
- (3) 1 Aamad (Chatustra jati)
- (4) 1 Paran (Mishra Jati)
- (5) 2 Parmelu
- (6) Tihai in difficult laya
- (7) Kavitta
- (8) Tatkaar thah, dugan, Tigun, Chaugan, Athgun laya.
- (9) Ability to Present Tatkar with variety in high speed
- (10) Ability to recite bols as in traditional way while Performing.

Abhinaya in any two of the following:-

1. Bhajan
2. Shlok
3. Thumari
4. Gat Bhav (Kaliya Mardan)

SAWARI:-

- (1) Tatkaar-Thah, Dugan, Chaugan
- (2) Rangmanch ka Tukda
- (3) 2 Aamad
- (4) Four Tukdas

ASHTMANGAL:-

1. 2 Chakkardar Tukdas
2. 2 Sadi Paran
3. 1 chakkardar Paran
4. Some Tihais
5. Practice recite learnt bols

Practical-II
(Stage Performance)

Maximum marks- 35

Learning Outcomes:

After completion of this course, the students will be able to:

- Demonstrate, an understanding of the aesthetics of dance.
- Knowledge of movement structure and musicality in relation to music.

E-Resources:-

www.dancelassonline.in

(Online dance lessons and certificate course for biggners on skype by Divya Dance School)

https://youtu.be/GrsI_1_rFZA

(Interview of Pt. Birju Maharaj, Published on 11 Jan,2015)

<https://youtu.be/x6ArP5ne1wk>

(Origin of Kathak from Doordarshan archives)

Kathak Dance

Nishnat Part-II

Theory -I

Time: 3 HourS

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Develop the knowledge of Western and India concept of 'Origin of dance' and 'Ras.Siddhant' of Sanskrit Literature.
- Learn about 'Ashta Nayika' according to Natyashastra and contributions of Kathak maestro.
- Develop the skills of notation writing.

Content:

Unit –I

Origin of dance according to the Indian and Western concept.

Unit-II

Brief introduction to Ras theory as describe in Sanskrit literature and contribution and time of authors.

Unit-III

Life sketch and contribution of famous artists in the field of Kathak.

Unit-IV

- (a) Asht Nayika Bhed according to Natyashastra.
- (b) Knowledge of Nav Rasa with special context to Shringaar Rasa.

Unit-V

Ability to write notation of prescribed taals.

Theory -II

Time: 3 Hours

Maximum marks- 35

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Completely understand about Kathak Dance from Mughal to Modern Period.
- Learn about Rangshala according to Natyashastra and contribution of following legends in the growth of Indian Dance –Ravindra Nath Tagore, Uday Shankar, Madam Menka.
- Develop the skill of writing essay, notation and knowledge of Rechak and Pad-bhed.

Content:

Unit –I

Intensive and comprehensive study on Kathak Nritya from Mughal time to modern time.

Unit –II

Contribution in Indian Classical Dance-

Ravindra Nath Tagore, Uday Shankar, Madam Menka

Unit-III

Study of types of Rangshala according to Natyashastra.

Unit-IV

Essay on dance related topic

Unit-V

Rechak, Pad Bhed

Suggested Reading:-

1. Tak, Dr. M. (2006). Aitihashik Pariprekshya Main Kathak Nritya, Kanishk Publishers, Distributers, New Delhi
2. Raghuveer, Dr. G. (2000), Kathak Ke Prachin Nrattang, Publication Scheme, Jaipur
3. Vajpai, R. (1999), Kathak Prasang, IInd Edition, Vani Prakashan, New Delhi
4. 'Azad', Pt. Tirathram Kathak Darpan. Nateshwar Kala Mandir, New Delhi
5. Bakshi, Dr. Km. Jyoti (2000). Kathka Aksharon Ki Arsi, Hindi Granth Akdamy, Madhya Pradesh
6. Sen, A. K. (2005). Bhartiya Shastriya Taalon Ka Shastriya Vibechn, Hindi Granth Akdamy, Madhya Pradesh
7. Khokar, M. (1984). Traditions of Indian Classical Dance. New Delhi: Clarion Books.
8. Kumar, A. (2014). Famous Dancing Gurus. New Delhi: Cyber Tech Publications.
9. Massey, R. (1999). India's Kathak Dance Past, Present, Future. New Delhi: Shakti Malik Abhinav Publications.
10. Mehta, U. (2011). Legacy of Classical Dances in India. New Delhi: Cyber Tech Publications.
11. Misra, S. (1992). Some Dancers of India. New Delhi: Manjit Singh Harman Publishing House.

Practical-I

Maximum Marks: 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Perform different variety of 'Amad'.
- Present Jati Paran.
- Execute 'Gat Nikas'
- Present Kathak Nritya on Thumari, bhajan etc.

Content:

Tritaal:

1. Amad (Advanced)
2. Permolu
3. Chakkardar Permolu
4. Kamali Paran or Badhaiya Paran
5. Paran in each Jati (Chatasra, Tisra, Khand, Mishra)
6. Gat-Nikas
7. Ability to dance Presentation and Padhant of Prescribed taals.
8. Ability to perform Abinaya on Thumari, Bhajan and Shloka
9. Ability to Perform of any three Nayika and Ras.
10. Ability to Perform any two Taal given by the Prescribed Syllabus (Ashtmangal, Chautaal, Pancham Sawari)

Abhinaya: Perform on any two

- (1) Shlok
- (2) Bhajan
- (3) Thumari
- (4) Gat-Bhav-Kaliya mardan.

Matttaal

1. Tatkar – Than (Barabar), Dugun, Chaugun
2. Rangmanch ka Tukda
3. Two Aamad
4. Four Tukda
5. Two Chakkardar Tukda
6. Four Simple Paran
7. Some Tehaies

Practical-II
(Stage Performance)

Maximum marks- 35

Learning Outcomes:

After completion of this course, the students will be able to:

1. Develop Presentation Skills of the students.
2. Develop the proficiency in 'ABHINAYA'
3. Develop the sense of Performing in Group Choreography.
4. Recite the 'Padhant' with the active use of Voice modulation.

E-Resources:-

www.sangeetgalary.co.in

(Browse and contribute articles, references and theories)

Sangeetnatak.gov.in

(Scheme of Scholarships in various Classical Dance & Music from by Ministry of Culture, Government of India)

www.artindia.net

(A complete dictionary of Classical Dancer's, Performers and institutes)

Kathak Dance

Nishnat Part-III

Theory -I

Time: 3 Hours

Maximum marks- 50

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Learn types of Jatis and Yatis and their Chalan.
- Understand about Tandav and Lasya in detail.
- Learn Asth-Nayikas in detail and historic contribution of eminent Acharys of Sanskrit literature.

Content:

Unit-I

Description of Jatis and Yatis with example.

Unit-II

- (a) Detailed description of Tandav and Lasya
- (b) Natyadharmi, Lokdharmi Nautanki, Natak, Sutradhar, Karan Anghar, Opera, Nrityanatika, Ras, Poorvrang.

Unit-III

Description of nayika Bhed and sub nayika based on different types of Awasthas.

Unit-IV

Life sketch of Acharya Bhurut, Nandikeshwara, Dhananjay, Abhinav Gupt in context of their historical contribution.

Unit-V

Ability to write notation of learnt bols.

Theory -II

Time: 3 Hours

Maximum marks- 35

Note:- Attempt five questions in all, selecting one question from each unit. All questions carry equal marks.

Learning Outcomes:

After completion of this course, the students will be able to:

- Learn about Natyashastra in dance's perspective.
- Gain detail knowledge about Gharana's of Kathak.
- Understand the various features of Indian Classical Dance forms.
- Learn about the contributions of renowned Kathak artists and develop writing skills on Kathak related topics.

Content:

Unit-I

Brief study of Natyashastra in context of Dance.

Unit-II

- (a) Kathak Dance in modern day, its different gharanas their origin and history and their Comparative study
- (b) Resurrection of Dance.

Unit-III

Detailed study of Indian Classical Dances jewellery and different types of instrument used in their presentation.

Unit-IV

Life sketch of any Murdhanya Kalakaar and his contribution from any Indian Classical Dance.

Unit-V

Essay on any topic related to Kathak Dance.

Suggested Reading:-

1. Dadhich, Dr.Puru (1948) Kathak Nritya Shiksha, Part-1I, Bindu Prakashan, Indore
2. Singh, Mandvi (1990), Bhartiya Sanskriti Main Kathak Nritya Parampara, Swati Publications, Delhi
3. Bakshi, Dr. Km. Jyoti (2000). Kathka Aksharon Ki Arsi, Hindi Granth Akdamy, Madhya Pradesh
4. Vajpai, Rashmi (1999), Kathak Prasang, IInd Edition, Vani Prakashan, New Delhi
5. Raghuveer, Dr. Geeta (2000), Kathak Ke Prachin Nrattang, Publication Scheme, Jaipur
6. Sen, Arun Kumar (2005). Bhartiya Shastriya Taalon Ka Shastriya Vibechn, Hindi Granth Akdamy, Madhya Pradesh
7. 'Azad'. Pt. Tirathram (2015), Kathak Gyaneshwari, Nateshwar Kala Mandir, New Delhi
8. 'Azad'. Pt. Tirathram Kathak Darpan. Nateshwar Kala Mandir, New Delhi
9. Bose, Mandakranta. (2001). Speaking of Dance: The Indian Critique. New Delhi: D. K. Printworld (P) Ltd.
10. Coomaraswamy, Ananda. (1970). The Mirror of Gesture. New Delhi: Munshiram Manoharlal
11. Bose, Mandakranta. (2001). Speaking of Dance: The Indian Critique. New Delhi: D. K. Printworld (P) Ltd.
12. Coomaraswamy, Ananda. (1970). The Mirror of Gesture. New Delhi: Munshiram Manoharlal
13. Srivastava, Ranjana. (2004). Tantra Mantra Yantra in Dance An Exposition of Kathaka. New Delhi: D.K. Printworld (P) Ltd.
14. Venkataraman, Leela. (2014). Indian Classical Dance: Tradition and Transition. New Delhi: Roli Books

Practical-I

Maximum Marks: 90

Learning Outcomes:

After completion of this course, the students will be able to:

- Gain proficiency in previous learned syllabus.
- Understand the sense of STAGE Presentation.
- Develop the ability of 'Padhant'.
- Presentation in different Taals.

Content:

1. Ganesh Paran
2. Two Amad
3. Two Simple Natwari Tukda
4. Two Chakkardar Natwari Tukda
5. One Simple Pakhawaj Paran
6. One Chakkardar Pakhawaj Paran
7. Jati with Bols
8. Chatasra, Tisra, Misra, khand, Sankeern Jati
9. One Simple Premelu
10. One Chakkarda Premelu
11. Gat-Kaliya Mardan, Draupadi Cheer-Haran
12. Kavitt

Nritta:

Zarab, Bol Jati, Various types of Tehaies

Abhinaya:

(1) One Shlok (2) One Bhajan (3) One Thumari

Padhant:

Padhant with dance performance and Practice of padhant on Lahara and Theka

Other Taal:

Dance present on any two Taal, given below:

- (a) Pancham Sawari (15)
- (b) Ashtmangal (11)
- (c) Matt Taal (18)

DIPLOMA COURSE:
Archival Studies and Records Management

Understanding Archives: Concepts and Theories

Max. Marks: 100
(CA: 40 + FA: 60)

L	T	P	C
2	0	0	2

- Understanding Archives and its Scope
- Records and their preservation in era of Information Technology
- Personal and Societal Significance of Archives
- Types of Archives- Public, Corporate and Digital
- Theories- Custodialism and Post-Custodialism
- Archives and Law- Public Records Act, 1933.
- Orientalism and Institutionalization of Knowledge in British India
- Historical Evolution of National Archives of India, New Delhi
- The Establishment of National Library, Kolkata
- Repository of the Nehru Memorial and Museum Library, New Delhi

Learning Outcomes:

After the completion of the course Students will be able to:

- **Understand the importance of Archives in the era of Information Technology.**
- **Analyze the various theoretical paradigms on Archives.**
- **Comprehend the motive behind the Institutionalization of knowledge in British India.**

Recommended Books:

1. Bhatt, Rakesh Kumar, 1995, *History and Development of Libraries in India*, New Delhi: Mittal Publications.
2. Craven, Louise, 2016, *what are Archives? Cultural and Theoretical perspectives: A Reader*, New York: Routledge.
3. Foucault, M., 2002, *Archaeology of Knowledge*, Psychology Press.
4. Guide to the Records in the National Archives of India, 1977, Vol. I-X, New Delhi: NAI.
5. Ketelaar, Eric, 2012, Cultivating Archives: Meanings and Identities, *Archival Science*, 12:19–33.
6. Millar, Laura, 2010, *Archives: Principles and Practices*, Neal-Schuman Publishers.
7. O' Toole, James M. and Richard J. Cox, 2006, *Understanding Archives & Manuscripts*, Chicago: Society of American Archivists.
8. Said, Edward, 2001, *Orientalism: Western Conceptions of the History*, New Delhi: Penguin Books.

Suggested E-Resources:

- Lubar, Steven, 'Information Culture and the Archival Record',
https://www.jstor.org/stable/pdf/40294102.pdf?ab_segments=0%2Fdefault-2%2Fcontrol&refreqid=search%3A2397c207396d65eee21487afd04af1de
- Nesmith, Tom, 'Seeing Archives: Postmodernism and the Changing Intellectual Place of Archives',
https://www.jstor.org/stable/pdf/40294187.pdf?ab_segments=0%252Fdefault-2%252Fcontrol&refreqid=excelsior%3A14d68d43a3443ed7c77dc2c314a7b499
- Bell, David F. 'Infinite Archives',
<https://muse.jhu.edu/article/174964/pdf>

Preservation Planning and Records Management

Max. Marks: 100
(CA: 40 + FA: 60)

L	T	P	C
2	0	0	2

➤ Defining Preservation and Records Management

- Selection and Collection of Sources
- Genres of Records- Private Papers/Periodicals/Government Files.
- Conventional and Functional Filing System
- Accession and Arrangement of Public and Private Records
- Indexing of Records
- Techniques of Preservation- Flattening, Handmade Repair, Tissue Repair
- Hand lamination, Chiffon Repairing and Conservation of Documents
- Digitization and Microfilming
- Ethics of Recordkeeping

Learning Outcomes:

After the completion of the course Students will be able to:

- Understand the importance of Preservation and Records Management.
- Be acquainted with technicalities of preservation of documents in archives.
- Analyze the process of filing system, microfilming and indexing.
- Develop skills for vocational purposes.

Recommended Books:

1. Batra, N.L., 1996, *A Study in to the Ancient Building Material – An Emphasis on Preservation and Conservation*, Felicitation Volume of Dr. K. M. Srivastava. Batra, N.L., Heritage Conservation, New Delhi: Aryan Books International.
2. Cohen, Laura B., 2011, *Reference Services for Archives and Manuscripts*, London: Routledge.
3. Cozine, James, 2004, *Saving the Big Thicket: From Exploration to Preservation, 1685-2003*, Denton: University of North Texas Press.
4. Craven, Louise, 2016, *What are Archives? Cultural and Theoretical perspectives: A Reader*, New York: Routledge.
5. Cummings, Kate, 2010, *Ways of Seeing: Contextualizing the Continuum*, *Records Management Journal*, 20:1.
6. Ketelaar, Eric, 2012, Cultivating Archives: Meanings and Identities, *Archival Science*, 12:19–33.
7. Lee, Christopher A. 2011, *A Framework for Contextual Information in Digital Collections*, *Journal of Documentation* 67, no. 1: 95-143.

Suggested E-Resources:

- Meeks, Stephanie K. Introduction: The Future of Preservation', <https://muse.jhu.edu/article/596225>
- Shepard, John . 'Preservation',

https://www.jstor.org/stable/pdf/899640.pdf?ab_segments=0%2Fdefault-2%2Fcontrol&refreqid=search%3Ab5314a2b8df53e5b20014a2b130cc4c3

- Guerra, Claudia. 'Cultural Mapping: Engaging Community in Historic Preservation', <https://muse.jhu.edu/article/631476>

Archiving Regional and Local History

Max. Marks: 100
(CA: 40 + FA: 60)

L	T	P	C
2	0	0	2

- Understanding Regional History.
- Importance of Regional Archives.
- A general survey of the holdings of Rajasthan State Archives, Bikaner.
- Survey of Sources at Maulana Abul Kalam Azad Arabic Persian Research Institute.
- Pt. Hiralal Shastri Papers: Private Diary.
- Defining Folklore.
- Alternative sources.
- Folk Religious traditions.
- Women as carriers of cultural history.
- Institutionalizing Rajasthani Folklore: Role of Komal Kothari & Rupayan Sansthan, Borunda.

Learning Outcomes:

After the completion of the course Students will be able to:

- Comprehend importance of Regional archiving
- Develop understanding of functioning of Regional Archives
- Inculcate skills of preservation of historical sources of information.
- Understand Traditions of archiving local and folkloric knowledge.

Recommended Books:

1. Bhattacharya, D.K. (July - December 2015). Studying Folklore: The Indian Experience. *Indian Anthropologist*, Vol. 45, No. 2. pp. 1-10.
2. Goody, Jack. (2010). *Myth, Ritual and the Oral*. Cambridge, UK: Cambridge University Press.
3. *Guide to The Records in The Rajasthan State Archives*. (1991). Bikaner: Rajasthan State Archives.
4. Marzolph, Ulrich. (Jan. - Apr., 1998). What Is Folklore Good for? On Dealing with Undesirable Cultural Expression. *Journal of Folklore Research*, Vol. 35, No. 1, Special Issue: International Rites, pp. 5-16.
5. Nadira, Anvarunnisa. (1978). *Tonk ki Mahanta ke Do Minar*, Arabic Persian Research Institute, Tonk: APRI.
6. *Rajasthan Sujas*. (1997). August-September (Special Issue on Archives).
7. Sharma, Preeti. (2012). "Hearing the hidden voices of feminine sexuality: Folkloric challenges to patriarchic traditions in Rajasthan", *International Journal of Interdisciplinary Cultural Studies*, 7(2):37-47.
8. Shastri, Hiralal (1970). *Pratyaksha Jivanshastra: Autobiography*, Jaipur: Anupam Prakashan.
9. Usta, A Lateef. (2008). *Arabic Persian Research Institute*, Tonk: APRI.

Suggested E-Resources:

- An Institutional History of Rupayan Sansthan, Jodhpur | Sahapedia

<https://www.sahapedia.org/institutional-history-of-rupayan-sansthan-jodhpurb>

- Maulana Abul Kalam Azad Arabic Persian Research Institute, Tonk www.maapritonk.nic.in
- Rajasthan State Archives - State Portal www.rsad.rajasthan.gov.in/

Project Report

Max. Marks: 100
(CA: 40 + FA: 60)

L	T	P	C
0	0	16	8

Guidelines for writing the **Project Report**: Size 50-60 pages, double line space, in TNR 12 Font size. For Hindi type font to be used DevLys 010, size 14. Sequence of content - Title page, certificate of the supervisor, declaration by the student, content page, list/s of tables, graphs, charts, maps, illustrations, photographs and plates, acknowledgement, preface pages (to be numbered in small Roman digits, i, ii, iii... x). From chapter 1 to last pages Arabic numerals (1,2,3..75). If any, the Appendices and list of technical terms/glossary will follow the conclusion chapter and will not be numbered. Reference section/Bibliography will similarly not be numbered. Reference style - APA.

Synopsis: 8-10 pages including the research problem, tentative chapterisation, objectives, methodology, literature review and bibliography, with TNR 12 Font, double space.

The **Project Report** will be evaluated by the departmental board of 3 members, including Head, supervisor and one faculty member.

Certificate in Android Application Development

Theory-40 hrs.

Practical-40 hrs.

Learning Outcomes: After completion of this course, the students will be able to:

- Install and configure Android application development tools
- Design and develop User Interfaces for the Android platform
- Integrate applications with pre-existing third party libraries and manage application data
- Publish application to the Android Market

Section A

Introduction, Android versions, app development process, Android Studio, project, Java code, app build process, emulators and physical devices, log system, Model-View-Presenter pattern, views, resource files, layouts, text views, scrolling views, activities and explicit intents, activity navigation, activity lifecycle and managing states, activities and implicit intents

Section B

User input controls, buttons, text input, checkboxes, radio buttons, toggle buttons, switches, spinners, dialogs, alert dialog, date and time pickers, menus, app bar, options menu, contextual menu, contextual action bar, popup menu

Section C

Broadcast intents and broadcast receivers, notifications (creating, delivering, reusing, clearing), shared preferences, files, storing data using SQLite, sharing data with content providers, apk and publishing android app

Suggested Books:

1. Lee, Wei-Meng. (2011). Beginning Android Application Development. Indianapolis, IN: Wiley Publishing, Inc.
2. Annuzzi, Joseph Jr., Darcey, Lauren, & Conder, Shane. (2014). Introduction to Android Application Development: Android Essentials (4th ed.). Michigan, US: Addison-Wesley
3. Deitel, Paul J., & Deitel, Harvey. (2017). Android How to Program (3rd ed.). Pearson Publication
4. Meier, Reto. (2012). Professional Android 4 Application Development. Indianapolis, IN: John Wiley & Sons
5. Griffiths, David, & Griffiths, Dawn. (2017). Head First Android Development (2nd ed.) . O' Reilly Media, Inc.
6. DiMarzio, J.F. (2010). Android: A Programmer's Guide. Tata McGraw-Hill Education Pvt. Ltd.

Laboratory Practices:

- 1: Installation and exploration of Android Studio IDE.
- 2-3: Creating project and app, running app on emulator and physical device.
- 4-5: Working with toast and log system.
- 6-7: Configuring manifest file, handling layouts.
- 8-10: Creating and switching between activities, working on apps with explicit intents, understanding activity life cycle and states.

- 11-17: Exploring and using various UI controls (text inputs, buttons, checkboxes, radio buttons, toggle buttons, switches, spinners, date and time pickers, images).
- 18-19: Creating and managing dialogs.
- 20-24: Creating and managing options menu, contextual menu, contextual action bar, popup menu.
- 25-27: Handling notifications (creating, delivering, reusing, clearing).
- 28-31: Working with shared preferences and files.
- 32-36: Creating and manipulating SQLite database.
- 37-38: Working with context providers.
- 39-40: Creating apk, publishing android app.

Advanced Diploma in Medical Image Processing

Theory-80 hrs.

Practical-80 hrs.

Learning Outcomes: After completion of this course, the students will be able to:

- Apply clinical image management skills
- Provide consultancy to companies and business enterprises in developing tools and techniques for their specialties, where imaging is pivotal
- Enhance the imaging skill sets, expands futuristic academic and research possibilities and is more likely to create a bridge between the preclinical and clinical image science

Section A

Neuro Anatomy (Image Processing and Analysis Perspective): Relevance and importance with Advance Imaging, Tools-Brain Imaging with MRI, fMRI, DTI (Diffusion Tensor Imaging), Computational Neuro Anatomy, Measurement of brain Activity-EEG, CAT SCAN.

Cardiac Anatomy, Morphology & Coronary Imaging (Image Processing and Analysis Perspective): Basic cardiac anatomy and physiology, advance imaging modalities- Echocardiography, Cardiac Molecular Imaging, Cardiovascular CT, Cardiovascular MR, Coronary ⁺XRay Angiography, Coronary CT Angiography, Coronary MR Angiography, Analysis of ECG

Section B

Oncology (Image Processing and Analysis Perspective): Cause and nature of diseases & trauma, inflammation and infection. Radiation therapy, Chemotherapy, Hormone Therapy, Surgery, Immunotherapy & Radionuclide therapy, Benign and malignant, Methods of spread of malignant disease, Staging, Cancer prevention and public education and +Computerised early detection processes, Patient management on treatment, side effects related to radiation and dose, Acute and Late Monitoring – Information and communication, +Cancer awareness in society.

Nuclear Imaging (Image Processing and Analysis Perspective): Imaging systems • Gamma camera - general principles • ECT (Emission Computed Tomography): Single photon emission computed tomography (SPECT) - general principles • Positron emission tomography (PET) - general principles. +Machine learning basics with python applied in Medical Image Processing.

Section C

Radiology in Forensic Medicine (Image Processing and Analysis Perspective) - Use of radiography in +damaged/mutated skeletal identification, Radiography of the +damaged skull, use of Radiography in mass disaster +(Mass killing, flood/drought, earthquake, tsunami etc).

Recent Advances in Imaging and Health Awareness: Translational imaging, Imaging used for ENT, Imaging in inflammation & infection, Image Guided Surgery (IGS), 3D/4D imaging and reconstruction. Introduction to Dermatoglyphics, Concept of CPR, Basic First Aid- Burns, Bug bites, broken bones, Hypothermia, Shock, Poison, and Breathing issues.

Suggested Books:

1. Recent advances in Radiology and Medical Imaging, Lodge & Steiner
2. Publisher-Churchill Livingstone (1979), ISBN 10: 0443018642 ISBN 13: 9780443018640
3. Decision Making in Radiation Oncology, Volume 1, Editors: **Lu**, Jiade J., **Brady**, Luther W. (Eds.), ISBN 978-3-642-13832-4, Springer Publication.

4. Introduction to Radiologic Sciences and Patient Care, 5th Edition Arlene Adler, Richard Carlton , Elsevier Publication.

Laboratory Practices:

1. Write a program in Matlab for the computation of various trigonometrical functions like sin,cos waves taking various values . Plot them.
2. Write a program for the edge detection using Sobel , Robert, Canny edge detection algorithm. Plot there histogram.
3. Develop complete software for all the basic pre-processing tasks in normal/medical images.
4. Write programs implementing various noises and its removal using Matlab.
5. Blur and de-blur any image and compute there basics statistics.
6. Develop GUI in MATLAB for Medical Calculator (BMI, BP, Thyroid, Diabetics etc) program.
7. Optimize the space any medical image using compression algorithms.
8. Develop complete GUI for image segmentation algorithms generally used.
9. Develop a GUI for the implementations of various fitness functions in Genetic Algorithm.
10. Demonstrate the concept of Fuzzy System in medical image processing.
11. Apply ANN to classify images corresponding to tumor (benign or malignant).
12. Apply hybrid approach to multi classify a tumor in any part of human body.

Portrait Painting –I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Analyze own problem in portrait painting and solve accordingly.
- Learn proper techniques to create a portrait painting.
- Create aesthetic appeal in a portrait.

Size : ½ Imperial (Paper/canvas)

Medium : Water or oil colour.

Head study (Male and female) Blocking of planes and masses, Foreshortening relationship of head with neck and shoulder, techniques of colour application in monochrome and full colours. Portrait study should bring out proportion and the characteristic of the model.

Each Student is supposed to submit (for Final Exam): 5 Studies of Portrait.

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Elective Course (Display of art work with report and Viva-Voce)

Print Making Art-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Know the meaning, nature and various methods of printmaking medium and its application in the field of art.
- Understand materials, tools and processes from variety of relief techniques like Wood cut and Linoleum cut.
- Apply relief printing process in their own creation and value the historic traditions of the medium.
- Develop self motivation, self direction and strong work ethic.

Medium : Lino or Wood

Size : Not less than 10"×12"

Introduction to lino cut and wood cut techniques. Preparation of Black & White and multi colour blocks in lino & woodcut. Printing fine details. Creative experimentation.

Each Student is supposed to submit (for Final Exam) : 5 Prints

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Elective Course (Display of art work with report and Viva-Voce)

Mural Painting- I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Know about various methods of painting and the ancient cultural tradition of mural art in India.
- Explain indigenous cultural tradition of mural art.
- Learn and enhance technical skill related to tempera process of mural painting.
- Create original work of art and apply skills for professional ends and develop personal style and contribute to art work.

Tempera Process training in mixing of colours, use of gum and egg media and method of preparing indigenous colour use of gold and silver colours.

Size : 1'×1½' Medium : Tempera

Each Student is supposed to submit : 5 Works

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Elective Course (Display of art work with report and Viva-Voce)

Sketching and Media Exploration – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes

After the accomplishment of the course students will be able to:

- Develop eye and hand coordination.
- Explore ideas and improve communication skills.
- Explore the expressive possibilities of various media.

Sketches (Indoor and Outdoor), Exploration of Possibilities and Limitations of Various Media.

End Semester Examination evaluation Scheme

Each Student is supposed to submit (for Final Exam) :

- (a) Five works in any medium (Paintings, Graphics, Landscape, Drawings)
- (b) A Sketch book containing not less than 50 sketches.
- (c) Practical competency (Internal).

General Instructions :

- (a) There should be 5 Periods for each theory course, 12 Periods for each Elective course and 8 (4+4) Periods for Course DNP 419L
- (b) Practical Exam.- Final assessment for each Elective Course (Display of art work with report and Viva-Voce) and for Course DNP 419L (Display of Art Work)

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Portrait Painting-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Know about the role of portraiture in art practices (from ancient to contemporary).
- Understand the anatomy of face, structure, light, shade, proportion and the characteristics of model.
- Develop eclectic and aesthetic knowledge about portrait making

Size : ½ Imperial (Paper/Canvas)

Medium : Water, oil colour or Acrylic.

Head study (Male and Female) Blocking of planes and masses, Foreshortening relationship of head with neck and shoulder, techniques of colour application in monochrome and full colours. Portrait study should bring out proportion and the characteristic of the model.

Each Student is supposed to submit (for Final Exam): 5 Studies of Portrait.

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Elective Course (Display of art work with report and Viva-Voce)

Print Making Art-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Know the several modes of artistic expression in the intaglio process of printmaking
- Understand materials, tools and processes from variety of intaglio techniques like dry point, etching and aquatint.
- Prepare portfolio of art work.
- Think critically, communicate clearly and work creatively in intellectual pursuit of print making.
- Analyze, interpret and evaluate the form and content of works of art.

Size : Not less than 10"×12"

Medium : Wood or Etching

Introduction to dry point and etching techniques. Preparation of Metal Plate with sensitive surfaces. Basic experimentation in various textures as done on Zinc Plate. Different type of grounds (Hard ballground, Liquid Hard ground and soft ground) and Aquatint. Multicolour Printing. Mix Media, creative experimentation.

Each Student is supposed to submit (for Final Exam): 5 Prints.

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Elective Course (Display of art work with report and Viva-Voce)

Mural Painting-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Know about various methods of painting and the ancient cultural tradition of mural art in India.
- Explain indigenous cultural tradition of mural art.
- Learn and enhance technical skill related to tempera process of mural painting.
- Create original work of art and apply skills for professional ends and develop personal style and contribute to art work.

Tempera Process training in mixing of colours, use of gum and egg media and method of preparing indigenous colour use of gold and silver colours.

Size: 1' × 1½'

Medium: Tempera

Each Student is supposed to submit (for Final Exam): 5 Works.

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Elective Course (Display of art work with report and Viva-Voce)

Sketching and Media Exploration - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes

After the accomplishment of the course students will be able to:

- Develop unique approach regarding materials to create a work of art.
- Develop communication skills through Visual Art.
- Explore the expressive possibilities of various media used in creating works of art.
- Attain and understanding of personal aesthetic and visual language.

Sketches (Indoor and Outdoor), Exploration of Possibilities and Limitations of Various media.

End Semester examination evaluation scheme.

Each student is supposed to submit (for Final Exam):

- (a) 5 works in any medium (Paintings, Graphics, Landscape, Drawings).
- (b) A Sketch book containing not less than 50 sketches.
- (c) Practical competency (Internal)

General Instructions:

- (a) There should be 5 Periods for each theory Course, 12 Periods for each Elective Course and 8 (4+4) Periods for Course DNP 420L
- (b) Practical Exam.-Final assessment for each Elective Course (Display of art work with report and Viva-Voce) and for Course DNP 420L (Display of Art Work)

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Composition-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Explore new mediums.
- Upgrade their previous Artistic experiments.
- Know critical theories and their applications in composition.

Compositional exercise based on studies of object and object group in space, on studies of Human figure and animals, and on studies of local scene, compositional analysis of painting; exercise in the use of colours and texture values, original painting based on preparatory studied compositional analysis of painting.

Size : Size not less than Imperial.

Medium : Oil Colour, Tempera, Water Colour, Mix Media etc.

Each Student is supposed to submit (for Final Exam): 5 compositions.

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Discipline Elective Course (Display of art work with report and Viva-Voce)

Composition-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes

After the accomplishment of the course students will be able to:

- Know subjects and materials used in composition
- Explore socio-political subjects through composition.
- Identify the importance of realistic and abstract subject matter in composition.

Compositional exercise based on studies of object and object group in space, on studies of Human figure and animals, and on studies of local scene, compositional analysis of painting; exercise in the use of colours and texture values, original painting based on preparatory studied compositional analysis of painting.

Size : Size not less than Imperial.

Medium : Oil Colour, Tempera, Water Colour, Mix Media etc.

Each student is supposed to submit (for Final Exam): 5 Compositions.

General Instructions :

C.A. (40 Marks) : Continuous Assessment will be conducted by a Board of Examiners minimum three teachers one time in a Semester.

Practical Exam.- Final assessment for each Discipline Elective Course (Display of art work with report and Viva-Voce)

Drawing as a Visual Language Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Practical:

- Explore and practice individual drawing style and techniques.
- To draw the drawings with the help of basics shapes, Animal study, Human anatomy, live model study.
- Develop creative composition for Story Book illustrations
- Drawing images in a series like graphic novels, comic book, storyboards and directing manuals.
- Creating multi-figured compositions.
- Digital Illustration: Vector and Raster.
- The basics of traditional 2D animation. Introduction to the skill required thereof.
- Difference between “looking at the drawing” and “seeing the drawing”.
- Observation and Line of action.
- Caricaturing fundamentals, Exaggeration, Attitude, Silhouettes, gesture drawing, line drawing and quick sketches, drawing from observation, memory and imagination.
- Principle of animation and the animator’s drawing tools like light box, field charts, line tests, the exposure sheet (“X” sheet), and perspective in animation. Objects in perspective, Animals in Perspective, human forms in perspective, Cast shadow exercise, shapes in perspective with light and shade, and foreshortening (of cylinders).
- Stylization of drawings.

Learning Outcomes:

Upon Completion of the course, the students will be able to:

- Develop visual story telling like comic strips and graphic novel.
- Create digital illustration through computer software like Adobe Photoshop and Adobe Illustrator.
- Implement range of rendering techniques, as a mean of communicating ideas and thought effectively.
- Utilize drawing as a tool of representation and visual communication.
- Develop an understanding of variety of traditional drawing materials.
- Create character design for animation and other medium.
- Develop an expression of individual art and illustration.

Recommended Books:

1. Whitaker, H., Halas, J. (2009) *Timing for Animation* (2nd Ed.) Burlington. MA: Focal Press.
 2. Perard, Victor (2004). *Anatomy and Drawing*. USA. Dover publications
 3. Male, Alan (2007). *Illustration: A Theoretical and Contextual Perspective*. UK, UK: Thames and Hudson
 4. Mulick, Milind (2006). *Watercolour (new ed.)* India, Jyotsna Prakashan.
 5. Simblet, Sarah (2009). *Sketch book for the artist*, US, US: DK Publishing.
- Hultgren, Ken (2016). *The Art of Animal Drawing: Construction, Action Analysis, Caricature*, Green Point Books.

Design Methods and Processes Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Practical:

- Define a need by considering appropriate human, functional and aesthetic factors;
- Gather and use relevant information for design decision making.
- Generate and develop ideas using appropriate methods.
- Test and evaluate their design ideas, making appropriate modifications.
- Apply appropriate communication techniques to inform and defend ideas.
- Developing forms and planning the steps in making their artifact.
- Explore appropriate materials and suitable techniques to make final artifact.
- Make appropriate modifications to enhance the artifact.
- Find a design solution as per all above given details.

Learning Outcomes:

- Develop critical and lateral thinking approach.
- Develop a basic design concept, visualization and manipulation techniques.
- Develop an appreciation of function, aesthetics and technology in design.
- Develop basic design thinking and communication skills.
- Create activities and experiences for basic process of design, adapt in their abilities, interest and design in context of human society, economy, politics and socio-cultural aspect.

Recommended Books:

1. Balaram, S (2011). Thinking Design, SAGE Publications India Pvt Ltd
2. Papanek, Victor (1971). *Design for the Real World: Human Ecology and Social Change*, New York, Pantheon Books.
3. Vyas, H. Kumar (2009). *Design and Environment: A Primer* (3rd ed.). India, National Institute of Design.
4. Munari, Bruno (1971). *Design as Art*. Penguin books

Recommended E-Resources:

<https://www.bloomsburydesignlibrary.com/taxonomy?id=disciplines>

Architectural Drafting - I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

- Introduction to various tools, techniques, and skills necessary for architectural drafting.
- Introduction to drawings and its types.
- Emphasis is on lettering, line weight, dimensioning systems, graphic standards and the methods used to produce accurate drawings.
- Various type of projections. Drawing in Orthographic projection.
- Drawing in Orthographic projection. Projection of Points, Lines, Planes and Solids.
- Graphic and Digital Presentation through Google Sketch up, Adobe Photoshop & Illustrator.

Learning Outcome:

Upon completion of the course, the students will be able to:

- Read and understand technical drawings.
- Use drawing instruments such as T-scale, Set square and conversion scale for drawing architectural design.
- Learn the style and mannerism in which a drawing is made and presented.
- Understand the orthographic projections, how to scale drawings and importance of same.
- Visualize and perceive an object in 2D and 3D.

Recommended Books

1. Bhatt.N.D.53rd Edition (2014). *Engineering Drawing*. Charotar Publishing House. Anand. Gujrat.
2. Clois E. Kicklighter Ed D.W. Scott Thomas. (2016) *Architecture: Residential Drafting and Design*. Goodheart-Willcox. Illinois. United States

Drawing III: Analytical Drawing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Practical:

- To work on structure of man-made object & natural specimen & rendering techniques to enhance light & shade effect, material quality of the object, surface quality, texture, relative proportion in linear & massive methods.
- To work on perspective study (one point and two point) on the basis of solid geometrical construction and emphasizing on Construction of objects.
- To work on analyzing objects and drawing from observation on the basis of orthographic and isometric /parallel projections.
- Exploration exercises on constructional drawing with curves and ellipsis to be incorporated in the study

Medium: Pencil, Pencil Colors, Ink, Crayons and Water Color - Transparent and Opaque. Maintain sketch file with rough/fair sketches.

Learning Outcomes:

Upon Completion of the course, the students will be able to:

1. Develop hand and eye coordination for Analytical Drawing
2. Incorporate design, composition, and spatial organization theories in their design solutions.
3. Utilize a variety of traditional drawing materials.
4. Develop drawing skill which could be implemented for design solution development.
5. Critically interpret and analyze design work in terms of form and structure.
6. Utilize fundamental concepts of aesthetics in creating design drawings.

Understand the basic and formal elements of design and drawings.

Recommended Books:

1. Colussy, M. Kathleen (2007). *Rendering fashion, fabric and prints*. New Delhi : Pearson Education
 2. Casals Josep (2010) *Watercolor : Course of drawing and painting Atrium group de ediciones* New York: Publicaciones Barcelona.
 3. Casals Josep (2004) *Drawing : Drawing and painting course*, New York: Publicaciones Barcelona.
- Casals, Josep. (2004) *Pastel: Course of drawing and painting*, Barcelona: Atrium Publication

Form Space and Order Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Course Outline:

Section A

- Study of lines and forms : Lines (Their Visual Qualities), Composition of two Dimensional
- Forms, Forms in Nature (Animate and Inanimate).
- Material and Texture, Colour, Light.

Section B

- Anthropometry.
- Study of spaces: Positive and Negative Spaces, Activation of spaces through Stables /
- Mobiles.
- Design of an object in everyday use.

Section C

- Understanding Architectural Aesthetics.
- Elements of Visual Aesthetics.
- Attributes of Form and Space.
- Platonic Forms. (Derivatives forms and transformation).
- Scale, Proportion, Contrast.
- Alignment, Repetition, Pattern, Rhythm
- Principles of Organization of Form & Space
- Study of building by application of principles of Aesthetic Appraisal.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Balance composition, by using design principles.
- Understand the importance of elements and principles of design, in application of making design composition.
- Develop ability to assess design in two dimension and third dimension.
- Demonstrate independence of judgment by producing unique designs.

Recommended Books

1. Ching Francis D. K. (2012). *Architecture: Form Space & Order*. Wiley & Sons. New Jersey
2. *Pramar V.S.* (1973). *Design Fundamentals in Architecture*. Somaiya Publications. N. Delhi

Color Concepts Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

- Making of different color schemes.
- Color concept for Interior spaces.

Learning Outcomes:

Upon Completion of the course, the students will be able to:

1. Understand the theory of Colour and utilization of the same in spaces.
2. Relate the colour as per culture and society, and relate the same with current trends.
3. Understand the psychology and cultural association of colour
4. Incorporate design, colour composition, and spatial organization theories in their design solutions.
5. Utilize a variety of colour scheme for different interior spaces.

Practical:

- Making of different color schemes.
- Color concept for Interior spaces.

Recommended Books

1. DeLong, M., Martinson, B. (2012). *Color and Design*. New York, NY: Bloomsbury Publication Plc.
2. Swirnoff, Lois (2003). *Dimensional Color* (2nd ed.). New York, NY: W. W. Norton & Company.
3. Feisner, Edith Anderson (2014). *Color Studies*, New York, NY: Bloomsbury Publishing.
4. Albers, Josef (2013). *Interaction of Color* (50th Anniversary ed.). New haven and London, Yale University Press.
5. Pavey, Don (2003). *Colour and Humanism: Colour Expression Over History*. USA, Universal Publishers.
6. Patti Mollic.2013. *Color Theory : An Essential Guide to Color – From Basic Principles to Practical Applications*. Walter Foster Publishing. CA. USA
7. Bride M. Whelan. (1994). *Color Harmony*. Rockport Pub. USA
8. Edith Anderson Feisner. (2006). *Color studies*. Fairchild Publication. New York
9. Reed, Ron. (2010). *Color + Design : Transforming Interior space*. Fairchild Books. New York
10. Flynn, Maria. (2001). *Colour Your world : creating harmonious mood in the home*. RotoVision Book. Switzerland.

Cultural Anthropology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Practical :

- To collect data of relevant area, to compare and find visual, motivational, social, ethical and anthropological differences.
- Various assignment to interpret. The analytical data for use in interior Design.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Inculcate the understanding of culture and its influence.
- Identify the basic elements of different cultures.
- Do a comprehensive analysis of the design
- Comprehensive analysis of the design

Recommended Books

1. Scupin, R. (1995). *Cultural anthropology a global perspective*. Englewood Cliffs, NJ: Prentice Hall.
2. Nanda Serena L. Warms Richard. (2007). *Cultural Anthropology* (Ninth Edition). Wadsworth/Thomson Learning. Belmont.
3. John L. Allen and Audrey C. Shalinsky (eds.) (2004). *Student Atlas of Anthropology*. Guilford, CT: McGraw-Hill/Dushkin.

Interior Structures Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Practical:

- To explore developing and constructing structures from various possible materials. Emphasizing on modular permanent and installation possibilities of the structures.
- To study the structural member, their specification and constructional detail.
- Outdoor study such as visit to various buildings, public spaces and so on encouraging the student to adopt an interactive, research based on innovative approach.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Determine the sizes, placements and design of structure in available spaces.
- Understanding of the process of building construction and materials to be used.

Recommended Books

1. McKay W.B. (2013)..*Building Construction*. Pearson India, Delhi
2. Emmitt Stephen 3rd edition. (2014). *Building Construction*. Wiley-Blackwell
3. Rangwala.2015. *Building Construction*. Charotar Publishing House. Anand (Gujrat)

E-Resources:

Andrew W. Charleson, Structures as architecture (Online download available).

Materials and Applications Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Practical:

- The physical, behavioral and visual properties of the following materials and their use in the construction of floor, walls, ceiling doors, windows, staircase, built in furniture, and other components of interior architecture.
- All material's market surveys, case studies and site visit to understand the system of construction & details.
- Study of material application in form of portfolio and documentation will be required.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Identify materials and there behaviour to be considered while designing a space.
- Understand the importance of relation between material and design while planning.

Recommended Books

1. Calladine C. R. (2010). *Masonry Construction*. Springer Publication. Dordrecht. Netherlands
2. Ming Wang Fu. (2016). *Design and Development of Metal-Forming Processes and Products*. Springer International Publishing AG, Cham. Switzerland
3. Porter Terry .2012.*Wood: Identification & Use*. Guild of Master Craftsman Publications Ltd. East Sussex. United Kingdom

Building Codes and Standards

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory

Section A

- Planning, policy and guidance and other permission required.
- Standards of the Construction Industry
- Anthropometric Data

Section B

- Furniture and fitting data
- Sustainability, energy saving and green issues
- Structures and wind loads
- Ventilation
- Doors, windows, sanitary fitting

Section C

- Brick work and block work
- Stone work
- Damp proofing
- Plaster and render
- Metals
- Insulation
- Paints interior and exterior

Learning Outcomes:

Upon completion of the course, the students will be able to:

- The students will focus to learn the importance of Byelaws and its relevance in design.
- Students will be able to justify the materials to be used for construction and why.

Recommended Books

1. Ching D.K. (2010). *Residential Building Codes*. John Wiley and Sons Ltd. Chichester. United Kingdom
2. International Code Council. (2018). *Significant Changes to the International Building Code*. Cengage Learning, Inc. OH, United States.

Furniture Design and Detailing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory:

Section A

- Measured drawing of existing furniture (Plan, Elevation and Detail)
- Analysis of the form, function & technical aspects of the existing furniture.
- Study of various styles, systems and product in the market.

Section B

- History of furniture from early days to industrial revolution.
- Scientific way of designing any three type of furniture systems based on ergonomics, material, working parameters and visual perception.

Section C

- Drawing and model making.
- Cost criteria of Design and mass production of furniture.
- Case studies of modern furniture designers Such as Ward Bennt, AlvarAalto, Owen Jones George Nelson, Hans Wegner George Nakashima etc.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Focused to learn the Knowledge of carpentry & develop working drawings of Furniture.
- Justify the materials to be used for construction.
- Showcase their designing/design ideas in live/3D manner to help understand /portray ideas better.

Recommended Books

1. Crawshaw Fred D. (2018). *Furniture Design: For Schools and Shops*. Forgotten Books. London
2. Lawson Stuart. (2013). *Furniture Design: An Introduction to Development, Materials and Manufacturing*
3. Thompson. (2011). *Product and Furniture Design (The Manufacturing Guides)*. Thames & Hudson Ltd. London.UK

Architectural Drafting - II and CAD I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

- Learn the skill of drafting manually which should include furniture layout, electrical layout false ceiling plan, partition design, flooring plans, design of doors & windows, colour schemes, surface treatments etc.
- A brief review of computer hardware & software required for interior architectural applications working with Auto CAD.
- Construction of digital models:
- Working in 3.D to construct wireframe modeling, surface modeling, solid modeling.
- Introduction to rendering, hidden surface removal, assigning shades.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Determine the sizes, placements and design of structure in available spaces.
- Understanding of the process of building construction and materials to be used.

Recommended Books

1. Bhatt N. D., 53rd Edition (2014). *Engineering Drawing*, Anand (Gujrat). Charotar Publishing House
2. Clois E. Kicklighter Ed. D., W. Scott Thomas. (2016). *Architecture: Residential Drafting and Design*. Goodheart-Willcox. Tinley Park. Illinois. United States.

Interior Design Project-I

L T P C
0 0 6 3

Max. Marks : 90
(CA: 60 + ESA: 30)

Objective:

To develop professional skills of the student and encourage independent thinking. The student will be the core custodian of the project and the onus will be on them from beginning till the end, which will develop a sense of ownership and commitment.

Practical:

- Use of Design process.
- A theme based design.
- Three interior schemes of different functional types will form the major design assignment.
- The design exercise should address issues such as institution character through interior environment corporate image, economic factors & behavioral patterns, integration of commercial activity etc.
- Design folio should include furniture layout, electrical layout, false ceiling plan, fashion design & details, flooring plan, design of door & window, colour schemes etc. specifying material usage and related technical knowledge.

Business Practices

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory:

Section A

Introduction to marketing: Definition, importance and scope of marketing, Understanding needs, wants, demands; marketing approaches, modern day approach towards marketing, mass marketing to customization; Value delivery process, the structure of service industry.

Section B

Segmentation in Interior Design Industry; Career Opportunities in Interior Design Industry, terminologies; Role and responsibilities of an Interior Designer, Process to be followed in Industry while working, Entrepreneurial aspect of Industrial Design

Section C

Segmentation in Interior Design Industry; terminologies; Role and responsibilities of a Interior Designer. Product Life cycle - stages and strategies for different stages of production. Product-mix, product mix decisions; Pricing decisions, pricing objectives, policies methods of setting price, pricing strategies, factors affecting each segment; Marketing communication: advertising, sales promotion, personal selling, publicity and public relations.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Understand the Market environment in interior design Industry.
- Understand Customer centric approach in modern marketing

Recommended Books

- Kotler, Philip (2003) *Marketing management*, Pearson, New Delhi
- Gandhi, J. C. (1985) *Marketing: an managerial introduction*, Tata McGraw-Hall, New Delhi
- Ramaswamy, V. S. (2002) *Marketing management: planning, Implementation and control*, Macmillan, Delhi
- Easey, Mike (2002) *Fashion marketing*, Blackwell, Oxford.

Recommended E-Resources:

1. Bloomsbury Design Library: an online resource for Design <https://www.bloomsburydesignlibrary.com/>
2. CW Interiors - <http://www.cwinteriors.in/>
3. <https://www.oreilly.com/library/view/understanding-industrial-design/9781491920381/>

E-Courses:

1. <https://alison.com/course/fundamentals-of-marketing-your-business-online>
2. <https://www.edx.org/course/marketing-fundamentals-who-customer-babsonx-bpet-mktx-0>
3. https://info.flexible.falmouth.ac.uk/falmouth-advertising-strategy-online-sp?utm_campaign=Falmouth+study+portals&utm_source=StudyPortals&utm_medium=MastersPortal&utm_content=ASPGGradDip
4. <https://www.coursera.org/learn/wharton-marketing>

Interior Design Project – II

L	T	P	C
0	0	6	3

Max. Marks : 90
(CA: 60 + ESA: 30)

Objectives:

- To explore ideas in Interior Design, develop sense in design, practice the Design Process, develop use of material their functional aspects.
- To understand the salability , function trends, demands of market and implementation.

Practical:

To make minimum three mini projects of different residences, where main emphasis shall be use of textile and furniture. All projects will be evaluated for innovation, functional aspects, technical parameters as well as economic considerations.

Detail specification and document will be required.

Trends and Forecasting for ID

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Theory:

Section A

Introduction to the world of Interior Design the structure of the Industry, the terminologies of Interior : Style, Interior, Design, Silhouette. The Interior Cycle and its stages. Long-run and short-run Interior design including /Style. Use of colours/material.

Section B

Trends and the role of trend forecasting: Forecasting: Interior Forecasters, Forecasting services/agencies, publications, trend portfolio; promotion as a tool for trend forecasting

Section C

Forecasting process: From Producers to Consumers, primary and Secondary Market Forecasts; Style Theme Development; Trend Presentation

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Identify the impact of trend in design.
- Apply critical thinking skills to forecast trend through research and analysis.

Recommended Books

1. Raymond Martin. (2010). *The Trend Forecasters Handbook*. Laurence King Publishing. London. United Kingdom
2. Tennant Ellie (2017). *Design Bloggers at Home: Fresh Interiors Inspiration from Leading on-Line Trend Setters*. Ryland, Peters & Small Ltd. London, United Kingdom

Lighting Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory

Section A

- Importance of lighting in interiors.
- Study of lighting levels & criteria of judgment.
- Study of Natural & artificial lighting.

Section B

- Study of lighting devices available in the market and their characteristics,
- Selection of lights, and its relation to concept

Section C

- Study the economic data,
- Measurement of light and its importance as a medium.
- Fixture selection and placement, floor, table, desk, wall, ceiling units.
- Psychological impact on human needs & emotion.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Understand and learn to execute the entire process.
- Understand the parameters required to be considered during the selection of light for various space and design.
- Identify basic parameters for lighting design.

Recommended Books

1. Präkel David. (2010). *Lighting*.AVA Publishing.SA

Sustainable Environments

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory

Section A

- Definition of green building, and sustainable and eco-friendly design,
- Global environmental issues as per UN charter.
- Global concern, policy options in developing and developed counters.

Section B

- Inclusive manufacturing its meaning and scope.
- Sustainable and inclusive manufacturing concepts, implementations and concern

Section C

- Science of Acoustics
- Behavior of sound in enclosed space.
- Understanding acoustics and its integration with sound absorbent.
- Thermal Comfort - heat flow, thermal properties of material, human response to thermal environment.
- Comfort vs functionality.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Understand and learn to utilize material in a sustainable manner.
- Understand the parameters required to be considered during the designing of any sustainable projects.

Recommended Books

2. Chan, Yenna. (2007). *Contemporary Design in Detail: Sustainable Environments*. Rockport.
3. Mobbs, Michael. (2005). *Sustainable House Living for Our Future*. Choice Books,
4. *Winning Strategies for a Sustainable Future Reinhard Mohn Prize 2013*. Bertelsmann Stiftung, 2013
5. Fulekar, m. H. (2016). *Environment and sustainable development*. Springer, India, private.

Critical Thinking

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory

Section A

- Definition of Critical thinking.
- Introduction of critical thinking as a competitive recourse.
- Creativity and psychology
- Thought process and types of thinking

Section B

- To develop lateral thinking and generate innovative ideas.
- Definition of universal design
- Application of universal design

Section C

- History of Interiors, difference in design thinking across history

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Think critically the parameters to be considered while designing a space can be analyzed well functionally and conceptually. They will be able to create new ideas as per space.
- Understand the importance of relation between design and services while planning.

Recommended Books

1. Hilary Collins .2010. *Creative Researc*, Bloomsbury. Visual Arts AVA Books. Switzerland
Design Thinking. Nigel Cross. E-Book

CAD - II: Walkthrough 3D Max Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Practical:

Module 1

Key frame Animation

- Creating Key frames, Auto Key frames, Move & Scale Key frame on the timeline, Animating with constraints & simple controllers, function curves in the track view,

Module 2

Understanding Cameras, Lighting & Rendering

- Configuring & Aiming Cameras, camera motion blur, camera depth of field, camera tracking, using basic lights & lighting Techniques, working with advanced lighting, mental ray lighting etc.

Module 3

Rendering with Mental-Ray, V-Ray & Baseline

- Mental-Ray, V-ray, light setup, Mental-Ray V-ray rendering settings, HDRI Illumination, Fine-tuning shadows, Final render setting etc.

Module 4

Final Rendering

- An in-depth look at the render settings in Max and how to create fully rendered animated sequences.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Develop 3D Interior or Exterior.
- Knowledge about the coloring, transitions, textures, various kinds of models and professional skills.
- Develop the work habits even in the pressurized work environment.

Recommended Books

1. Murdock, L. Kelly. *Autodesk 3DS Max 2015: Complete Reference Guide*. (2014). United States, US. [SDC Publications](#).
2. Kuhlo, Markus. Eggert, Enrico. (2010). *Architectural Rendering with 3ds Max and V-Ray: Photorealistic Visualization*. United States, US. Focal Press.

Tickoo, Sham. *Autodesk 3ds Max (2017) A Comprehensive Guide*. (ED.) (2017). United States, US. BPB Publications.

Design Project - III : Luxury Interior

Objective:

- To think of innovation in designing luxury interior design
- To understand the problems of public building
- To learn different parameters of luxury interior design
- To learn to make professional presentation

Practical:

- Use design process and simulate live project using existing plan of building
- Make model and process document
- Use the design process to design a public building interior

Design Project - IV : Textile

Objective:

- To understand the interior design requirement of film / drama / sets
- To understand the visual merchandising
- To understand the intricacy of retail windows

Practical

- To make a script and design sets for a particular nature
- Minimum two sets of opposite styles should be created
- Three different kinds of retail window, size wise, and product wise, and product wise different, needs to be created for visual merchandising

Design Project - V : Furniture

Objective:

- To understand furniture design
- To understand furniture design as an important unit in interior design

Practical :

- To design for a live / hypothetical market, a complete set of co-ordinated range of furniture to service a particular market segment. Emphasis should be on exploration of material and functionally.
- The design should either for premium market, or regular market or foldable and specific market.
- Furniture could be stackable

Design Project - VI

Objective:

- To show capability as a designer from brief to final presentation
- To show competency in the areas of Project Design, including all aspects of Design, cost and marketing

Practical:

- To choose a live or hypothetical project and conceptualize, and visualize if including cost and all other constraints.
- Final project will show case the status of student in all areas.
Emphasis will be placed on creative solution, keeping in mind all possible limitations and possibilities

Portfolio and Presentation Techniques

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory

Section A

- Presentation Technique
- Verbal and non - verbal communication
- Problems of communication

Section B

- Portfolio Presentation techniques. Industry Visit, Group Discussion, Panel discussion (With External).
- Expansion of Demo- Reel (Digital & Physical)

Section C

- Role of personality and different presentation
- Documentation & Correspondence

Learning Outcomes:

Upon successful completion of the course, students will be able to:

- Deal with nerves and think more positively about public speaking
- Use body language and tone of voice to enhance their presentations
- Use slides and visual aids effectively
- Deliver an enthusiastic and well-practiced presentation
- Determine and develop personal presentation style
- Find ways to overcome nervousness for presentation

Recommended Books

1. **Gorden L Raymond.** (1998). *Basic Interviewing Skills*. United States, US. Waveland Press.
Ganguly, Anand. (2017). *Success In Interview*. India In. Ramesh Publishing House.

Material Studies-II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

- Linear materials: Thread, Wire (Compositions)
- Soft materials: Clay (Relief compositions, 3D figures & compositions)
- Hard Materials: Wood (Relief compositions, 3D compositions); Glazed tiles (Relief compositions, 3D compositions); Metal (Relief compositions, 3D compositions)

Learning Outcome:

Upon completion of the course, the students will be able to:

- Know the properties of various materials and its use accordingly.
- Handle material and use them for making design prototypes.
- Fuse various materials to create new aesthetic appealing and functional product.

Recommended Books:

1. Honig, J. M., & Rao, C. N. (1981). *Preparation and characterization of materials*. New York: Academic Press.
2. Vlack, L. H. (1985). *Elements of materials science and engineering*. Reading, MA: Addison-Wesley.
3. Raghavan, V. (2015). *Materials science and engineering: A first course*. Delhi: PHI Learning Private Limited.
4. Coutts, H. (2001). *The art of ceramics: European ceramic design 1500-1830*. New Haven, CT: Published for the Bard Graduate Center for Studies in the Decorative Arts, New York by Yale University Press.
5. Houseley, L. (2009). *The independent design guide: Innovative products from the new generation*. New York: Thames & Hudson.

Research Methodology and Craft Study

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Theory:

Section A

- Need Based Study: crafts
- Nature, Purpose, Problems & Importance.
- Meaning, objective & motivations
- Type of research – Historical, Descriptive, Explorations, Formulation of Research problem.

Section B

- Making a Research format
- Meaning of Research Design
- Procedure of preparing Research Design
- Writing Hypothesis
- Data Collection
- Observation, Interview, and Questionnaire.

Section C

- Sampling: Meaning, types, data
- Analysis of data
- Report writing
- Case studies of crafts
- Craft documentation

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Understand meaning & methodology of research
- Evaluate literature from a variety of sources, pertinent to the research objectives.
- Identify and justify the basic components of the research framework relevant to the tackled research problem majorly based on the Craft sector.
- Collect research data; analyze it, interpret the data, write research findings and conclusion.

Recommended Books:

1. Glatthorn, Allan A. (2005) *Writing the Winning Dissertation: Step by Step*, Guide Research. Sage pub.
2. Pollard, Elizabeth (1986) *Visual art research*, New York: Greenwood Press.
3. Kothari. C. R. (2004) *Research Methodology: methods and techniques*, New Delhi: Age International.
4. Verma, R. K. and Verma, Gopal (1988) *Methodology and techniques of research*, New Delhi: Anmol.
5. Reddy, C. R. (1987) *Research methodology in social science*, Delhi: Daya Pub. House.
6. Kenneth, D. Bailey (1987) *Methods of social research*, New York: Free Press.
7. Mckeluey, Kathryn (2003) *Fashion design process, innovation & practice*. Blackwell Pub. Oxford.

Drawing III: Analytical Drawing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Practical:

- To work on structure of man-made object & natural specimen & rendering techniques to enhance light & shade effect, material quality of the object, surface quality, texture, relative proportion in linear & massive methods.
- To work on perspective study (one point and two point) on the basis of solid geometrical construction and emphasizing on Construction of objects.
- To work on analyzing objects and drawing from observation on the basis of orthographic and isometric /parallel projections.
- Exploration exercises on constructional drawing with curves and ellipsis to be incorporated in the study

Medium: Pencil, Pencil Colors, Ink, Crayons and Water Color - Transparent and Opaque. Maintain sketch file with rough/fair sketches.

Learning Outcomes:

Upon Completion of the course, the students will be able to:

7. Develop hand and eye coordination for Analytical Drawing
8. Incorporate design, composition, and spatial organization theories in their design solutions.
9. Utilize a variety of traditional drawing materials.
10. Develop drawing skill which could be implemented for design solution development.
11. Critically interpret and analyze design work in terms of form and structure.
12. Utilize fundamental concepts of aesthetics in creating design drawings.

Understand the basic and formal elements of design and drawings.

Recommended Books:

4. Colussy, M. Kathleen (2007). *Rendering fashion, fabric and prints*. New Delhi : Pearson Education
5. Casals Josep (2010) *Watercolor : Course of drawing and painting Atrium group de ediciones* New York: Publicaciones Barcelona.
6. Casals Josep (2004) *Drawing : Drawing and painting course*, New York: Publicaciones Barcelona.
7. Casals, Josep. (2004) *Pastel: Course of drawing and painting*, Barcelona: Atrium Publication

Design Methods and Processes

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Theory:

Section-A

- Fundamentals of Design
 - a. Definition of Design
 - b. Necessity of Design
 - c. Design and Society
- Form and Function

Section-B

Design Thinking: Critical thinking-exploring possibilities, constraints and inherited psychographs; Significance of design research and design practice; Sustainability; Convergence – prototyping alternatives and possible scenarios; Aesthetics and function; Problem solving – where process meets method; Design – client needs and/or user needs; Green design.

Section-C

Methodology: Concept; Design brief; Branding; Research; Analysis; Implementation/prototyping; Costing, specifications for multiplication; Production; Quality monitoring.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Develop critical and lateral thinking approach.
- Develop a basic design concept, visualization and manipulation techniques.
- Develop an appreciation of function, aesthetics and technology in design.
- Develop basic design thinking and communication skills.
- Create activities and experiences for basic process of design, adapt in their abilities, interest and design in context of human society, economy, politics and socio-cultural aspect.

Recommended Books:

1. Balaram, S (2011). Thinking Design, SAGE Publications India Pvt Ltd
2. Papanek, Victor (1971). *Design for the Real World: Human Ecology and Social Change*, New York, Pantheon Books.
3. Vyas, H. Kumar (2009). *Design and Environment: A Primer* (3rd ed.). India, National Institute of Design.
4. Munari, Bruno (1971). *Design as Art*. Penguin books

Recommended E-Resources:

<https://www.bloomsburydesignlibrary.com/taxonomy?id=disciplines>

Fabric Structure - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory:

Section A

Different methods of fabric formation-weaving, knitting, non-woven. Introduction to weaving preparatory-winding, warping, sizing and pirn winding. Introduction of loom, classification and parts of loom; Motion of the loom: primary motion, secondary motion-Take-up and Let off, Expression of reed/heald count: methods, different reed count system-Stockport and Bradford, heald count.

Section B

Basic weaves & variations-

- Plain: Warp Rib, Weft Rib and Matt (Basket)
- Twill: Right Hand and Left hand (balance and unbalance)
- Satin: Regular and Irregular

Section C

Modified Weave of the basic-

- Plain: Hopsack, Barley-corn, Mock-leno and Huck-a-back weave
- Rhythmic Twill Weaves: Pointed, Diamond, Herring-Bone and Diaper, Honeycomb, Broken twill, Curve twill, wave twill and Angle of twill
- Satin: Backed cloth

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Identify and work on Handloom with care.
- Identify and differentiate between basic weaves and modified weaves
- Identify suitable materials according to the end use of the product for apparel, furnishing and accessories
- Distinguish between different fabric construction methods and giving reasons, apply their properties to different fabric items and clothing.
- Surface Ornamentation using more than one or two weaves and variety of yarns like cotton, polyester, wool and blended etc.

Recommended Books:

1. Grosicki, Z (1988) *Watson's Textile Design and Color*, Butterworth, London.
2. Mohamed, M.H. and Lord, P.R.(2005) *Weaving – Conversion of yarn to fabric*, Woodhead, Pub. Cambridge
3. Nisbet, Harry (2014) *Grammar of Textile Design*, Abhishek Pub. New Delhi.
4. Marks, R. and Robinson, A.T.C.(1986) *Principles of weaving*, The Textile Institute

Draping and Pattern Making-I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

Draping:

- Introduction to Draping- Explanation of parts of the dress form, Uses of the tools, Blocking of fabric, Grain & its Importance, Handling of fabrics.
- Basic Bodice-Front & Back.
- Basic Skirts-Front & Back.

Pattern-Making:

- Introduction to Pattern Making.
- Draft Basic Bodice Front & Back.
- Draft Basic skirt.
- Draft Basic sleeve

Final Assignment:

To select a category and create pattern/drape of any 1 of the following and stitch it.

- Garments - Exercises for Dart Manipulation- Shift dart into another area/convert one dart into two darts & two darts into one dart
- Fashion Accessories - Hand bag/ clutch/stole with surface ornamentation/shrug/belts etc.
- A range of home textile products – Complete Dining set/Bedroom set/Sofa cover & single bed-sheet set

Learning Outcomes:

Upon completion of the course, the students will be able to

- Understand the basics of converting a 2D fabric/paper into a 3D garment/product
- Understand the basics of cutting and finishing a fabric as basic stitching will be taught.

Recommended Books:

1. Hilde Jaffe & NurieRelis (2012) *Draping For Fashion Design* (Fifth Edition), New Delhi: Published by Pearson Education.
2. Ernestine, Kopp (1987), *New Fashion areas for designing apparel through the flat pattern*, New York: Fair child.
3. Joseph-Armstrong, Helen(2006) *Pattern Making for fashion design*,—III Edition, New York: Published by Pearson Education.

Traditional Indian Costumes

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory:

Section-A

Traditional costumes of various regions of India; Costumes of Northern & Central states (Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Haryana, Madhya Pradesh, Orissa)

Section-B

Costumes of southern & Eastern states (Kerala, Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal, Bihar)

Section-C

Costumes of North- Eastern states (Assam, Manipur, Mizoram, Nagaland, Sikkim, Maharashtra, Rajasthan, Gujarat); Design elements of costumes & their influence on historical, present & future clothing; Socio-economic & historical events their influence on fashion.

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Identify Traditional Indian Costumes of different states with reference of the past clothing and illustrate the same.
- Illustrate prevailing designs of costumes worn by people of different states.
- Design contemporary costumes taking reference from the traditional ones.

Recommended Books:

1. Ghurye, G.S, (1966), *Indian Costumes*, popular prakashan, Bombay.
2. Kumar, Ritu, (2006), *Costumes And Textiles Of Royal India*, Christie books ltd., USA.
3. Bhandari, Vandana (2005), *Costumes, Textiles & Jewellery of India*, Mercury books, London.
4. Alkazi, Roshan (2006), *Ancient and Medieval Indian Costume*, Art heritage, New Delhi.
5. Arora, Vishu (2008), *Suvasas the Beautiful Costumes*, abhishek publication, Chandigarh.
6. Bhatnagar, Parul (2004), *Traditional Indian Costumes and Textiles*, Abhishek publication, Chandigarh.
7. Bhatnagar, Parul (2005), *Decorative Design History in Indian Textiles and Costumes*, .Chandigarh ,India: Abhishek Publications
8. Parekh, Soha (2012), *Splendour in threads, red pepper books*, Mumbai.
9. Banerjee, Mukulika (2004), *The Sari*, Berg, Oxford.
10. Patterns of the 1930s; (2003), *Motifs Anneestrente*, Pepin press, Amsterdam.
11. Roetzel, Bernhard (2004), *Gentleman a Timeless Fashion*, konemann, Cambrige.
12. Johnson, Kim K. P. (2003) *Fashion foundation: early writings on fashion and dress*, Berg Oxford
13. McClaud, Peter (2013) *Past and Present trends in fashion technology* .Chandigarh ,India: Abhishek Publications
14. Ezekiel, James(2010) *An insight into fashion history*.Chandigarh ,India: Abhishek Publications
15. Kaplan, N. S. (2012) *Changing trends in apparel industry*. Chandigarh ,India: Abhishek Publications
16. Roetzel, Bernhard (2004) *Gentleman a timeless fashion*, Cambridge: Konemann
17. The Pepin Press (2003) *Patterns of the 1930s*. Amsterdam: Pepin Press

Art and Illustration Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

- Life Study
- Anatomy & Figure Drawing
- Memory Drawing
- Stylized Croqui
- Composition based on theme

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Study basic proportion and drawing properly to improve drawing skills.
- Preview and visualize and thus draw the same in order to communicate thoughts
- Develop the understanding of new era, atmosphere, situations and observation of changing styles.

Recommended Books:

1. Pérard, V. S. (2004). *Anatomy And Drawing*. Mineola, Dover Publications, NY.
2. John, R., & Raynes, J. (2002). *How To Draw The Human Figure: A Complete Guide*. Bath, Eng.: Paragon.
3. Raynes, J., & Raynes, J. (2003). *How To Draw The Human Figure: A Complete Guide*. Bath: Paragon.
4. Martin,D.(2011) *Great Big Book Of Fashion Illustration*, Anovabooks, Hong Kong.
5. Alexandra,S.I.(2012) *Technical Drawing For Fashion Design, Garment Source Book*, The Pepin Press, Netherlands.
6. Perard,V.*Human Anatomy*,Mumbai,India, Grace Prakashan
7. Simblet,S. (2001) *Anatomy for the Artist*, Penguin UK
8. Ireland,P.J. (2003) *Figure templates for fashion illustration* , Batsford
9. Martin, D.(2009) *Big book of fashion illustration*, London Botsford
10. Cally, B.(2007) *100 years of fashion illustration*. London: Laurence King Pub.
11. Ireland, P.J. (1995) *Fashion design illustration : children* .London: B T Batsford Ltd

Calculation and Costing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory:

Section-A

Basic costing concepts: Classification of costs, types of costs, methods of costing, elements of cost.

Section-B

- **Spinning Calculations**
 - a. Yarn numbering, Direct & Indirect system of yarn numbering, Universal yarn numbering system, conversion from one system to other, Calculation of resultant yarn number of plied yarn.
 - b. Yarn Twist, Twist factor, twist per unit length, S & Z twists
- **Weaving Calculations**
 - a. Calculation of length of warp and weft in a fabric, Weight of warp and weft required for particular length of cloth, weight per unit area of cloth,
 - b. Cloth cover, cover factor
 - c. Concept of cloth setting

Section-C

- **Fabrics, apparel and other textile made-ups, accessories costing**
 - a. Cost of raw material
 - b. Calculation of processing cost
 - c. Cost of packing and transportation
 - d. Other cost components

Fabric Structure-II

Objectives:

- To understand the various fabric construction through advanced weaves.
- To understand the working principles, scope and limitations of dobby and Jacquard.
- To understand the working principles of shuttle less loom.

Theory:

Section A

Advanced weaves: Extra warp weave, Extra weft weave, Double cloth in plain weave, Hopsack weave, Barley corn weave, Crepe weave, Bedford weave, effects through colour and weave.

Section B

Important parts of Dobby, Working principal of Dobby, scope of Dobby and the limitations of Dobby.
Handloom dobby- Types of Dobby : Barrel Dobby, Lattice Dobby, Hardekar dobby.

Section C

Important parts of Jacquard, Working principal of Jacquard, scope of Jacquard and the limitations of Jacquard.

Types of Jacquard: Single lift and single cylinder Jacquard, Double lift single cylinder Jacquard and Double lift Double cylinder Jacquard. Introduction of Electronic Jacquard.

Card Punching Machine: Hand card punching machine, Piano card punching machine. Electronic card punching machine.

Introduction of Shuttle less Loom: Projectile Loom, Rapier Loom and Air-Jet Loom

Practical:

- To prepare four samples on given any above weaves for given subject.
- To prepare a sample in Extra warp or extra weft weave for Dress material/ furnishing.
- To prepare a sample of Double cloth with plain weaves for given subject.

Suggested Readings:

1. Watson's Textile Design and Color – Z. Grosicki.
2. Advanced Watson's Textile Design and Color – Z. Grosicki.
3. Weaving – Conversion of yarn to fabric – Mohamed and Lord
4. Grammar of Textile Design - Nisbet.

Draping & Pattern Making II**Objectives:**

- To explore ideas in Apparel design, develop sense in design, material technique and style.
- To understand the suitability, trends, market demand in production of range/ product for Apparel.
- To have deep knowledge in the areas of Apparel.

Practical:**Draping:**

- Convert darts into pleats /Gathers/Tucks.

Develop one Garment through draping.**Pattern Making:**

- Convert Darts into-Seam Line/Princess/Yokes, etc.
- Convert Darts into- Gathers/Tucks/Flare/pleats, etc.
- Sleeve Variations

Develop two garments through pattern making.**Learning Outcomes:**

Upon completion of the course, the students will be able to:

- Estimate the cost of products with different methods and elements.
- Cost the given sample of fabric according to its construction.
- Cost the end-product from fabric to apparels, including packaging and transport

Recommended Books:

1. Taggart W. S. (1998), *Cotton Spinning Calculations*, Navneet Prakashan, Bombay.
 2. Gupta Sen (1971), *Weaving Calculation*, Taraporevala Publishers, Bombay.
- Ashen hurst T.R. (1998). *Textile Calculations*, Abhishek Publishers, Chandigarh.

DES	316	Draping and Pattern Making - II	2	0	0	2
DES	316L	Draping and Pattern Making – II Lab	0	0	8	4

Surface Designing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

Develop suitable designs on paper, samples and actual product using **any 1** of the following printing methods:

- Block printing method. Styles of printing: Direct style of printing with Pigment dyes, Resist style of printing with natural dyes. **Product Cotton Table Mats/Cotton Top.**
- Screen printing with photo chemical method. Styles of printing: Resist style of printing with reactive dyes, Discharge style of printing with acid dyes, Crepe style of printing, Devor style of printing. **Product- Cotton dupatta/Silk Scarf /Cotton Table cloth /Blended curtain.**
- Transfer printing method. Styles of printing-Direct style of printing with sublim dyes. **To develop a product (A4/A3 sized).**

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Understand the functions of different types of chemicals, dyes and other required ingredients, their properties and taking precautions during applications.
- Develop knowledge and skills of various methods and styles of Printing.
- Develop ability to transfer a design on fabric according to the design/concept made on paper.

Recommended Books:

- McKelvey K., Munslow J. (2012), *Fashion design process, innovation & Practice*, 2 Edition, Wiley, US.
- Carbman B.P., (1985), *Textiles: Fibers to Fabrics*, The Gregg/McGraw-Hill, US.
- Gohl E.P. & Vilensky. (1983). *Textile Science*, CBA publisher and Distributors, Delhi.
- V.A Shenai. (1996). *Technology of Dyeing*, Sevak publication, I edition. Mumbai.
- V.A Shenai., (1995). *Technology of Printing*, III edition, Sevak publication, Mumbai.
- Clarke. W. (1974), *An Introduction to Textile Printing*, Newness Butter Worth, London.
- Storey J. (1992). *Dyes and Fabrics*, Thames and Hudson, London.

– Trends and Forecasting

Objectives:

- To understand the need and essence of Trend forecasting.
- To study the various methods and sources of Trend forecasting.

Theory:

Section A

Trends and the role of trend forecasting; Forecasting Personnel.

Section B

Forecasting services / agencies, publications.

Section C

Forecasting process: From Producers to Consumers, primary and Secondary Market Forecasts

Practical:

To prepare a trend report on the basis of secondary data analysis.

Suggested Readings:

1. Fashion From Concept To Consumer by Gini Stephens Frings
2. The Business of Fashion: Designing, Manufacturing, and Marketing by Leslie Davis Burns, Kathy K. Mullet and Nancy O. Bryant
3. Fashion Forecasting by Kathryn Mckelvey, Janine Munslow
4. Fashion Forward: A guide to Fashion Forecasting by Chelsea Rousso
5. Color Forecasting for Fashion by Kate Scully
1. A trend forecaster's handbook by Raymond Martin

Construction Techniques (Hard Material) Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Practical:

- Construct a Lifestyle Accessory product using any of the following techniques and processes:
 - Working of basic tools and machinery with reference to construction.
 - Basic techniques - Sawing, Drilling, filling, polishing, Soldering, etc.
 - Basic Surface modeling – hard or semi hard material transformation; wire manipulation, twisted wire fabrication, geometrical shape fabrication, etc.
 - Basic Mechanisms- Screw, Pin joints, Jump rings Mechanisms, etc.
- To Develop and incorporate any one of the below mention surface embellishment methods on constructed outcome / Product.
 - Embossing
 - Engraving
 - Texturing
 - Oxidization
 - Etching

Learning Outcomes:

Upon completion of the course, the students will be able to:

- Understand the functional aspects and steps involved in transformation of concept to a fabricated product.
- Get hands-on experience to make final utility product from their own designs from provided hard materials.

Recommended Books:

- Miranda M. Rosa, (2014). *Surface Modification By Solid State Processing*: Woodhead Publishing, UK.
- Karl Ulrich, Steven Eppinger, (2015). *Product Design and Development* 6th Edition: McGraw-Hill Education, NY, New York.
- Asa Christiana, (2017), *Build Stuff with Wood: Make Awesome Projects with Basic Tools*, Taunton Press, U.S.A.
- Diane Fitzberger, (2018). *Wood Pallet DIY Projects*, Fox Chapel Publishing, U.S.A.
- Ulrich, Karl (2012), *Product design and development*. New Delhi: Mcgraw Hill.
- Hudson, Jennifer (2011) *Process: 50 product designs from concept to Manufacture*. Laurence King Publishing

Design Project - II

Objectives:

- To develop professional skills of the students and encourage independent thinking. The students will be the core custodians of the project and the onus will be on them from beginning till the end which will develop a sense of ownership and commitment. The students will also learn to keep the deadlines sacrosanct. The project will lead to the development of the designer's skills and knowledge through a process of 'hands on-minds on'.

Project outline:

- In the design project students will get the opportunity to apply the knowledge and skills acquired in previous semesters.

- The project will be supervised by a guide who will guide the students and give feedback as and when required. The selection of the guide will be on basis of the type of project selected by the students. The project will be driven by the students and students will have many opportunities for independent decisions.
- The project may be based on a realistic brief from the industry or it may be a hypothetical brief in either case a guide will be there to supervise the project.
- Students will set specific goals/objectives, decide upon the tasks to be undertaken that should lead to the outcome based on the requirement of the project.
- Students will follow the design process to reach the design solution.
- The intermediary steps should be well planned and executed and should lead to a concrete result as per the objective set for the project.
- Students will set the timeline and will adhere to the set timeline.
- At the time of submission 2 copies of the final designs will be submitted by the students.
- Students will chronologically document each step in detail while doing the project which led to the final output and submit 2 copies of the same to the department as a library resource for future reference.
- If the project is lengthy and project guide feels the need then design project II and Design Project III may be merged to fulfill the requirement of time.

Introduction to CAD for Apparel Lab

L	T	P	C
0	0	4	2

Max. Marks : 60
(CA: 40 + ESA: 20)

Objectives:

- To create awareness in Computer aided designing.
- To provide hands on experience on CAD.
- To understand the importance of CAD.

Practical:

- Introduction to LECTRA – MODARIS and DIAMINO
- F1 TO F8 functions.
- Path creation
- Pattern creation on MODARIS.
 1. Basic Bodice front & Back
 2. Basic Skirt
 3. Dart Manipulation
 4. Basic Sleeve
 5. Sleeve variation
 6. Skirt Variation
- Size chart manipulation.
- Pattern modification.
- Adding seam allowance.
- Introduction to grading
- Pattern grading
- Variant making
- Introduction to Marker planning & Marker efficiency on DIAMINO.

Innovation Workshop FLD Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Project outline:

- Innovation means many things to many people, and means different things within a single business. Innovation and design aren't simply about new products or technology. They're also about how to improve products in everyday use, leading to reduced costs, increased usability and new business opportunities. The workshops have an emphasis on imparting practical skills and knowledge able to be easily applied in everyday business.
- This program is carefully tailored to suit student's group specific requirements and will involve a mixture of practical and theoretical exercises designed to encourage creative thinking.
- In this paper, learners will create innovative concepts for lifestyles

Learning outcomes

Upon completion of the course, the students will be able to:

- Generate innovative ideas and give alternate innovative form to the ideas generated.

Recommended Books:

1. Linton, Harold (2012) *Portfolio Design*, Second Edition. W. W. Norton. New York.
2. Bryan Lawson, (2005). *How Designers Think*. The Design Process Demystified. Netherlands: Architectural Press.

Visual Merchandising

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Theory:

Section A

- Introduction to Visual Merchandising: The role of Visual Merchandising in a store, the growing significance of Visual Merchandising
- The need for a consistent Store Image and achieving synergy through all visual communication tools.
- History and Evolution of organized retail stores and systematic merchandise presentation.

Section B

- Theories of Visual Merchandising: Color and Texture, Line and composition, Lights and lighting
- Areas of display: The store exteriors, Window display, Store interiors
 - The exterior of the store: Façade, Window design in storefront
 - Display window construction
 - Store Interiors: Focal Points, Clusters
 - Mannequins
 - Store Fixtures
 - Display Props
 - Graphics and Signages

Section C

- Store planning and design: Store layouts and design, planogram
- Means of visual communication: Furnitures and fixtures, props, Graphics and signage, Mannequins
- Promotional Visual Merchandising

Learning Outcomes:

Upon completion of the course, students will be able to:

- Understand the concept of Visual Merchandising
- Apply basic design principles and color theories to the construction of promotional displays and advertising.
- Appreciate how the history of art and design influence current display practice and contemporary images.
- Understand the basic functions of retail store operations including store location and layout, shopping centre analysis, retail market segmentation and strategies, and the merchandising mix.
- Prepare and execute displays for exhibitions and promotional events using the visual dynamics of light as a design element.

Recommended Books:

- Colborne, Robert (1996). *Visual merchandising: The Business of Merchandise Presentation*. Delmark Cengage Learning, New York
- Pegler, Martin M (2006) *Visual Merchandising & Display*. Fairchild Pub. New York.
- Serrats, Marta (2006) *Point of purchase. Collins design*. New York.

Recommended E-courses:

- <https://www.udemy.com/visual-merchandising-course-for-retailers-and-students/> Copyright © 2018 Udemy, Inc.)
- <https://alison.com/courses/nsdc-course-retail-trainee-associate/content/scorm/10686/visual-merchandising> (it is the website and learning platform of Capernaum Ltd, trading as Alison. Capernaum Ltd is registered in Ireland, Company Number: 383734.)

Paper VI – Fundamentals of Computer

Objectives:

- To understand the need for automation and use of computers in every domain of work.
- To be able to use application software for Data tabulation, analysis and presentation.
- To understand the processing of Images to assist documentation and presentation.

Theory:

Section A:

1. Basic components and their functions
2. Primary and secondary storage
3. The use of computers at the most basic levels of working
4. The need and essence of automation in Industry.

Section B:

1. Understanding of operating system
2. Network basic and Internet
3. Internet as a powerful tool for data collection.
4. Overview of Word Processors (MS-Word), Spreadsheet (MS-Excel), Presentation (MS-Power Point)

Section C:

1. RGB color Model; Monitor Resolution; Graphics/Image File Formats; Pixels, Bit-Map, Monochrome Bit-Map Image, Grayscale Bit-Map Image, 24 Bit Color Image, 8-Bit Color Image;
2. Standard System Independent Formats: GIF, JPEG, TIFF
3. System dependent Formats: BMP, PAINT, SCANNING
4. Introduction to CorelDraw/Adobe Illustrator

Practical:

1. Documentation using MS-Word
2. Data Tabulation using MS-Excel
3. Data Analysis and presentation using MS-Powerpoint
4. Photo editing & capturing

Suggested Readings:

1. Fundamentals of Computers, Rajaraman V., PHI
2. Fundamentals of Computers Graphics & Multimedia, Mukherjee, PHI
3. Microsoft office – Resource kit; Microsoft Corporation

Creative Thinking Lab

L T P C

0 0 8 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- To understand design thinking & creativity in design.
- Understand the difference between 2 Dimensional and 3 dimensional design & its properties
- To understand colour & its application through elements and principles of design.

Practical:

1. Types of thinking

2. Creative Thinking

- Explaining creativity
- Creativity and psychology
- Creativity process
- Creativity and environment

3. Design Thinking-

- What is Design?
- Role of Design and Designer in Society
- Visualization of a Design Concept, sources, inspiration
- Transformation from 2D to 3D Visualization and its characteristics
- Process of: a) Perception (b) Conception (c) Transformation

Note : conduct assignments in form of act, poetry, visuals or film

4. Elements of design (line, form, colour, texture, tone, space)

5. Principle of design (unity, harmony, balance, dominance, rhythm, proportion)

6. Creative Design based on 2 Dimension giving emphasis on color, texture, line, shapes.

7. Design based on 3 Dimension

- (i) Use of any flat surface (eg.- paper, fabric etc.)
- (ii) Use of any semi solid material (eg.- clay etc.)
- (iii) Use of any solid material (eg. Metal, wood etc.)

Suggested Readings:

1. Neil Thomas, Adair on creativity & innovation, Viva books PLV. New Delhi [Indian Edi] – 2006
2. George Gamez, Creativity [How to catch lightning in a Bottle, Jaico Pub. House, Mumbai, 1997.
3. शर्मा. अग्रवाल. रुपप्रद कला के मूल आधार
4. श्रीमती शर्मिला गर्जर. वस्त्र रंगाई तकनीक

Visual Research and Development Lab

L T P C

0 0 8 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- To improve observation and visual expression and interpretation.
- To develop the sense and language of colour.
- To understand the application of colour in various forms.

Practicals:

- **Effect of colour, colour mixing, texture & their influence on colour perception.**(eg. - paper work)
- **Influence of fabric characteristics on the appearance of colours.**(collection of different types of fabric and analysis on the basis of appearance.)
- **Visual research of natural objects and manmade objects.**
- **Visual Research through printing-**
 - Develop 5 different paper designs for each of following dyed & printed styles & show the relation of colour & perception through dyeing & printing.
 - I. Tie & dye with direct dyes for 5 samples (size = 10"×10")
 - II. Direct style of printing with pigment dyes by stencil/ screen method on cotton, silk and wool
- **Visual Research through weaving-**
 - Application of colour, colour mixing, textures & its effects through weaving.
 - Mixture of different dyed fibres/yarns & dyed yarn by twisting.
 - Combination of different coloured threads, colour strips & checks.
 - Simple regular & irregular, counts-change, graduated pattern.
 - Compound orders of colouring.
 - Balance of contrast in pattern range designing.
 - Colour combinations in relation to weave.

Suggested Readings:

1. Z. Grosicki, Watson's Textile Design and colour, Newnes – Butler – worths, London, 1975, 7th ed:
2. Bride M. Whelan, Color Harmony 2, Rockport Publishers, USA, 1994.
3. Colin Gale and Jasbir Kaur, The textile book, BERG Pub, Oxford, 1st edi, 2002.
5. Paterson, Textile Colour Mixing, Abhishek Pub., Chandigarh, 2002.

Computer Aided Textile Designing (Weaving) - I Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- To create awareness in CATD.
- To understand the scope & importance of CATD.
- To provide hands on experience of CATD.
- Develop 20 designs for each of following with illustration on paper
 - Dress material
 - Furnishing
- Preparation of sketch book with selected 50 relevant sketches for printing.

Methodology:

1. Creation of weave
2. Basic pathway for Making New Design
 - a. Editing a Peg-Plan.
 - b. Editing the draft.
 - c. Editing the warp and weft patterns.
 - d. Making the yarns and the yarn Libraries.
3. Weaving and Printing Design.
4. Print the Master Cards.
5. Edit 10 designs of each category
6. Take 5 printouts of each.

Conceptual Design Lab

L T P C

0 0 6 3

Max. Marks : 100

(CA: 40 + ESA: 60)

Select an actual or hypothetical brief; Redefine brief based on consumer segments; Select a specific product category; Select an Inspiration; Select a theme/mood/story; Secondary and Primary Data collection; Data analysis; Finalizing the concept; Exploration in terms of elements taken from inspiration; Create initial concepts; Finalize a concept and develop at least 3 concept sketches. Prepare specification sheets along with costing.

Suggested Readings:

1. Gini Stephens Fringe, Fashion From concept to Consumer, Prentice Hall Pub., 6th Edition, 1999.
2. Philip Kotler – Marketing Management
3. Consumer Behavior, 10/E Leon Schiffman, Leslie Kanuk
4. S.P. Gupta, Statistical Methods, Sultanchand & Sons, New Delhi, 2006.
5. Research Methodology- S.S.Srivastava

Design Studio (Weaving) - I Lab

L T P C

0 0 10 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- To develop ability to create advance weaves.
- To enable students to understand & learn methods of developing fabric using different types of fibre, yarn, dyes & technique of weaving & printing

Weaving:

- 1) Collect 5 different types of woven fabrics and analyse them according to following points and present it as a swatch book:
 - a. Fibre, b. yarn, c. count, d. Reed, e. pick, f. end, g. weight, h. lifting, i. drafting, j. denting, k. shrinkage & l. weave
- 2) Develop 5 suitable paper designs for each of following & develop one Woven Sample of each:
 - a. Plain Double cloth weave.
 - b. Broken Twill weave.
 - c. Extra warp and Weft.
 - d. Bed-ford-cord weave.
 - e. Herring bone weave.

Note:

- 1) Theme should be given by concerned Teacher.
- 2) Preparation of sketch book with selected 50 sketches.

Computer Aided Textile Designing (Printing) -I Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- To create awareness in CATD.
- To understand the scope & importance of CATD.
- To provide hands on experience of CATD.
- Develop 20 designs for each of following with illustration on paper
 - Dress material
 - Furnishing
- Preparation of sketch book with selected 50 relevant sketches for printing.

Methodology:

1. Creation of design with the help of Adobe Photoshop
2. Source of design for scanning
 - a. Artist Sketch
 - b. Printed cloth
3. Scanning Process
4. Functions of tools
5. Resizing & re-sampling
6. Repeat setting
7. Retouching/Editing
8. Colour Separation/ concept of layer & channels
9. Over Lapping
10. Creation of Design
11. Edit 10 designs of each category.
12. Take 5 printouts of each.

Design Studio (Printing) - I Lab

L T P C

0 0 10 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives :

- To develop ability to create advance weaves.
- To enable students to understand & learn methods of developing fabric using different types of fibre, yarn, dyes and technique of weaving & printing.

Printing :

- 1) Collect 5 different types of printed fabrics & analyse them according to following points & present it as a swatch book:
 - a. Fibre, b. yarn, c. count, d. reed, e. pick, f. end, g. weight, h. Lifting, i. drafting, j. denting, k. shrinkage, l. weave, m. dyes, n. fastness method & o. style
- 2) Develop 5 suitable paper designs for each of following & develop one Printed Sample of each:
 - a. Direct style of printing with Pigment dyes by block for Table cloth/Bed sheet
 - b. Resist style of printing with natural dyes by block for mats
 - c. Resist style of printing with reactive dyes by block/screen for Dress material
 - d. Discharge style of printing with acid dyes by screen for scarf
 - e. Take any one above style & method with value addition for curtain

Note:

- 3) Theme should be given by concerned Teacher.
- 4) Preparation of sketch book with selected 50 sketches.

Computer Aided Textile Designing (Weaving) II- Lab

L T P C

0 0 8 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives

- To develop concept and designs based on clients' needs and utility.
- To explore ideas in design, develop sense in design, material technique and style.
- To understand the suitability, trends, market demand in production of range/ product for textile industry.

Summary of learning outcomes

This paper would help to develop advanced skills and exploration in processes and materials. It encourages the synthesis of ideas from both direct and conceptual sources to produce outcomes to satisfy a set design brief. The core idea behind a design project is to develop professional skills of the students and encourage independent thinking.

The student should also understand the importance of research and evaluating the role of the client and market in the design process and product usage and utility for textile design.

The project may be based on a realistic brief from the industry or it may be a hypothetical brief in either case a guide will be there to supervise the project. A design project should be given as an individual project to students.

The students will be the core custodians of the project and the onus will be on them from beginning till the end which will develop a sense of ownership and commitment. The students will also learn to keep the deadlines sacrosanct. The project will lead to the development of the designer's skills and knowledge through a process of 'hands on-minds on'. A range (Minimum 4 articles) has to be developed.

The project will be culminated with a "Project Report". The project report shall be as per the below mentioned format:

1. Cover Page
2. List of contents
3. Introduction
4. Methodology
5. Data collection
6. Data analysis
7. Representation of the analyzed data.
8. Design outcome
9. Conclusion
10. List of tables and graphs
11. References.

Computer Aided Textile Designing (Printing) - II Lab

L T P C

0 0 8 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- To be able to understand specific CAD software.
- To develop design concepts on CATD for Woven/Print Design

Printing :

1. Develop 10 designs for each of following with illustrations on paper
 - (a) Dress Material
 - (b) Furnishing
2. Develop and edit all above designs on software (Arahne)
3. Take 5 printouts of each.

Note: Prepare a sketch book with minimum 50 sketches.

Methodology:

- Creation of design with the help of Arahne
- Scanning Process
- Functions of tools
- Resizing & re-sampling
- Repeat setting
- Retouching/Editing
- Colour Separation
- Draping

Internal Design Project (Weaving)

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives

- To develop concept and designs based on clients' needs and utility.
- To explore ideas in design, develop sense in design, material technique and style.
- To understand the suitability, trends, market demand in production of range/ product for textile industry.

Summary of learning outcomes

This paper would help to develop advanced skills and exploration in processes and materials. It encourages the synthesis of ideas from both direct and conceptual sources to produce outcomes to satisfy a set design brief. The core idea behind a design project is to develop professional skills of the students and encourage independent thinking.

The student should also understand the importance of research and evaluating the role of the client and market in the design process and product usage and utility for textile design.

The project may be based on a realistic brief from the industry or it may be a hypothetical brief in either case a guide will be there to supervise the project. A design project should be given as an individual project to students.

The students will be the core custodians of the project and the onus will be on them from beginning till the end which will develop a sense of ownership and commitment. The students will also learn to keep the deadlines sacrosanct. The project will lead to the development of the designer's skills and knowledge through a process of 'hands on-minds on'. A range (Minimum 4 articles) has to be developed.

The project will be culminated with a "Project Report". The project report shall be as per the below mentioned format:

1. Cover Page
2. List of contents
3. Introduction
4. Methodology
5. Data collection
6. Data analysis
7. Representation of the analyzed data.
8. Design outcome
9. Conclusion
10. List of tables and graphs
11. References.

Trends and Forecasting Lab

L T P C

0 0 2 1

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives :

1. To develop an understanding of methods and techniques used to analyze textile fibers, yarns and fabrics for end use performance.
2. To familiarize students with the different testing equipment's, their underlying principles and the international accepted standards, test methods and the language of measurement.
3. To be able to analyze and interpret the results and predict the general textile behavior Performance.
4. To analyze the fabric and to understand the depth of reproduction for Textile industry.

Practical :

To prepare a trend report on the basis of secondary data analysis.

Weaving and Printing :

5. Preparation the sample before cloth analysis.
6. Collect 5 different woven/ptinted samples for analysis.
7. Understanding the conditioning of the textile material.
8. Checking require the entire text according to the end use of the material.
9. Understanding the textile standard.
10. Select any one sample for reproduction.
11. Fabric defect identification.
12. Fabric Care.

Suggested Readings:

1. Fashion From Concept To Consumer by Gini Stephens Frings
2. The Business of Fashion: Designing, Manufacturing, and Marketing by Leslie Davis Burns, Kathy K. Mullet and Nancy O. Bryant
3. Fashion Forecasting by Kathryn Mckelvey, Janine Munslow
4. Fashion Forward: A guide to Fashion Forecasting by Chelsea Rousso
5. Color Forecasting for Fashion by Kate Scully
6. A trend forecaster's handbook by Raymond Martin

Textile Testing and Assurance Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives :

1. To develop an understanding of methods and techniques used to analyze textile fibers, yarns and fabrics for end use performance.
2. To familiarize students with the different testing equipment's. their underlying principles and the international accepted standard, test methods and the language of measurement.
3. To be able to analyze and interpret the results and predict the general textile behavior Performance.
4. To analyzwe the fabric and to understand the depth of reproduction for Textile industry.

Practical :

1. Preparation the sample before cloth analysis.
2. Collect 5 different woven/printed samples for analysis.
3. Understanding the conditioning of the textile material.
4. Checking require the entire test according to the end use of the material.
5. Unmderstanding the textile standard.
6. Select any one sample for reproduction.
7. Fabric defect indentification.
8. Fabric Care.

Design Studio (Printing) - II Lab

L	T	P	C
0	1	2	6

Max. Marks : 100

Objectives :

- To develop a sense of design, material, technique & style.
- To understand the suitability, color trends, customer demand, market segment, in production of range for Home furnishing.

Practical :

Printing

- Develop any two ranges of following (no. of articles should be 4 in each range)
 - (a) Furnishing for office purpose (sheer curtain, upholstery, carpet, cushion cover, mats etc.)
 - (b) Home Furnishing (Curtain, Bed-sheet, pillow cover, floor Covering, quilt etc.)
 - (c) Dress material for Adults.
 - (d) Dress material for kids.

Preparation of sketch book with selected 100 sketches.

Note : Each and every printing student should develop and weave at list one sample given above subject on Jacquard/Digital Printing.

Design Studio (Weaving) - II Lab

L T P C

0 0 12 6

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- To analyze the fabric and to understand the depth of reproduction for Textile industry.
- To develop a sense of design, material, technique & style.
- To understand the suitability, color trends, customer demand, market segment, in production of range for Home furnishing.

Weaving :

- 1) Develop any two ranges of following (no. of articles should be 4 in each range)
 - a) Furnishing for office purpose (sheer curtain, upholstery, carpet, cushion cover, mats etc.)
 - b) Home Furnishing (Curtain, Bed-sheet, pillow cover, floor covering, quilt etc.)
 - c) Dress material for Adults
 - d) Dress material for kids
- 2) Preparation of sketch book with selected 100 sketches.

Note: Each and every weaving / printing student should develop and weave at list one sample given above subject on Jacquard / Digital Printing

Physical Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

- Describe origin of earth, continents and ocean basin, Isostasy, diastrophism, drainage pattern and several landforms.
- Describe the wind movements, pressure, composition and structure of the earth, jet streams.
- Classify world in terms of climate, air masses and fronts and describe cyclones and their types.
- Describe ocean bottom reliefs of Indian ocean, distribution of temperature and salinity, tides, currents and coral reefs.

Course Content:

Unit I Definition and Scope of Physical Geography; Origin of the Earth: - Gaseous Hypothesis of Kant, Nebular Hypothesis of Laplace, Tidal Hypothesis of James Jeans and Big Bang Theory; Interior of the Earth; Origin of the Continent and Oceans: - Wegner's Theory of Continental Drift and Plate Tectonic Theory; Theories of Mountain Building: - Geosyncline Orogen Theory of Kober and Plate Tectonic Theory.

Unit II Isostasy: - Concept and Views of Airy and Pratt; Diastrophism: - Faults & Folds; Weathering: - Physical, Chemical and Biological; Drainage pattern and Cycle of Erosion: - Davis & Penck; Landforms: - Fluvial, Coastal and Arid.

Unit III Composition and Structure of the Atmosphere; Atmospheric temperature: - Insolation and Heat Budget; Atmospheric pressure: - Vertical and Horizontal; Distribution of Air pressure; Winds: - Planetary, Periodic and Local winds; Jet stream:-Definition, Characteristics & its Significance.

Unit IV Air masses: - Source region and Classification of Air masses; Fronts: - Frontogenesis and Frontolysis, Type of Fronts; Cyclones: - Tropical and Temperate Cyclones; Anti Cyclones; Climatic Classification by Koppen.

Unit V Reliefs of the ocean basins - Bottom reliefs of the Indian Ocean; Distribution of Temperature and Salinity of Oceans; Ocean currents: - Atlantic Ocean and Pacific Ocean Currents; Tides: - Type and theory of Origin (Progressive wave and Stationary Wave theory); Coral reefs: - Conditions of growth, Types and Origin according to Darwin and Murray.

Stencils are to be permitted during the examination.

Recommended Books:

1. Barry, R. G. & Chorley, R. J. (1998). *Atmosphere: Weather and Climate* (7th ed.). London, UK: Routledge.
2. Das, P. K. (1968). *The Monsoons*. New Delhi, India: National Book Trust.
3. Dayal, P. (1996). *A Text book of Geomorphology*. (2nd ed.). Patna, India: Shukla Book Depot.
4. Garrison, T. (1998). *Oceanography*. (3rd ed.). California, CA: Wadsworth.
5. Gohchingleong (2011). *Certificate Physical and Human Geography*. New Delhi, India: Oxford University Press.
6. Khullar, D. R. (2016). *Physical Geography*. Ludhiana, India: Kalyani.
7. Siddartha, K. (2014). *The Earth's Dynamic surface: A textbook on Geomorphology*. New Delhi, India: Kisalya.
8. Singh, S. (2015). *Geomorphology*. Allahabad, India: Pravalika.
9. Smalls, R. J. (1985). *The Study of Landforms*. New York, NY: McGraw Hill.
10. Strahler, A. N. & A. H. Strahler (2008). *Modern Physical Geography*. (4th ed.). New Jersey, NJ: John Wiley & Sons.

11. चौहान, वी. एस. (1996). भौतिक भूगोल. मेरठ, भारत: रस्तोगी.
12. शर्मा, एच. एस. (2014). भौतिक भूगोल. जयपुर, भारत: पंचशील.
13. सिंह, एस. (2005). भौतिक भूगोल. गोरखपुर, भारत: वसुन्धरा.

Suggested e-learning materials:

1. Interior of earth

<https://www.nationalgeographic.com/science/earth/surface-of-the-earth/earths-interior/>

2. Plate Tectonics, Weathering, Mass Wasting and Erosion
<http://hkss.cedd.gov.hk/hkss/eng/education/GS/eng/hkg/chapter4.htm>
3. Geomorphic Processes
<http://ncert.nic.in/ncerts/l/kegy206.pdf>

Fundamentals of Cartography Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, students will be able to:

- Describe cartography and theoretical background of scales and their types.
- Draw plain, diagonal, comparative, time and Vernier scale.
- Enlarge, reduce and combine maps.
- Describe the uses of thermometer, barometer, hair hygrometer, rain gauge and wind vane.
- Conduct a plain table survey through radiation, intersection and traversing.

Course Content:

- 1) Meaning and Definition of Cartography.
- 2) Scale: - Plain, Diagonal, Comparative (Distances and Time), & Vernier (2 exercises of each scale).
- 3) Enlargement, Reduction & Combination of maps.
- 4) Weather Instruments: - Thermometer, Barometer, Hair hygrometer, Rain Gauge & Wind vane.
- 5) Plane Table Survey: - Methods of Plane Tabling; Radiation, Intersection and Traverse.

Non Scientific calculators are allowed during the examination

Recommended Books:

1. Mishra, R. P. (2014). *Fundamentals of Cartography* (2nd ed.). New Delhi, India: Concept.
2. Robinson, A. R. (2011). *Elements of Cartography* (6th ed.). London, UK: Chapman & Hall.
3. Saha, P., & Basu, P. (2011). *Advanced Practical Geography* (7th ed.). Kolkatta, India: Books & Allied.
4. Singh, R. L. (2011). *Elements of Practical Geography* (8th ed.). New Delhi, India: Kalyani.
5. खुल्लर, डी. आर. (2015). *प्रयोगात्मक भूगोल*. लुधियाना, भारत: कल्याणी.
6. दयाल, पी. (2006). *प्रयोगात्मक भूगोल की रूपरेखा*. नई दिल्ली, भारत: राजेश.
7. शर्मा, जे. पी. (2011). *प्रायोगिक भूगोल (पंचम सं.)*. मेरठ, भारत: रस्तोगी.
8. सिंह, आर. एल. (2013). *प्रायोगिक भूगोल के सिद्धान्त (तृतीय सं.)*. इलाहाबाद, भारत: शारदा पुस्तक भवन.

Suggested e-learning materials:

1. Introduction to Cartography

<http://www.sfu.ca/~hickin/Maps/Chapter%201.pdf>

2. Scale

http://earthsci.org/education/fieldsk/Map_Scales/geo_scales.html

3. Plane table surveying

<https://nptel.ac.in/courses/105107122/33>

4. Methods of Plane table Surveying

<https://nptel.ac.in/courses/105107122/34>

5. Weather Instruments

<http://sites.tufts.edu/stompactivitydatabase/files/formidable/Weather-Instruments.pdf>

Human Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

- Define human geography and relate it to the other social sciences; describe man environment relationships and schools of human geography.
- Describe evolution of man, classify human races and describe migration theories.
- Map and describe the distribution of several tribes- Pigmies, Badawins, Eskimos, Khirgiz, Gujjars, Bakarwals, Toda, Bhil and Santhal and their economic activities.
- Describe population distribution of the world with maps, concepts of population growth, population theories and human development.
- Classify cities functionally; describe urbanization, settlements and their types.

Course Content:

- Unit I** Definition and Scope of Human Geography, its relation with other Social Sciences; Man – Environment relationship; Schools of Human Geography: Determinism, Possibilism and Neo – determinism; Fundamental principles of Human Geography: Principle of Activity, Principle of Areal Differentiation, Principle of Terrestrial Unity.
- Unit II** Evolution of Man: Monogenetic Theory, Multi Origin Theory and Modern Theory; Criteria of classification of Human Races; Classification and Distribution of Human Races according to G. Taylor; Factors of evolution of Human Races; Migration Zone Theory by G. Taylor
- Unit III** Distribution of Tribes in the Equatorial and Desert Region: Habitat, economic activities and Social organization of Pigmies and Badawins; Distribution of Tribes in the Grasslands and Tundra Region: Habitat, Economic activities and Social organization of Eskimos and Khirgiz; Distribution of Tribes in North and South India: Habitat, Economic activities and Social organization of Gujjars & Bakarwals and Toda; Distribution of Tribes in East and West India: Habitat, Economic activities and Social organization of Santhal and Bhil; Early economic activities of mankind: - Food gathering, Hunting & Shifting cultivation.
- Unit IV** Distribution of population: World distribution pattern Physical, Economic and Social factors influencing spatial distribution; Concept of Over population, Under population, Optimum population and Zero population growth; Demographic Transition Theory; Migration Internal and International, General laws of migration- E.G. Ravenstein's laws, Lee's model, Zelinsky's mobility transition model; Concept of Human Development, Population problems and Policy of India.
- Unit V** Settlement: Origin and Types of settlement; Rural settlement-Pattern of rural settlements, House types and Building materials, Rural settlement in India; Urban settlement- Origin of towns, Patterns of cities; Functional classification of cities, Zoning of cities; Urbanization and Problems: with special reference to slums.

Stencils are to be permitted during the examination

Recommended Books:

1. Huntington, E. (1959). *The Principles of Human Geography* (2nd ed.). New York, NY: John Wiley & Sons.
2. Husain, M. (2014). *Human Geography* (4th ed.). Jaipur, India: Rawat.
3. Leong, G. C. & Morgan, G. C. (2010). *Human and Economic Geography* (2nd ed.). Oxford, UK: O.U.P.
4. Maurya, S. D. (2015). *Human Geography*. Allahabad, India: Pravalika.

5. Negi, B. S. (1982). *Human Geography- An Ecological Aproach*. Meerut, India: Kedarnath Ramnath.
6. Rubenstein, J. M. (2003). *An Introduction to Human Geography* (7thed.). New Jersey, NJ: Prentice Hall.
7. Singh, L. R. (2005). *Fundamentals of Human Geography* (2nded.). Allahabad, India: Sharda Pustak Bhawan.
8. Verma, J.K. (2008). *Human Geography*. New Dehli, India: GNOSIS.
9. कौशिक, एस. डी. (2011). *मानव भूगोल के सरल सिद्धांत* (12 वॉ सं.). मेरठ, भारत: रस्तोगी.
10. गर्जुर, आर., एवं जाट, बी. सी. (2006). *मानव भूगोल*. जयपुर, भारत: पंचशील.
11. मौर्या, एस. डी. (2009). *मानव भूगोल* (तृतीय सं.). इलाहाबाद, भारत: शारदा पुस्तक भवन.
12. सिंह, के., एवं सिंह, जे. (2009). *मानव भूगोल*. नई दिल्ली, भारत: राधा.
13. सिंह, के. (2010). *मानव भूगोल*. जयपुर, भारत: इशिका.
14. हुसैन, एम. (2012). *मानव भूगोल* (चतुर्थ सं.). जयपुर, भारत: रावत.

Suggested e-learning materials:

1. Schools of Human Geography: Determinism, Possibilism and Neo – determinism
<http://ncert.nic.in/ncerts/l/legy101.pdf>
2. factor of Evolution human race and criteria
<http://egyankosh.ac.in/bitstream/123456789/41420/1/Unit-4.pdf>
3. Migration Zone theory by Griffith Taylor
<https://booksite.elsevier.com/brochures/hugy/SampleContent/Mapping-Race-and-Ethnicity.pdf>
4. Bushmen Tribe
<http://www.newworldencyclopedia.org/entry/Bushmen>

Statistical Techniques and Data Representation Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe statistical sampling and represent frequency distribution in several forms.
- Represent statistical data through diagrams- multiple bar diagram, simple pyramid diagram, rectangular diagram, wheel or pie diagram, and spherical diagram.
- Measure mean, median mode & standard deviation.
- Represent Statistical data through graphs-poly linear graph, climograph and triangular graph.

Course Content:

1. Meaning and definition of statistics, data and sampling.
2. Statistical series and their types.
3. Frequency distribution and its presentation.
4. Measures of Central tendency : Arithmetic Mean Mode & Median. (Direct Method)
5. Measure of Dispersion: Standard Deviation.
6. Representation of statistical data through diagrams :- Multiple Bar diagram, Simple Pyramid diagram, Rectangular diagram (Simple and Divided), Wheel or pie diagram, Spherical diagram
7. Representation of statistical data through graphs: - Poly Linear graph, Climograph, Triangular graph.
Scientific calculators are allowed during the examination.

Recommended Books:

1. Alvi, Z. (2005). *Statistical Geography Methods and Applications* (2nd ed.). New Delhi, India: Rawat.
2. Dadson, S. J. (2017). *Statistical Analysis of Geographical Data an Introduction*. Oxford, UK: John Wiley & Sons.
3. Gupta, S. P. (2012). *Statistical methods* (4th ed.). New Delhi, India: Sultan Chand and Sons.
4. Mahmood, A. (2017). *Statistical Methods in Geographical Studies* (6th ed.). New Delhi, India: Rajesh.
5. Saha, P. & Basu, P. (2011). *Advanced Practical Geography* (7th ed.). Kolkatta, India: Books & Allied.
6. Singh, R. L. (2011). *Elements of Practical Geography* (8th ed.). New Delhi, India: Kalyani.
7. खुल्लर, डी. आर. (2015). *प्रयोगात्मक भूगोल*. लुधियाना, भारत: कल्याणी.
8. नागर, के. एन. (2013). *सांख्यिकीय के मूलतत्त्व* (चतुर्थ सं.). मेरठ, भारत: मीनाक्षी.
9. शर्मा, जे. पी. (2011). *प्रायोगिक भूगोल* (पंचम सं.). मेरठ, भारत: रस्तोगी.

Suggested e-learning materials:

1. Sampling

<https://epgp.inflibnet.ac.in/ahl.php?csrno=17 P01,M-12>

2. Frequency distribution

<https://epgp.inflibnet.ac.in/ahl.php?csrno=17 P01,M-12>

3. Histogram

<https://www.liverpool.ac.uk/~ccl/lskills/WN/NumeracyDiagrams.html#histo>

4. Measures of central tendency

<https://www.mathsisfun.com/data/central-measures.html>

5. Standard deviation method

https://www.learner.org/courses/againstallodds/pdfs/AgainstAllOdds_StudentGuide_Unit06.pdf

6. Diagrams

<http://egyankosh.ac.in/bitstream/123456789/20422/1/Unit-14.pdf>

Introduction to Geography of India

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

- Describe and map the location of India, its physiographic divisions.
- Describe the drainage, climate, soil and vegetation their types and distribution.
- Describe major crops, minerals, industrial regions, population of India and their distribution.
- Demarcate Rajasthan in terms of physiography, describe climate, drainage, vegetation, soils and their distribution.
- Describe agriculture, livestock, irrigation, human resources and tourism.

Course Content:

Unit I Introduction :- Location; Neighbouring countries; Frontiers; India :- A land of Diversities ; Unity within Diversities; Physiographic Division- Himalayan Region, The Great Plains of India, Peninsular Plateau, Coastal Plains and Islands.

Unit II Drainage systems of India; Climate: - Summer and Winter Season; Monsoon: - Mechanism of Monsoon; Soil - Type, Distribution & Characteristics; Vegetation: - Type and their Distribution.

Unit III Agriculture: - Major Crops and their Distribution (Wheat, Rice & Tea); Minerals: - Distribution and Production of Iron ore & Coal; Industrial Regions of India and their Problems; Transport & Trade: - Ports and Foreign Trade; Population: - Distribution & Density of Population, Sex Composition & Literacy Rate.

Unit IV Physiographic Division of Rajasthan; Climate:- Major seasons; Drainage Systems; Natural Vegetation:- Type, Distribution & their importance; Soils of Rajasthan.

Unit V Agriculture:- Type and Distribution of Major Crops in Rajasthan (Bajra & Mustard) ; Livestock :- Sheep & Camel; Irrigation :- Indira Gandhi Canal Project; Human Resources of Rajasthan: - Distribution & Density, Sex ratio, SC/ ST; Tourism in Rajasthan : Major Tourist Spots & its importance in the Economy of Rajasthan.

Stencils are to be permitted during the examination

Recommended Books:

1. Bhalla, L. R. (2016). *Geography of Rajasthan* (12thed.). Jaipur, India: Kuldeep.
2. Khullar, D. R. (2014). *India, A Comprehensive Geography* (3rd ed.). Ludhiana, India: Kalyani.
3. Mishra, V. C. (1967). *Geography of Rajasthan*. New Delhi, India: National Book Trust.
4. Singh, G. (2010). *Geography of India* (9th ed.). Delhi, India: Atma Ram.
5. बंसल, एस. सी. (2015). *भारत का भूगोल* (तृतीय सं.). मेरठ, भारत: मीनाक्षी.
6. मामोरिया, सी. (2018). *भारत का वृहत भूगोल*. आगरा, भारत: साहित्य भवन.
7. शर्मा, एच. एस., एवं शर्मा, एम. एल. (2017). *राजस्थान का भूगोल* (13वाँ सं.). जयपुर, भारत: पंचशील.
8. शर्मा, एच. एस., एवं शर्मा, एम. एल. (2017). *भारत का नूतन भूगोल*. जयपुर, भारत: आर. बी. डी. पब्लिशिंग हाउस.
9. शर्मा, आर. (2014). *राजस्थान का वृहत भूगोल* (द्वितीय सं.). उदयपुर, भारत: हिमाशुं.
10. सक्सैना, एच. (2014). *राजस्थान का भूगोल* (12वाँ सं.). जयपुर, भारत: राजस्थान हिन्दी ग्रंथ अकादमी.
11. सक्सैना, एच. एम., सक्सैना, आर. एवं सक्सैना, पी. (2017). *भारत का भूगोल*. जयपुर, भारत: रावत.
12. सिंह, जी. (2006). *भारत का भूगोल*. दिल्ली, भारत: आत्माराम.
13. हुसैन, एम. (2018). *भारत का भूगोल* (सप्तम् सं.). नई दिल्ली, भारत: टाटा मैकग्राहिल.

Suggested e-learning materials:

1. Monsoon

<https://www.britannica.com/science/Indian-monsoon>

2. Drainage system of India

<https://iasscore.in/pdf/samplenotes/4.%20Drainage.pdf>

3. Indira Gandhi canal

<https://nroer.gov.in/55ab34ff81fccb4f1d806025/file/57cff6e816b51c038dedd394>

4. Human Resources of Rajasthan

<http://worldpopulationreview.com/countries/india-population/>

Mapping and Prismatic Compass Survey Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, students will be able to:

- Create distribution maps through chorochromatic, simple shading, choro-schematic methods.
- Create maps of isobars, isotherms and dot method.
- Conduct prismatic compass survey through radiation and intersection method.
- Correct closing error through Bowditch rule.

Course Content:

1. Distribution Map: - General Rules and Methods of drawing map.
2. Qualitative Methods :- Chorochromatic Method, Simple Shading Method, Naming Method, Choroschematic Method- Geometrical Symbol, pictorial Symbol and Literal Symbol Method.
3. Quantitative Method:- Choropleth, Isopleth – Isobars and Isotherms, Dot Method
4. Prismatic Compass Survey:- Instruments required for Prismatic Compass Survey.
5. Prismatic Compass Survey:- Radiation Method, Intersection Method.
6. Traverse Method
7. Correction of closing Error with Bowditch Rule.

Non-Scientific calculators are allowed during the examination

Recommended Books:

1. Mishra, R. P. & Ramesh, A. (2014). *Fundamentals of Cartography* (2nd ed.). New Delhi, India: Concept.
2. Raize, E. (1948). *General Cartography*. London, UK: McGraw Hill.
3. Sarkar, A. (2015). *Practical Geography: A Systematic Approach* (3rd ed.). Kolkatta, India: Orient Black Swan.
4. Singh, R. N. & Kanaujia, L. R. S. (1998). *Map Work & Practical Geography*. Allahabad, India: Central Book Depot.
5. खुल्लर, डी. आर. (2015). *प्रयोगात्मक भूगोल*. लुधियाना, भारत: कल्याणी.
6. दयाल, पी. (2006). *प्रयोगात्मक भूगोल की रूपरेखा*. नई दिल्ली, भारत: राजेश.
7. शर्मा, जे. पी. (2011). *प्रायोगिक भूगोल* (पंचम् सं.). मेरठ, भारत: रस्तोगी.

Suggested e-Learning Materials:

1. Distribution Maps

<http://ncert.nic.in/ncerts/l/legy303.pdf>

2. Prismatic Compass Survey

<https://www.svce.ac.in/departments/cve/downloads/Surveying%20I/Unit%202.pdf>

Economic Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

- Define economic geography, describe its scope and relate it with other social sciences
- Classify resources and describe soil mineral and energy resources
- Describe spatial distribution, production and trade of rice, wheat, cotton, tea and Classify world into agricultural regions
- Describe several industries, their location determinants, and distribution of iron- steel and cotton-textile industry.
- Describe trade, transport, their controlling factors, major law making bodies of the world and major transport routes.

Course Content:

- Unit I** Definition and Scope of Economic Geography; Development of Economic Geography. Its relation with other Subjects; Concept of the Economy; Economic Activities: Primary, Secondary and Tertiary; Impact of Economic Activities on the Environment.
- Unit II** Natural Resources: Meaning and Classification of Resources; Conservation of Resources: Water & Forest; Soil Resources: Composition of Soil, Factors affecting soil formation; Soil profile, Soil classification (NRCS); Mineral Resource: Type, Distribution & Production of Iron Ore; Energy Resources: Types, Distribution and Production of Coal and Petroleum.
- Unit III** Agriculture: Physical and Socio– Cultural environment influencing crop production; Spatial Distribution, Production and International trade of Rice & Wheat; Spatial Distribution, Production and International trade of Cotton; Spatial Distribution, Production and International trade of Tea; Agricultural Classification: Whittlesey's Classification.
- Unit IV** Manufacturing Industry: Meaning & Types; Determinants of location of industry; Industrial Location Theory: A. Weber; Distribution & production of Iron & Steel industry; Distribution & Production of Cotton Textile iIndustry.
- Unit V** Trade: Type of trade, Factors affecting International trade; Evolution of International trade, Barriers of International trade, Agencies: GATT, WTO, EUROPEAN UNION; Transport: Importance & Development of transport; Means of transport; Water Transport: Suez Canal, Panama Canal, North Atlantic Route.
- Stencils are to be permitted during the examination.

Recommended Books:

1. Guha, J. L. & Chattoraj, P. R. (2009). *Economic geography – A Study of Resources* (9thed.). Kolkata, India: The World Press.
2. Gurjar, R. & Jat, B. C. (2010). *Resources and Environment* (7thed.). Jaipur, India: Panchsheel.
3. Hodder, B. W. & Lee, R. (2008). *Economic Geography* (Indian Reprint). Jaipur, India: Rawat.
4. Leong, G. C. & Morgan, G. C. (1982). *Human and Economic Geography* (2nd ed.). New York. NY: Oxford Press.
5. Maurya, S. D. (2018). *Economic Geography*. Allahabad, India: Pravalika.
6. Shelar, S. K. (2013). *Principles of Economic Geography*. Kanpur, India: Chandralok.
7. Siddhartha, K. (2006). *Economic Geography Theories, Processes and Patterns* (2nded.). Delhi, India: Kisalaya.
8. Siddhartha, K. (2016). *Economic Geography* (3rded.). Delhi, India: Kitab Mahal.

9. गौतम, ए. (2015). *आर्थिक भूगोल के मूल तत्त्व*. इलाहाबाद, भारत: शारदा पुस्तक भवन.
10. जाट, बी. सी. (2016). *आर्थिक भूगोल* (चतुर्थ सं.). जयपुर, भारत: पंचशील.
11. मामोरिया, सी. (2012). *आर्थिक भूगोल* (द्वितीय सं.). आगरा, भारत: साहित्य भवन.
12. राव. एस. (2013). *आर्थिक भूगोल*. गोरखपुर, भारत: वसुन्धरा.
13. सिंह, के. एन. एवं सिंह, जे. (2010). *आर्थिक भूगोल के मूलतत्त्व* (11वाँ सं.). गोरखपुर, भारत: ज्ञानोदय.
14. सिंह, जे. (2009). *संसाधन भूगोल*. नई दिल्ली, भारत: राधा.

Suggested e-learning materials:

1. Suez Canal trade route

<https://www.britannica.com/topic/Suez-Canal>

2. Panama Canal

<https://www.pancanal.com/eng/op/routes.html>

Relief Representation and Topographical Maps Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, students will be able to:

- Interpret topographical maps.
- Represent topographical features with the help of contours.
- Identify Human and natural phenomenon.
- Create Profiles using Contours in the topographical sheets.

Course Content:

1. Methods of Relief Representation : Hachures, Contours, Layer tint, BM, Spot heights
2. Representation of Relief Features : Water fall, Ridge, Gorge, Pass, Hanging valley along with U-shaped valley, Sand dunes, Cirque, Dolines
3. Profiles: Serial, Superimposed, Projected & Composite.
4. Conventional Signs & Symbols on Toposheets/Open Series Map (OSM).
5. Interpretation of Toposheets/Open Series Map (OSM).

Recommended Books:

1. Mishra, R. P. & Ramesh, A. (2014). *Fundamentals of Cartography* (2nded.). New Delhi, India: Concept.
2. Raize, E. (1948). *General Cartography*. London, UK: McGraw Hill.
3. Singh, G. (2009). *Map work and Practical Geography* (4thed.). Delhi, India: Vikas.
4. खुल्लर, डी. आर. (2015). *प्रयोगात्मक भूगोल*. लुधियाना, भारत: कल्याणी.
5. शर्मा, जे. पी. (2011). *प्रायोगिक भूगोल* (पंचम् सं.). मेरठ, भारत: रस्तोगी.

Suggested e-learning materials:

1. Method of relief representation
<http://www.sfu.ca/~hickin/Maps/Chapter%204.pdf>
2. Representation of relief features
<http://ncert.nic.in/ncerts/l/kegy305.pdf>

World Regional Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

- Elucidate physical aspects of Asia, Europe, Africa, North & South America and Oceania.
- Describe cultural aspects of Asia, Europe, Africa, North & South America and Oceania.
- Compare different continents of world.
- Illustrate terrain, drainage, climate, natural vegetation and Industrial regions of studied continents.

Course Content:

Unit I Asia -Geographical Location and Extension, Unity in Diversity in Asia, Terrain and Drainage, Spatial Distribution of Population, Climate, Natural Vegetation & Soil, Industrial Regions of Japan and China.

Unit II Europe -Location, Extension and Geographical Characteristics, Terrain & Drainage, Climate, Natural Vegetation & Soil, Spatial Distribution of Population, Industrial Regions of Britain.

Unit III Africa -Location and Extension, Terrain & Drainage, Climate, Natural Vegetation & Soil, Spatial Distribution of Population, Industrial Regions of Africa.

Unit IV North & South America -Location, Extension and Geographical Characteristics, Terrain & Drainage, Climate, Natural Vegetation & Soil, Spatial Distribution of Population, Industrial Regions of U.S.A.

Unit V Oceania (Australia and New Zealand) -Location, Extension and Geographical Characteristics, Terrain & Drainage, Climate, Natural Vegetation & Soil, Spatial Distribution of Population, Industrial Regions of Australia.

Stencils are to be permitted during the examination.

Recommended Books:

1. Cole, J. (1996). *A Geography of the World's Major Regions*. London, UK: Routledge.
2. Cole, M. M. (1961). *South Africa*. New York, NY: Dutton.
3. Gourou, R. (1980). *The Tropical World* (5th ed.). London, UK: Longman.
4. Hussain, M. (2012). *World Geography* (4th ed.). Jaipur, India: Rawat.
5. Kolb, A. (1977). *Geography of a Cultural Region*. London, UK: Methuen.
6. Manku, D. S. (2017). *A Regional Geography of the World* (6th ed.). Ludhiana, India: Kalyani.
7. Minshull, G. N. (1984). *Western Europe*. New York, NY: Hodder & Stoughton.
8. Songquiao, Z. (1994). *Geography of China*. New York, NY: John Wiley & Sons.
9. Ward, R. W. & Miller, A. (1989). *World Regional Geography: A Question of Place*. New York, NY: John Wiley & Sons.
10. अग्रवाल, एस. (2011). *विश्व का भूगोल*. जयपुर, भारत: इशिका.
11. राव, बी. पी., एवं सत्यपति, डी.पी. (2010). *एशिया की भौगोलिक समीक्षा* (द्वितीय सं.). गोरखपुर, भारत: वसुन्धरा.
12. लोढा, आर. एम. (2010). *औद्योगिक भूगोल* (चतुर्थ सं.). जयपुर, भारत: राजस्थान हिन्दी ग्रंथ अकादमी.
13. सक्सेना, एच. एम. (2011). *विश्व का प्रादेशिक भूगोल*. मेरठ, भारत: रस्तोगी.
14. सिंह, जे., एवं राव, बी. पी. (2007). *तीन दक्षिणी महाद्वीप* (सप्तम् सं.). गोरखपुर, भारत: वसुन्धरा.

Suggested e-learning materials:

1. Drainage of Australia

<https://www.7continentslist.com/australia/rivers-in-australia.php>

2. Drainage of North America

<https://www.7continentslist.com/north-america/rivers-in-north-america.php>

3. Physical features and climate of Australia

https://saylordotorg.github.io/text_world-regional-geography-people-places-and-globalization/s15-australia-and-new-zealand.html

4. Climate, natural vegetation

https://na.unep.net/atlas/africa/downloads/chapters/Africa_Atlas_English_Chapter_1.pdf

Map Projection Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, students will be able to:

- Elucidate necessity & classification of map projections.
- Compare different kind of map projections.
- Construct map projections graphically.
- Suggest projection for any area of earth surface.

Course Content:

1. Map Projection: Definition and History of Map Projection.
 2. Necessity & Classification of Map Projection.
 3. Graphical Construction of Map Projection.
 4. Zenithal Projection: Polar zenithal equidistant projection, Polar zenithal equal area, Gnomonic polar zenithal projection, Orthographic polar zenithal projection.
 5. Conical Projection: Simple conical projection with one and two standard parallel. Bonne's projection & Polyconic projection.
 6. Cylindrical Projection: Perspective cylindrical projection, Cylindrical equal area projection, Mercator's projection.
 7. Conventional Projection: Molleweide's projection & Globular projection.
- Non Scientific calculators are allowed during the examination

Recommended Books:

1. Saha, P. & Basu, P. (2011). *Advanced Practical Geography* (7thed.). Kolkatta, India: Books & Allied.
2. Singh, G. (2009). *Map work and Practical Geography* (4thed.). Delhi, India: Vikas.
3. खुल्लर, डी. आर. (2015). *प्रयोगात्मक भूगोल*. लुधियाना, भारत: कल्याणी.
4. शर्मा, जे. पी. (2011). *प्रायोगिक भूगोल* (पंचम् सं.). मेरठ, भारत: रस्तोगी.
5. सिंह, आर. एल. (2013). *प्रायोगिक भूगोल के सिद्धान्त* (तृतीय सं.). इलाहाबाद, भारत: शारदा पुस्तक भवन.

Suggested e-learning materials:

1. Types of map projection

<https://www.gistda.or.th/main/en/node/950>

2. Meaning and elements of map projection, construction of conical and cylindrical projection
<http://ncert.nic.in/textbook/pdf/kegy304.pdf>

Geographical Thought

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

- Explain evolution of geographical thought and relationship of Geography with other branches of knowledge.
- Describe different tools and techniques of geographical study.
- Compare ancient, medieval and modern scholar's contributions in Geography.
- Elucidate important concepts of Geography as well as recent trends and current issues of subject.

Course Content:

Unit I Definition and Aims of Geography, Branches of Geography. Relationship of Geography with other Sciences, Tools and Techniques in Geography; Evolution of Geographical Thoughts.

Unit II Beginning of Classical Geography: Contribution of Greeks (Herodotus & Eratosthenes); Contribution of Romans. (Strabo & Ptolemy) Early Medieval Geography: Contribution of Arab Geographers (Al – Burini & Ibn-Battuta); Renaissance : Marco polo, Varenius and E. Kant; Main Aspects of Geography in Ancient India.

Unit III Contribution of German Schools of Geography: Humboldt & Carl Ritter; Contribution of French School of Geography: Vidal –De- La Blache & Jean Brunhes; Contribution of British School of Geography: Halford J. Mackinder; Contribution of American School of Geography: E. Huntington & Carl O. Sauer; Contribution of Soviet School of Geography : Peter Kropotkin

Unit IV Man –Environment Relations: Determinism, Possibilism and Neo-Determinism; Dichotomies in Geography: Physical Vs Human Geography, Systematic vs Regional Geography; Positivism and Quantitative revolution; Behaviouralism in Geography; Radicalism: Origin, Salient features & Objectives of Radical Geography.

Unit V Concept of Areal differentiation, Concept of Region and Types of Region; Concept of Cultural Landscape: Meaning & Elements of Cultural Landscape; Recent trends of Modern Geography: Six Trends by Freeman; Applied Geography: Meaning and Methods of Applied Geography; Need of Applied Geography in India.

Stencils are to be permitted during the examination.

Recommended Books:

1. Daniels, P., Bradshaw, M., Shaw, D. & Sidaway, J. (2008). *An Introduction to Human Geography: Issues for the 21st Century* (3rded.). London, UK: Prentice Hall.
2. Dikshit, R. D. (2018). *A Contextual History of Ideas* (2nded.). New Delhi, India: PHI.
3. Hussain, M. (2014). *Evolution of Geographical thought* (6thed.). New Delhi, India: Rawat .
4. Kaushik, S. D. & Rawat, D. S. (2017). *Geographical Thought and Methodology*. Meerut, India: Rastogi.
5. Martin, G. (2007). *All Possible Worlds. A History of Geographical Ideas* (4thed.). New York, NY: Oxford University Press.
6. Maurya, S. D. (2013). *History of Geographical Thought*. Allahabad, India: Sharda Pustak Bhawan.
7. Rana, L. (2008). *Geographical thought a systematic record of evolution*. New Delhi, India: Concept.

8. Singh, M. (2016). *Geographical Thought*. New Delhi, India: Sonali.
9. कौशिक, एस. डी. एवं रावत, डी. एस. (2017). *भौगोलिक विचारधारा एवं विधि तंत्र* (नवम् सं.). मेरठ, भारत, रस्तोगी.
10. जैन, एस. एम. (2018). *भौगोलिक चिन्तन का विकास* (संशोधित सं.). आगरा, भारत: साहित्य भवन.
11. प्रसाद, गोविन्द (2006). *भौगोलिक संकल्पनाएँ*. नई दिल्ली, भारत: डिसकवरी.
12. मौर्य, एस. डी. (2015). *भौगोलिक चिन्तन का इतिहास*. इलाहाबाद, भारत: प्रयाग पुस्तक भवन.
13. सिंह, जे. (2009). *भौगोलिक चिन्तन के मूल आधार*. नई दिल्ली, भारत: वसुन्धरा.
14. हुसैन, एम. (2006). *भौगोलिक चिन्तन का इतिहास*. जयपुर, भारत: रावत.

Suggested e-Learning Materials:

1. Man-Environment relations

<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06,M-12

2. Concept of Region

<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-20

3. Behaviouralism in Geography

<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-27

4. Radicalism

<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06,M-29

5. Applied Geography

<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06,M-34

Fundamentals of Geoinformatics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, students will be able to:

- Explain development and types of aerial photographs.
- Identify and interpret aerial photographs.
- Elucidate different elements and development of remote sensing.
- Describe different kinds of remote sensing platforms and discuss important elements of GIS.

Course Content:

1. Aerial photographs: Introduction & Development of Aerial photographs.
2. Methods and Types of Aerial photographs.
3. Identification of Aerial photographs.
4. Stereovision, Interpretation of Aerial photographs.
5. Remote Sensing: Meaning, Process & Elements of Remote Sensing.
6. Development of Remote Sensing.
7. Advantages of Remote Sensing.
8. Remote Sensing Platforms.
9. Satellite programmes of Remote Sensing of India.
10. GIS: Definition, Scope & Elements of GIS.

Non Scientific calculators are allowed in the examination.

Recommended Books:

1. American Society of Photogrammetry. (1993). *Manual of Remote Sensing (2nd ed.)*. Virginia, VA: ASP, Falls Church.
2. Fazal, S. (2008). *Remote Sensing Basics*. New Delhi, India: Kalyani.
3. Hammond, R. & McCullagh, P. (1978). *Quantitative Techniques in Geography: An Introduction (2nd ed.)*. Oxford, UK : Clarendon Press.
4. Nag, P. & Kudrat, M. (1998). *Digital Remote Sensing*. New Delhi, India: Concept.
5. Singh, R. L. (2011). *Elements of Practical Geography (8th ed.)*. New Delhi, India: Kalyani.
6. चौनियाल, डी. (2010). *सुदूर संवेदन एवं भौगोलिक सूचना प्रणाली*. इलाहाबाद, भारत: शारदा पुस्तक भवन.
7. शर्मा, जे. पी. (2011). *प्रायोगिक भूगोल (पंचम सं.)*. मेरठ, भारत: रस्तोगी.

Suggested e-learning materials:

1. History, type and application of aerial photography
<https://www.environmentalscience.org/principles-applications-aerial-photography>
2. Remote Sensing platform and GIS
http://ags.geography.du.ac.in/Study%20Materials_files/Punyatoya%20Patra_AM.pdf
3. Principles of Aerial Photography
<http://www.sfu.ca/~hickin/Maps/Chapter%208.pdf>
4. Interpretation of Aerial Photographs
https://www.nrem.iastate.edu/class/assets/nrem345/Week6_ALL.pdf

Physical Geology and Plate Tectonics

L T P C

6 0 0 6

Max. Marks : 100

(CA: 40 + ESA: 60)

Physical Geology

- Unit-1** Introduction to geology, scope, sub disciplines and relationship with other branches of science. Earth in the solar system, origin, size, shape, mass, density, rotational and revolution parameters. Internal constitution of the Earth. Age of the Earth.
- Unit-2** Introduction to minerals, rocks and fossils. Origin of oceans, continents and mountains. Types of mountains. Geosynclines. Theory of Isostasy. Geological Time-scale. Major events in the Earth's history.

Plate Tectonics

- Unit-3** Introduction to plate tectonics, types of plates and plate boundaries. Elementary ideas of continental drift and sea floor spreading. Introduction to craton, shields, trenches, mid-oceanic ridges and island arc.
- Unit-4** Earthquake: introduction and terminology, seismic waves, causes, magnitude, intensity and types of Earthquake, locating epicenter. Effects of Earthquakes and distribution of Earthquake belts. Seismic zones of India. Case studies of important Earthquakes of India: Sumatra Earthquake (2004), Bhuj Earthquake (2001) and Assam Earthquake (1950).
- Unit-5** Volcano: introduction, terminology, types, volcanic products, causes & effects and distribution of important volcanic belts. Relationship of Earthquakes with volcanic belts. Impact craters, morphology and their formation stages.

Physical Geology and Plate Tectonics Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Preparation of map showing seismic zones of India
2. Marking important Earthquake locations of India
3. Earthquake and volcanic zones of the world
4. Marking important plate boundaries and orogenic belts
5. Exercises based on finding location of Earthquake epicentre
6. Exercises based on Geological Time scale

Books Recommended:

1. A Text Book of Geology by P.K. Mukherjee (2000) World Press Private Limited-Kolkata
2. A Text Book of Geology by G.B. Mahapatra (2009) CBS Publisher, New Delhi
3. Charles Fletcher (2014) Physical Geology, The Science of Earth, John Wiley and Sons, Inc., New York
4. Holmes, Arthur (1992) Principles of Physical Geology, Vol. 1, Chapman and Hall, London.
5. K.M. Bangar (2009) Principals of Engineering Geology, Standard Publishers Distributors, New Delhi
6. Leet, L.D. and Judson, S. (1969) Physical Geology, Prentice Hall. Englewood Cliffs, NJ
7. Prabin Singh (2010) Engineering and General Geology. S.K. Kataria & Sons, New Delhi

Mineralogy, Crystallography and Economic Geology

L	T	P	C
6	0	0	6

Max. Marks : 100
(CA: 40 + ESA: 60)

Mineralogy

- Unit-1** Minerals: definition and classification. Common physical properties of minerals: form and shape, colour, streak, luster, cleavage, fracture, hardness, tenacity, transparency, specific gravity, magnetic nature. Classification of silicate minerals. Common rock forming minerals of igneous, sedimentary and metamorphic rocks.
- Unit-2** Polarizing microscope, its parts and functioning. Ordinary and polarized light. Nicol Prism and its construction. Optical properties of minerals: optically isotropic and anisotropic substances. Pleochroism, Extinction, Birefringence, Interference colours, Optic sign, Twinning.

Crystallography

- Unit-3** Introduction: Crystal - definition. Elementary idea of crystal structure. Parts of crystal - face, edge, apex, solid angle and interfacial angle. Crystallographic axes and angles. Parameters and indices. Elements of crystal symmetry. Common crystal forms - dome, prism, pyramid and pinacoid. Introduction to different crystals systems (normal classes).

Economic Geology

- Unit-4** Definition of ore and gangue minerals, tenor and grade of ore minerals. Introduction to processes of mineral formation: magmatic concentration, hydrothermal, Residual and mechanical concentration, Oxidation and Supergene enrichment, metasomatism, evaporation, sedimentary and metamorphic.
- Unit-5** Mode of occurrence, association, uses and Indian occurrences of metallic (iron, manganese, Chromium, copper, zinc, lead, aluminum, tungsten, gold, silver) and nonmetallic (mica, asbestos, graphite, gypsum) minerals.
Elementary idea regarding origin, uses and distribution of coal and petroleum in India.

Mineralogy, Crystallography and Economic Geology Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Study of physical properties of minerals: quartz, orthoclase, microcline, albite, labradorite, nepheline, muscovite, biotite, augite, hypersthene, tremolite, hornblende, olivine, serpentine, talc, chlorite, apatite, calcite, dolomite, garnet, kyanite, sillimanite, andalusite, staurolite, topaz, tourmaline, corundum, gypsum, graphite and kaolinite.
2. Optical properties of some common rock forming minerals -quartz, orthoclase, microcline, albite, garnet, biotite, muscovite, augite, hypersthene, hornblende, olivine and calcite.
3. Study of elements of symmetry of representative crystals
4. Study of ore and economic minerals in hand specimens: Magnetite, hematite, limonite, siderite, pyrite, pyrolusite, psilomelane, chromite, chalcopyrite, azurite, malachite, cuprite, sphalerite, galena, wolframite, scheelite, gypsum, barytes.
5. Preparation of maps showing distribution of important metallic and non-metallic deposits
6. Identification of different types of coal (lignite, anthracite and bituminous)
7. Distribution of important coal seams and petroliferous basins of India

Books Recommended:

1. Bateman A.M. (1962) Economic Minerals Deposit, John Willy & Sons, New York
2. Dana, E.S. and Ford, W.E. (2002) A textbook of Mineralogy, John Wiley and Sons, New York.
3. Dexter Perkins (2010) Mineralogy, Pearson Education, US
4. Gokhale, K.Y.GK. and Rao, T.C. (1978) Ore deposits of India their distribution and processing, Tata-McGraw Hill, New Delhi.
5. Nesse, D.W. (1986) Optical Mineralogy, McGraw Hill., CBS publication, New Delhi
6. Paul F. Kerr (1959) Optical Mineralogy, McGraw Hill Book Company, Inc., U.S
7. Phillips, Wm, R. and Griffen, D.T. (1986) Optical Mineralogy, CBS Edition, New Delhi
8. Read, H.H. (1968) Rutley's Element of Mineralogy (Rev. Ed.), Thomas Murby and Co., London

Petrology and Structural Geology

L T P C
6 0 0 6

Max. Marks : 100
(CA: 40 + ESA: 60)

Petrology

Unit 1 Igneous Petrology

Magma and its composition. Magmatic differentiation and assimilation. Common textures and classification of igneous rocks. Phase rule application to H₂O system. Brief petrographic description of common igneous rocks (granite, diorite, syenite, gabbro, dolerite, basalt, rhyolite, trachyte, dunite, pyroxenite and peridotite)

Unit 2 Sedimentary Petrology

Sediments and sedimentary rock: Origin of clastic & non-clastic sediments and genesis of sedimentary rocks. Sedimentary structures. Elementary idea about texture and mineral composition of clastic and nonclastic sedimentary rocks. General classification of sedimentary rocks. Description of fundamental rock types such as: conglomerate, breccia, sandstone, shale and limestone.

Unit 3 Metamorphic Petrology

Definition, types and agents of metamorphism. Metamorphic textures and structures. Classification of metamorphic rocks. Metamorphic zones and isograds. Common metamorphic rocks and their protoliths as given below: slate, phyllite, schist, gneiss, marble and quartzite.

Structural Geology

Unit 4 Concept of dip and strike of beds. Clinometer compass, Brunton compass and its uses. Folds: description and classification of folds. Causes of folding.

Unit 5 Faults: nomenclature, classification of faults and causes of faulting. Joints: geometric classification. Unconformity: types and significance. Overlap and offlap. Outlier and inlier. Nappe.

Petrology and Structural Geology Lab

L T P C
0 0 4 2

Max. Marks : 100
(CA: 40 + ESA: 60)

1. Megascopic study of the following Igneous rocks: granite, gabbro, rhyolite, basalt, dolerite, trachyte
2. Megascopic study of the following Sedimentary rocks: shale, sandstone, limestone, breccia, conglomerate
3. Megascopic study of the following Metamorphic rocks: gneiss, schist, quartzite, marble, slate, phyllite
4. Microscopic study of granite, gabbro, rhyolite, basalt, dolerite, sandstone, limestone, quartzite, marble.
5. Reading Topographical Maps of the Survey of India.
6. Determination of Map Scale
7. Exercises based on structural problems
8. Completion of outcrops
9. Drawing and interpretation of sections across elementary representative geological structures.

Books Recommended:

1. Best, Myron G. (2002) Igneous and Metamorphic Petrology, Blackwell Science, Oxford, UK
2. Blatt, H. and Tracy, R.J. (1996) Petrology (Igneous, Sedimentary, Metamorphic), W.H. Freeman and Co., New York.
3. Collins, J.D. and Thompson, D.B. (1982) Sedimentary Structures, George Allen & Unwin, London
4. Ehlers, E.G. and Blatt, H (1982) Igneous, Sedimentary and Metamorphic Petrology, CBS Publ., New Delhi
5. George H. Davis, Stephen J. Reynolds, Charles F. Kluth (2013) Structural Geology of Rocks and region, 3rd Ed. John Wiley and Sons, New York
6. Huang (1962) Petrology, McGraw Hill Book Co., New York
7. LeMaitre, R.W. (2002) Igneous Rocks: A classification and glossary of Terms, Cambridge University Press, New York
8. Nockold, Knox and Chinner (1978) Petrology for students, Cambridge Univ. Press., Cambridge
9. Pettijohn, F.J. (1975) Sedimentary Rocks, 3rd Ed. Harper and Row Publication, New Delhi
10. Tyrell, G.W. (1978) The Principles of petrology: An Introduction to the Science of Rocks
11. Winkler, H. G.F. (1967) Petrogenesis of Metamorphic Rocks, Springer-Verlag, New York
12. MP Billings (1972) Structural Geology, Prentice Hall, U.K.

Palaeontology and Stratigraphy

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

After the completion of this course, students will be able to

- Explain the principal elements of fossil preservation.
- Identify fossils based on morphology and evolutionary trends.
- Identify major lithotectonic units of India.
- Describe the geological evolution of the Earth and Indian continent.

Course Content:

Unit I Palaeontology: Definition, subdivisions and its relationship with stratigraphy. Fossils: definition and mode of preservation of fossils (body and trace fossils). Index fossils. Incompleteness of fossils record. Elementary ideas about origin and evolution of life.

Unit II Morphology and geological distribution of the following fossil groups in India:

- a. Phylum Mollusca (Class: Lamellibranchia or Bivalvia, Class: Gastropoda and Class Cephalopoda)
- b. Phylum Brachiopoda
- c. Phylum Echinodermata (Class Echinodea)
- d. Phylum Cnidaria (Corals)

Unit III Morphology and geological distribution of the following fossil groups in India:

- a. Phylum Arthropoda (Class Trilobita)
- b. Phylum Hemichordata (Class Graptolithina)

Introduction to palaeobotany. Brief account of Gondwana Supergroup and its flora. Introduction to Micropaleontology: foraminifera.

Unit IV Stratigraphy: definition and its scope. Principles of stratigraphy. Stratigraphic classification (Lithostratigraphy, Biostratigraphy and Chronostratigraphy) and correlation (Lithostratigraphy, Biostratigraphy and Subsurface). Brief account stratigraphic succession, correlation and economic significance of Dharwar, Aravallis, Cuddapah and Vindhya.

Unit V Brief account of Phanerozoic stratigraphic successions of Indian subcontinent as mentioned below:

Paleozoic (Spiti and Kashmir), Mesozoic (Spiti, Kutch and Jaisalmer) and Cenozoic (Assam and Siwaliks). Stratigraphic boundaries: Precambrian-Cambrian, Permian-Triassic and Cretaceous-Tertiary

Recommended Books:

1. Black, R. M. (1988). *The Elements of Palaeontology* (2nded.). Cambridge, UK: Cambridge University Press.
2. Boggs, S. (2001). *Principles of Sedimentology and Stratigraphy* (3rded.). New Jersey, NJ: Prentice Hall.
3. Jain, P. C. & Anantharaman, M. S. (1983). *Palaeontology: Evolution and Animal Distribution*. New Delhi, India: Vishal.
4. Krishnan, M. S. (1968). *Geology of India and Burma* (6thed.). Madras, India: CBS.
5. Kumar, R. (1978). *Historical Geology and Stratigraphy of India*. New Delhi, India: New Age International.
6. Lehmann, U. & Hilmer, G. (1983). *Fossil Invertebrate*. Cambridge, UK: Cambridge Earth Science Series.
7. Moore, R. C. Lalicker, C. G. & Fischer, A. G. (1997). *Invertebrate Fossils*. New Delhi, India: CBS.
8. Nield, E. W. & Tucker, V. C. T. (1985) *Palaeontology: An Introduction*. London, UK: Pergamon Press.
9. Prothero, D. R. (2004). *Bringing Fossil to Life – An Introduction to Paleontology* (2nded.). New York, NY:

McGraw Hill.

10. Ramakrishnan, M. & Vaidyanathan, R. (2010). *Geology of India* (Vol. 1). Bangalore, India: Geological Society of India.
11. Ramakrishnan, M. & Vaidyanathan, R. (2010). *Geology of India* (Vol. 2). Bangalore, India: Geological Society of India.
12. Shrock, R. R. & Twenhoffel, W. H. (1952). *Principles of Invertebrate Paleontology*. New Delhi, India: CBS.
13. Wadia, D. N. (1961). *Geology of India* (3rded.). London, UK: English language.
14. Weller, J. M. (1960). *Stratigraphic Principles and Practices*. New Delhi, India: Universal Book.
15. Woods, H. (2004). *Palaeontology Invertebrate* (8thed.). New Delhi, India: CBS.

Suggested e-learning materials:

1. Morphology of fossils
<http://www.ga.gov.au/scientific-topics/disciplines/palaeontology>
2. International Commission on stratigraphy
<http://www.stratigraphy.org/>
3. International Chronostratigraphic Chart
<http://www.stratigraphy.org/index.php/ics-chart-timescale>
4. Morphology of Fossils
<https://www.palaeontologyonline.com/>

Palaeontology and Stratigraphy Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After the completion of this course, students will be able to:

- Transform a stratigraphic cross-section into a historical summary.
- Explain Stratigraphy and broad tectono-stratigraphic divisions of India through maps.
- Identify different lithotectonic units of India and establish their stratigraphic correlations.
- Explain the morphological characters of different genera of fossils.

Course Content:

1. Study of morphological characters of different genera pertaining to Brachiopoda, Lamellibranchia, Cephalopoda, Gastropoda, Trilobita, Echinoidea and Anthozoa.
2. Preparation of lithostratigraphic maps of India showing distribution of the following: Dharwar, Cuddapah, Vindhyan.
3. Distribution of Gondwana Rocks in map of India.
4. Study of important Rocks of Rajasthan.

Recommended Books:

1. Black, R. M. (1988). *The Elements of Palaeontology* (2nded.). Cambridge, UK: Cambridge University Press
2. Boggs, S. (2001). *Principles of Sedimentology and Stratigraphy* (3rded.). New Jersey, NJ: Prentice Hall.
3. Jain, P.C. & Anantharaman, M. S. (1983). *Palaeontology: Evolution and Animal Distribution*. New Delhi, India: Vishal.
4. Krishnan, M. S. (1968). *Geology of India and Burma* (6thed.). Madras, India: CBS.
5. Kumar, R. (1978). *Historical Geology and Stratigraphy of India*. New Delhi, India: New Age International.
6. Lehmann, U. & Hilmer, G. (1983). *Fossil Invertebrate*. Cambridge, UK: Cambridge Earth Science Series.
7. Moore, R. C. Lalicker, C. G. & Fischer, A. G. (1997). *Invertebrate Fossils*. New Delhi, India: CBS.
8. Nield, E. W. & Tucker, V. C. T. (1985) *Palaeontology: An Introduction*. London, UK: Pergmon Press.
9. Prothero, D. R. (2004). *Bringing Fossil to Life – An Introduction to Paleontology* (2nded.). New York, NY: McGraw Hill.
10. Ramakrishnan, M. & Vaidyanathan, R. (2010). *Geology of India* (Vol. 1). Bangalore, India: Geological Society of India.
11. Ramakrishnan, M. & Vaidyanathan, R. (2010). *Geology of India* (Vol. 2). Bangalore, India: Geological Society of India.
12. Shrock, R. R. & Twenhoffel, W.H. (1952). *Principles of Invertebrate Paleontology*. New Delhi, India: CBS.
13. Wadia, D. N. (1961). *Geology of India* (3rded.). London, UK: English.
14. Weller, J. M. (1960). *Stratigraphic Principles and Practices*. New Delhi, India: Universal Book.
15. Woods, H. (2004). *Palaeontology Invertebrate* (8thed.). New Delhi, India: CBS.

Suggested e-learning materials:

1. Palaeontology
<http://www.ga.gov.au/scientific-topics/disciplines/palaeontology>
2. International Chronostratigraphic Chart
<http://www.stratigraphy.org/index.php/ics-chart-timescale>
3. Global standard Section and Points (GSSPs)
<http://www.stratigraphy.org/index.php/ics-gssps>
4. Fossils <https://www.palaeontologyonline.com/>

Geochemistry, Geomorphology Photogeology and Remote Sensing

L T P C

6 0 0 6

Max. Marks : 90

(CA : 30 + ESA : 60)

Geochemistry

Unit 1 Definition and scope, Composition of Earth and its constituents. Geochemical classification of elements. Principles of ionic substitutions in minerals. Radioactivity: Radioactive decay schemes decay constant, half life, parent-daughter relations. Radioactive and Stable isotopes: application and their use in geology.

Geomorphology

Unit 2 Definition and scope. Fundamental concepts. Weathering and its types. Fluvial cycle of erosion. Drainage patterns and their significance. Soil: Formation, soil profile and soil type. Physiographic subdivisions of India and their characteristics.

Unit 3 Geological work of wind, rivers, glaciers, oceanic current and their associated erosional and depositional landforms.

Photogeology and Remote Sensing

Unit 4 Introduction to Aerial photography. Types of aerial photos. Types of camera, film and filters. Multispectral Photography. Flight plan - location/area, purpose, time and season of photography. Introduction to overlap, sidelap, crab and fiducial marks. Geometric, Principles of aerial photographs-relief and tilt displacement. Distortion and Vertical exaggeration.

Taking measurement from aerial photographs: scale, distance, area and height. Elements of interpretation of aerial photograph.

Unit 5 Remote Sensing : Definition and principles. Energy used in remote sensing. Types of electromagnetic radiation (EMR). Energy interaction with Earth surface and atmosphere. Type of sensors: active and passive. Platforms. Scanning mechanism. Orbiting mechanics. Resolutions - Spectral, spatial, radiometric and temporal. Image Interpretation.

Application of photo geology and remote sensing.

**Geochemistry, Geomorphology Photogeology and
Remote Sensing Lab**

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA :20)

1. Calculations based on ratioactive method.
2. Identification of different drainage patterns.
3. Elementary study of aerial photographs.
4. Visual interpretation of aerial photograph.
5. Stereo-pair interpretation and depth perception.
6. Visual interpretation of standard FCC data.

Books Recommended:

1. Bhatia, S.S. (2008) : Fundamental of Remote sensing, Atlantic Publishers and Distributors, New Delhi.
2. David P. Paine and James D. Kiser (2012) : Aerial Photography and Image Interpretation, John Wiley and Sons, Inc., New York.
3. Faure, G. and Mensing, T.M. (2005) : Isotope, principles and applications. 3rd ed. John Wiley and Sons, New York.
4. George H. Davis, Stephen J. Reynolds, Charles, F. Kluth (2013) : Structural Geology of Rocks and region, 3rd ed. John Wiley and Sons, Inc., New York.
5. Mason, B. and Moore, C.B. (1982) : Introduction to Geochemistry, Wiley Eastern, New York.
6. Pandey, S.N. (2001) : Principle and applications of photogeology.
7. Patell, A.N., Surrender Singh (2011) : Principle of remote sensing. Scientific publishers, New Delhi.
8. Rampal, K.K. (1999) : Handbook of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi.
9. Sabbins, F.F. (1985) : Remote Sensing-Principles and applications, Freeman, New York.
10. Singh, S. (2006) Physical Geomorphology, Prayag Pustak Bhawan, Allahabad.
11. Thornbury, W.D. (2005) Principles of Geomorphology, John Wiley and Sons, New Delhi (India Reprint).

Hydrogeology, Environmental and Engineering Geology

L T P C

6 0 0 6

Max. Marks : 90

(CA : 30 + ESA : 60)

Hydrogeology

- Unit 1** Definition, Hydrological cycle, Precipitation, evaporation, transpiration and infiltration. Groundwater provinces of India.
- Unit 2** Darcy's law and its validity, Explorations of ground water. Ground water level fluctuation, Physical and chemical properties of Ground water.
- Unit 3** Origin and age of groundwater, Vertical distribution of groundwater, Types of aquifers, Water bearing properties of rocks Porosity and Permeability, Different types of springs and their formations, Groundwater recharge.

Environmental Geology

- Unit 4** Definition and concepts of environmental geology, General idea about components and composition of different environmental domains such as atmosphere, hydrosphere and biosphere. Types of environment and environmental parameters, Environmental pollution, Green house effect. Elements of geological hazards.

Engineering Geology

- Unit 5** Elementary concept of rock and soil mechanics, Role of Geology in civil engineering: Geological site investigations, foundation treatment and geotechnical considerations for construction of dams and reservoirs, tunnels, bridges and highway.

Hydrogeology, Environmental and Engineering Geology Lab

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

1. Groundwater provinces of India.
2. Major hydro-geochemical provinces of India.
3. Preparation of water table contour map and their interpretation.
4. Determination of permeability by falling and constant head method.
5. Graphical presentation of water quality data.
6. Exercises based on chemical analysis of Groundwater.
7. Preparation of seismic and flood zonation maps of India.

Books Recommended :

1. Bryant, E. (1985) : Natural Hazards, Cambridge Univ. Press, Cambridge.
2. Davies, S.N. and De Wiest, R.J.N. (1966) : Hydrogeology, John Wiley and Sons, New York.
3. F.G. Bell (2009) : Fundamentals of engineering Geology by BS Publications, Hyderabad.
4. H.M. Raghunath (2010) Groundwater, New Age International Publishers, New Delhi.
5. Johnson, R.B. and DeGraft, J.V. (1988) : Principle of engineering geology, John Wiley, New York.
6. Karnath, K. R. (1989) : Hydrogeology, Tata McGraw Hill Pub., New Delhi.
7. Keller, E.A. (1978) : Environmental Geology, Bell and Howell, USA.
8. Luis Gonzalez de Vallejo and Mercedes Ferrer (2011) : Geological Engineering, CRC Press, Netherland.
9. M.T. Maruthesha Reddy (2008) : A Text Book of Applied Engineering Geology, New Age International Publuishers, New Delhi.
10. N. Chenna Kesavulu (2014) : Text Book of Engineering Geology, Trinity Press, New Delhi.
11. Nagabhushaniah, H.S. (2001) : Groundwater in Hydrosphere, CBS Pub., New Delhi.
12. Prabin Singh, (2011) : Engineering and General Geology, S.K. Kataria & Sons, New Delhi.
13. Raghunath, H.M. (1990) : Groundwater, Wiley Eastern Ltd., New Delhi.
14. Subinoy Gangopadhyay (2013) : Engineering Geology by, Oxford University Press, New Delhi.
15. Todd, D.K. (1995) : Groundwater hydrology, John Wiley and Sons, New York.
16. Tolman, C.F. (1937) : Groundwater, McGraw Hill Book Co., New York.
17. Valdiya, K.S. (1987) : Environmental Geology - Indian Context, Tata McGraw Hill, New Delhi.

Hydrogeology, Environmental and Engineering Geology Lab

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA : 20)

1. Groundwater provinces of India.
2. Major hydro-geochemical provinces of India.
3. Preparation of water table contour map and their interpretation.
4. Determination of permeability by falling and constant head method.
5. Graphical presentation of water quality data.
6. Exercises based on chemical analysis of Groundwater.
7. Preparation of seismic and flood zonation maps of India.

Books Recommended :

1. Bryant, E. (1985) : Natural Hazards, Cambridge Univ. Press, Cambridge.
2. Davies, S.N. and De Wiest, R.J.N. (1966) : Hydrogeology, John Wiley and Sons, New York.
3. F.G. Bell (2009) : Fundamentals of engineering Geology by BS Publications, Hyderabad.
4. H.M. Raghunath (2010) Groundwater, New Age International Publishers, New Delhi.
5. Johnson, R.B. and DeGraft, J.V. (1988) : Principle of engineering geology, John Wiley, New York.
6. Karnath, K. R. (1989) : Hydrogeology, Tata McGraw Hill Pub., New Delhi.
7. Keller, E.A. (1978) : Environmental Geology, Bell and Howell, USA.
8. Luis Gonzalez de Vallejo and Mercedes Ferrer (2011) : Geological Engineering, CRC Press, Netherland.
9. M.T. Maruthesha Reddy (2008) : A Text Book of Applied Engineering Geology, New Age International Publuishers, New Delhi.
10. N. Chenna Kesavulu (2014) : Text Book of Engineering Geology, Trinity Press, New Delhi.
11. Nagabhushaniah, H.S. (2001) : Groundwater in Hydrosphere, CBS Pub., New Delhi.
12. Prabin Singh, (2011) : Engineering and General Geology, S.K. Kataria & Sons, New Delhi.
13. Raghunath, H.M. (1990) : Groundwater, Wiley Eastern Ltd., New Delhi.
14. Subinoy Gangopadhyay (2013) : Engineering Geology by, Oxford University Press, New Delhi.
15. Todd, D.K. (1995) : Groundwater hydrology, John Wiley and Sons, New York.
16. Tolman, C.F. (1937) : Groundwater, McGraw Hill Book Co., New York.
17. Valdiya, K.S. (1987) : Environmental Geology - Indian Context, Tata McGraw Hill, New Delhi.

Advance Geomorphology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Analyze the relation between geomorphological processes and landscape formation.
- Explain the structure of earth's interior.
- Describe endogenetic and exogenetic activities transforming the earth.
- Apply geomorphological knowledge in research related to land-use, mining and agriculture.

Course Content:

Section A

Geomorphology and Theories in Geomorphology

Geomorphology - Nature and scope; Development of geomorphological thought; The Earth's interior - Structure and constitution, recent views; Theories in Geomorphology- Theory of Isostasy- the concept of Sir George Airy and Pratt; Theories of Orogenesis – Geosynclines Orogen theory of Kober; Continental drift theory of A.G. Wegner.

Section B

Endogenetic Process

Plate tectonics- concept; plate margins and boundaries and distribution of plates; Endogenetic processes - Faulting, Folding and their geomorphic expressions; Earthquake- Concept, causes, classification, intensity and magnitude, geographical distribution; Volcanism- Concept, mechanisms and causes; Volcanoes- Classification, volcanic materials, topography associated with volcanicity and geographical distribution of volcanoes; Rocks and types of rocks.

Section C

Exogenetic Process and Regional Geomorphology

Exogenetic Process- Weathering, Mass wasting and Erosion – meaning, type and controlling factors; Geomorphic processes and resulting landforms-Fluvial, Arid, Glacial, Karst and Coastal; Application of Geomorphology to human activities:Land-use, Mining, Agriculture.

Stencils are to be permitted during the examination.

Recommended Books:

1. Bloom, A. L. (2009). *Geomorphology* (3rded.). New Delhi, India: Prentice Hall.
2. Chorley, R. J., Schumm, S. A., & Sugden, D. E. (1984). *Geomorphology*. London, UK: Methuen.
3. Dayal, P. (2010). *A Text Book of Geomorphology* (5thed.). New Delhi, India: Kalyani.
4. Fairbridge, R. W. (Ed.). (1968). *Encyclopedia of Geomorphology*. New York, NY: Reinhold Book Corporation.

5. Gregory, K. J., & Walling, D. E. (1973). *Drainage Basin Form and Process*. London, UK: Edward Arnold.
6. Gutierrez, M. (2013). *Geomorphology*. London, UK: Taylor and Francis.
7. Huggett, R.J.(2018). *Fundamentals of Geomorphology*. New York, NY: Routledge
8. Husain, M. (2002). *Fundamentals of Physical Geography* (4thed.). Jaipur, India: Rawat.
9. Kale, V., & Gupta, A. (2010). *Introduction to Geomorphology*. Hyderabad, India: Orient Longman.
10. Singh, S. (2013). *Geomorphology* (5thed.). Allahabad, India: Prayag Pustak Bhawan.
11. Strahler, A. N. (2016). *Introducing Physical Geography* (6thed.). New York, NY: John Wiley & Sons.

Cartographic Techniques Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students should be able to:

- Diagrammatically display secondary and primary data through diagrams for all three dimensions.
- Have an understanding of map projections which further helps in cartography.
- Interpret toposheets and open series maps for applied aspects.
- Use the tools of cartography for research purpose.

Course Content:

Cartography – Techniques and Tools of Cartography.

1. Introduction and Interpretation of Topographical maps, calculate nearest neighbour analysis.
2. Profiles – The method of drawing a profile, Types of profiles – serial, superimposed, projected, composite.
3. Mathematical Construction of Map Projections:-
4. Conical Projections:
 - Simple conical projection with one standard Parallel
 - Conical projection with two standard parallel.
 - Bonne's Projection
 - Polyconic Projection
5. Cylindrical Projections:
 - Cylindrical equidistant projection
 - Mercator's projection
6. Zenithal Projections:
 - Polar zenithal equal area projection
 - Orthographic polar Zenithal projection
7. Conventional Projection: - Mollweide's Projection
8. Representation of Statistical data using Microsoft Excel
9. Geological Maps: Determination of Dip and Strike.

Non – scientific calculators are allowed during the examination.

Recommended Books:

1. Mishra, R. P., & Ramesh, A. (2002). *Fundamentals of Cartography*. New Delhi, India: Concept.
2. Saha, P., & Basu, P. (2011). *Advanced Practical Geography*. Kolkatta, India: Books and Allied.
3. Singh, L. R. (2011). *Fundamentals of Practical Geography*. Allahabad, India: Sharda Pustak Bhawan.

4. Singh, R. L. (2011). *Elements of Practical Geography*. New Delhi, India: Kalyani.
5. तिवारी, आर. सी., एवं त्रिपाठी, एस. (2014). *अभिनव प्रयोगात्मक भूगोल*. इलाहाबाद, भारत: प्रवालिका.
6. भल्ला, एल. आर. (2006). *प्रयोगात्मक भूगोल*. अजमेर, भारत: कुलदीप.
7. शर्मा, जे. पी. (2012). *प्रायोगिक भूगोल* मेरठ. भारत: रस्तोगी.
8. सिंह, एल. आर. (2011). *मानचित्र एवं प्रयोगात्मक भूगोल*. इलाहाबाद, भारत: सेन्ट्रल बुक डिपो.

Suggested e-learning materials:

1. Map Projection
<https://www.gislounge.com/map-projection/>
2. Dip & Strike <http://www.jsu.edu/dept/geography/mhill/phylabtwo/lab4/dipf.html>

Economic and Resource Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe and develop the approaches to economic and resource geography.
- Describe the resource related issues, map them systematically.
- Explain the interference of world trading blocs in international economics.
- Describe the non-conventional resources and their usability and apprise public about the depletion of resources.

Section A

Economic Geography: An Introduction

Definition and scope of Economic Geography, Approaches to the study of Economic Geography: Systematic, Regional, System Analysis, Behavioral, Welfare and Environmental; Sectors of Economy: Primary, Secondary, Tertiary and Quaternary; Factors affecting the location of economic activities; Trade: Evolution of International Trade, Factors affecting International trade, World Trading Blocs: NAFTA, EUROPEAN UNION, OPEC and SAARC.

Section B

Mineral and Energy Resources

Meaning and concept of resource; Classification of resources – on the basis of availability, distribution & frequency of occurrence and use of resources; Production and distribution of mineral resources: Iron ore and copper; Energy Resources: Conventional Resources; Coal: Uses of coal, Principal coalfields of the world, Production of coal in the world; Decline of coal in world fuel supplies; Petroleum: Origin and uses of Oil, Distribution of oilfields in the world, Production and Trade of Oil in the world, Petroleum Reserves and the future of the Oil industry; Non – Conventional Resources: Solar, Wind.

Section C

Industries and Locational Theories

History of Industrial Development; classification of industries; Location Theories: Weber and Losch; Iron and Steel Industry; changing location of the Iron and Steel Industry; Cotton Textile Industry: Distribution, Production and Trade in the world.

Stencils are to be permitted during the examination.

Recommended Books:

1. Gautam, A. (2010). *Advanced Economic Geography*. Allahabad, India: Sharda Pustak Bhawan.
2. Guha, J. L., & Chattoraj, P. R. (2009). *Economic geography – A Study of Resources* (9th ed.). Kolkata, India: The World Press.
3. Hartshorn, T. A., & Alexander, J. W. (2009). *Economic Geography* (8th ed.). New Delhi, India: Prentice Hall.
4. Leong, G. C., & Morgan, G. C. (2010). *Human and Economic Geography* (2nd ed.). New Delhi, India: Saurabh.

5. Siddharth, K. (2018). *Economic Geography* (3rd ed.). Allhabad, India: Kitab Mahal.
6. गौतम, ए. (2015). *आर्थिक भूगोल*. मेरठ, भारत: रस्तोगी.
7. जाट, बी. सी. (2016). *आर्थिक भूगोल* (चतुर्थ सं.). जयपुर, भारत: पंचशील.
8. मामोरिया, सी. (2012). *आर्थिक भूगोल* (द्वितीय सं.). आगरा, भारत: साहित्य भवन.
9. सिंह, के. (1978). *मानव और आर्थिक भूगोल* (द्वितीय सं.). वाराणसी, भारत: तारा.
10. सिंह, के. (2009). *आर्थिक भूगोल के मूलतत्त्व : संसाधन उपयोग, संरक्षण एवं आर्थिक विकास का अध्ययन* (11 वाँ सं.) वाराणसी, भारत: ज्ञानोदय.
11. सिंह, के. एन., एवं सिंह, जे. (2010). *आर्थिक भूगोल के मूलतत्त्व* (11 वाँ सं.). गोरखपुर, भारत: ज्ञानोदय.
12. सिंह, जे. (2009). *संसाधन भूगोल*. नई दिल्ली, भारत: राधा.

Suggested e-learning materials:

1. International trade
<https://gspp.berkeley.edu/assets/uploads/research/pdf/ssrn-id1783908.pdf>
2. NAFTA [https://idatd.cepal.org/Normativas/TLCAN/Ingles/North American Free Trade Agreement-NAFTA.pdf](https://idatd.cepal.org/Normativas/TLCAN/Ingles/North%20American%20Free%20Trade%20Agreement-NAFTA.pdf)

Geographical Thoughts and Concepts

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Analyze the work of several scholars and their contribution to the field.
- Analyze the historical works and extract geographical information from them.
- Describe the concepts, paradigms and models in Geography.
- Develop an individual approach towards the subject.

Course Content:

Section A

Development of Geographical Thought

Ancient period: Indian, Greek and Roman contribution with special reference of Aryabhata, Eratosthenes and Ptolemy; Medieval period: contribution of Arab scholars with special reference of Al-Masudi, Al-Biruni; Modern period: Contribution of German (Humboldt, Ritter, Ratzel), French (Blache, Brunhes), British (Mackinder), American (Semple, Sauer), Soviet (Peter Kropotkin) Scholars.

Section B

Concepts, Paradigms and Models in Geography

Concept of dualisms in Geography- Physical vs. Human Geography, Systematic vs. Regional Geography; Meaning of Paradigms, Paradigm shift and Changing Paradigms of Geography; Models- Meaning, Definition, Characteristics, Types and Utility; Scientific Explanation in Geography; System analysis- Meaning, structure and types.

Section C

Contemporary Development

Quantitative Revolution in Geography; Welfare Geography; Radical Geography; Gender Geography.

Stencils are to be permitted during the examination

Recommended Books:

1. Daniels, P., Bradshaw, M., Shaw, D., & Sidaway, J. (2008). *An Introduction to Human Geography: Issues for the 21st Century* (3rded.). London, UK: Prentice Hall.
2. Dikshit, R. D. (2018). *A Contextual History of Ideas* (2nded.). New Delhi, India: PHI.
3. Hussain, M. (2014). *Evolution of Geographical thought* (6thed.). New Delhi, India: Rawat .
4. Kaushik, S. D., & Rawat. D. S. (2017). *Geographical thought and Methodology*. Meerut, India: Rastogi.
5. Martin, G. (2007). *All Possible Worlds. A History of Geographical Ideas* (4thed.). New York, NY: Oxford University Press.

6. Maurya, S. D. (2013). *History Of Geographical Thought*. Allahabad, India: Sharda Pustak Bhawan.
7. Rana, L. (2008). *Geographical thought A systematic record of evolution*. New Delhi, India: Concept.
8. Singh, M. (2016). *Geographical Thought*. New Delhi, India: Sonali.
9. कौशिक, एस. डी., एवं रावत, डी. एस. (2017). *भौगोलिक विचारधारा एवं विधि तंत्र* (नवम् सं.). मेरठ, भारत: रस्तोगी.
10. जैन, एस. एम. (2018). *भौगोलिक चिन्तन का विकास* (संशोधित सं.). आगरा, भारत: साहित्य भवन.
11. प्रसाद, जी. (2006). *भौगोलिक संकल्पनाएँ*. नई दिल्ली, भारत: डिसकवरी.
12. मौर्य, एस. डी. (2015). *भौगोलिक चिन्तन का इतिहास*. इलाहाबाद, भारत: प्रयाग पुस्तक भवन.
13. सिंह, जे. (2009). *भौगोलिक चिन्तन के मूल आधार*. नई दिल्ली, भारत: वसुन्धरा.
14. हुसैन, एम. (2006). *भौगोलिक चिन्तन का इतिहास*. जयपुर, भारत: रावत.

Suggested e-learning materials:

1. Dualism
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-16
2. System Analysis
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-26
3. Quantitative Revolution
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-25
4. Explanation in Geography <https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-32
5. Gender Geography
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-33

Introduction to Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the nature of the subject and understand the geographical knowledge in ancient civilizations.
- Develop an understanding of latitudes, longitudes, rotation, revolution, day and night and seasons.
- Explain human dimensions in geography in context of several tribes and their economic activities.
- Know the human adaptation to the environment in relation to several tribes.

Course Content:

Section A

Geography its nature and development

Geography- Nature, Meaning, Scope and branches; Main regions of geographical knowledge in Ancient Time with special referenc

Geographical Thoughts and Concepts

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Analyze the work of several scholars and their contribution to the field.
- Analyze the historical works and extract geographical information from them.
- Describe the concepts, paradigms and models in Geography.
- Develop an individual approach towards the subject.

Course Content:

Section A

Development of Geographical Thought

Ancient period: Indian, Greek and Roman contribution with special reference of Aryabhata, Eratosthenes and Ptolemy; Medieval period: contribution of Arab scholars with special reference of Al-Masudi, Al-Biruni; Modern period: Contribution of German (Humboldt, Ritter, Ratzel), French (Blache, Brunhes), British (Mackinder), American (Semple, Sauer), Soviet (Peter Kropotkin) Scholars.

Section B

Concepts, Paradigms and Models in Geography

Concept of dualisms in Geography- Physical vs. Human Geography, Systematic vs. Regional Geography; Meaning of Paradigms, Paradigm shift and Changing Paradigms of Geography; Models- Meaning, Definition, Characteristics, Types and Utility; Scientific Explanation in Geography; System analysis- Meaning, structure and types.

Section C

Contemporary Development

Quantitative Revolution in Geography; Welfare Geography; Radical Geography; Gender Geography.

Stencils are to be permitted during the examination

Recommended Books:

15. Daniels, P., Bradshaw, M., Shaw, D., & Sidaway, J. (2008). *An Introduction to Human Geography: Issues for the 21st Century* (3rd ed.). London, UK: Prentice Hall.
16. Dikshit, R. D. (2018). *A Contextual History of Ideas* (2nd ed.). New Delhi, India: PHI.
17. Hussain, M. (2014). *Evolution of Geographical thought* (6th ed.). New Delhi, India: Rawat .
18. Kaushik, S. D., & Rawat. D. S. (2017). *Geographical thought and Methodology*. Meerut, India: Rastogi.

19. Martin, G. (2007). *All Possible Worlds. A History of Geographical Ideas* (4thed.). New York, NY: Oxford University Press.
20. Maurya, S. D. (2013). *History Of Geographical Thought*. Allahabad, India: Sharda Pustak Bhawan.
21. Rana, L. (2008). *Geographical thought A systematic record of evolution*. New Delhi, India: Concept.
22. Singh, M. (2016). *Geographical Thought*. New Delhi, India: Sonali.
23. कौशिक, एस. डी., एवं रावत, डी. एस. (2017). *भौगोलिक विचारधारा एवं विधि तंत्र* (नवम् सं.). मेरठ, भारत: रस्तोगी.
24. जैन, एस. एम. (2018). *भौगोलिक चिन्तन का विकास* (संशोधित सं.). आगरा, भारत: साहित्य भवन.
25. प्रसाद, जी. (2006). *भौगोलिक संकल्पनाएँ*. नई दिल्ली, भारत: डिसकवरी.
26. मौर्य, एस. डी. (2015). *भौगोलिक चिन्तन का इतिहास*. इलाहाबाद, भारत: प्रयाग पुस्तक भवन.
27. सिंह, जे. (2009). *भौगोलिक चिन्तन के मूल आधार*. नई दिल्ली, भारत: वसुन्धरा.
28. हुसैन, एम. (2006). *भौगोलिक चिन्तन का इतिहास*. जयपुर, भारत: रावत.

Suggested e-learning materials:

6. Dualism
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-16
7. System Analysis
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-26
8. Quantitative Revolution
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-25
9. Explanation in Geography <https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-32
10. Gender Geography
<https://epgp.inflibnet.ac.in/ahl.php?csrno=17> P-06, M-33

Climatology

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe climate and climatic factors such as temperature, pressure, insolation and their distribution.
- Describe the origin and location of winds with world map.
- Explain Air masses, fronts, Jet streams and their impacts.
- Explain the relation of climate with agriculture, urban planning and health.

Course Content:

Section A

Climatology and Structure of Atmosphere

Definition & scope of Climatology; Structure and composition of Atmosphere, Insolation and heat budget of the earth; Distribution of Global Temperature: Vertical and Horizontal, Temperature inversion; Atmospheric Equilibrium: Stability and Instability; Distribution of atmospheric pressure: pressure belts and winds.

Section B

Special Weather Phenomenon

Jet streams and monsoon winds; Ocean atmospheric interaction: EL-Nino, Southern Oscillation and La-Nina; Atmospheric moisture: Humidity, evaporation and condensation, Precipitation: Types and world pattern of Precipitation; Concepts of Air masses: Types and distribution; Fronts: Origin, growth and classification of fronts. Frontogenesis and Frontolysis.

Section C

Disturbances and Applied Climatology

Cyclones: Tropical and Temperate; Anticyclones: Types of anticyclones, blocking highs; Climate Types and their distribution; Global climatic changes: Indicators and Theories - Astronomical or Orbital Theories, Theories Involving Change in the Composition of Atmosphere, Theories Involving Change in Solar Radiation; Applied Climatology: Climate and Agriculture; Climate and Housing, Climate and diseases, Climate and Urban planning

Stencils are to be permitted during the examination.

Recommended Books:

1. Agarwal, S. K. (2013). *Global Warming and Climate Change (Past, Present and future)*. New Delhi, India: A. P. H.
2. Critchfield, J. H. (2009). *General Climatology* (4thed.). Delhi, India: Prentice Hall.
3. Hussain, M. (2003). *Climatology*. New Delhi, India: Anmol.
4. Lal, D. S. (2014). *Climatology*. Allahabad, India: Sharda Pustak Bhawan.
5. Malhotra, R. (2010). *Climatology*. New Delhi, India: Global Vision.
6. Mehtani, S., & Sinha, A. (2010). *Climatology*. New Delhi, India: Commonwealth.
7. Singh, S. (2006). *Physical Geography*. Allahabad, India: Prayag.

8. Strahler, A. N. (2016). *Introducing Physical Geography* (6thed.). New York, NY: John Wiley & Sons.
9. Strahler, A. N., & Strahler, A. H. (1977). *Geography and Man's environment*. New York, NY: John Wiley & Sons.
10. लाल, डी. एस. (2009). *जलवायु विज्ञान*. इलाहाबाद, भारत: शारदा पुस्तक भवन.
11. शर्मा, एच. एस. (2014). *भौतिक भूगोल*. जयपुर, भारत: पंचशील.
12. सिंह, एस. (2013). *जलवायु विज्ञान* (अष्ट सं.). इलाहाबाद, भारत: प्रयाग पुस्तक भवन.

Suggested e-learning materials:

1. Cyclones https://www.imdtvm.gov.in/index.php?option=com_content&task=view&id=15&Itemid=30
2. EL Nino
<https://www.nationalgeographic.org/encyclopedia/el-nino/>

Geography of India

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Demarcate India physiographically into major divisions and understand seasons prevailing in the country.
- Locate the several mineral, energy and industrial resources on country's map.
- Describe demographic structure of India.
- Describe the geography of Rajasthan, its resources and problems.

Course Content:

Section A

Physical Features

Physiographic divisions of India: Evolution, Division and Significance of each division; Major river systems of India: Himalayan and the Peninsular river systems; Seasons of India: detail study of Monsoon; Climatic regions of India: Koeppen's climatic regions; Soils of India, major problems and methods of soil conservation.

Section B

Economic & Human Resources

Major mineral resources: Iron ore, manganese and mica; Energy resources: conventional (coal) and non-conventional (solar, wind); Major industries: Iron-steel, cotton textile industries and Industrial regions of India and their problems; Population: Growth, distribution, Composition: density, sex ratio; Means of Transport: Road and Rail.

Section C

Geography of Rajasthan

Physiographic Divisions; Climate; Drainage System; New comprehensive system of Soil Classification; Live stock (Sheep and Camel) and Dairy development.

Stencils are to be permitted during the examination.

Recommended Books :

1. Bhalla, L. R. (2016). *Geography of Rajasthan* (12thed.) Jaipur, India: Kuldeep.
2. Khullar, D. R. (2014). *India, A Comprehensive Geography* (3rded.). Ludhiyana, India: Kalyani.
3. Mishra, V. C. (1967). *Geography of Rajasthan*. New Delhi, India: National Book Trust.
4. Singh, G. (2010). *Geography of India* (9thed.). Delhi, India: Atma Ram.
5. बंसल, एस. सी. (2015). *भारत का भूगोल* (तृतीय सं.). मेरठ, भारत: मीनाक्षी.
6. मामोरिया, सी. (2018). *भारत का वृहत भूगोल*. आगरा, भारत: साहित्य भवन.
7. शर्मा, आर. (2014). *राजस्थान का वृहत भूगोल* (द्वितीय सं.). उदयपुर, भारत, हिमाशुं.
8. शर्मा एच. एस., एवं शर्मा, एम. एल. (2017). *भारत का नूतन भूगोल*. जयपुर, भारत: आर. बी. डी.

9. शर्मा, एच. एस., एवं शर्मा, एम. एल. (2017). *राजस्थान का भूगोल* (13वाँ सं.). जयपुर, भारत: पंचशील.
10. सक्सैना, एच. (2014). *राजस्थान का भूगोल* (12वाँ सं.). जयपुर, भारत: राजस्थान हिन्दी ग्रंथ अकादमी.
11. सक्सैना, एच. एम., सक्सैना, आर., एवं सक्सैना, पी. (2017). *भारत का भूगोल*. जयपुर, भारत: रावत.
12. सिंह, जी. (2006). *भारत का भूगोल*. दिल्ली, भारत: आत्माराम.
13. हुसैन, एम. (2018). *भारत का भूगोल* (सप्तम् सं.). नई दिल्ली, भारत : टाटा मैक्ग्राहिल.

Suggested e-learning materials:

1. Detail study of Monsoon

http://www.imd.gov.in/pages/monsoon_main.php

2. Climate of India

http://www.indiaenvironmentportal.org.in/files/climate_profile.pdf

orphometric Analysis Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students should be able to:

- Relate river actions and the topography of the region.
- Calculate linear, areal, relief and slope related parameters.
- Analyse the nature of river, its structure, direction of flow.
- Analyse the drainage basin, erosional work of any river and its impact over the landscape.

Course Content:

Morphometric Analysis of Drainage Basin :

Selection and delineation of a watershed;

1. Linear Aspects: Mapping of stream network, stream ordering based on Horton and Strahler, Bifurcation ratio
2. Areal Aspects: Basin area, parameter and length, Geometry of basin shape, Calculation and mapping of stream frequency and drainage density.
3. Relief Aspects: Hypsometric analysis- Percentage hypsometric curve, area-height curve and Calculation and mapping of relative relief (Smith's method).
4. Slope Analysis - Calculation and mapping of average slope (Wentworth's method), area-slope curve and slope ogive.

Scientific calculators are allowed during the examination.

Recommended Books:

1. Singh, R. L. (2011). *Elements of Practical Geography* (8th ed.). New Delhi, India: Kalyani.
2. Singh, S. (2010). *Geomorphology*. Allahabad, India: Prayag Pustak Bhawan.
3. Yadav, K. P. (2008). *Applications of Morphometry in Geomorphology*. New Delhi, India: Radha.
4. तिवारी, वी. (2010). *प्रायोगिक भूगोल* आगरा, भारत: रामप्रसाद एण्ड संस.
5. पाण्डेय, ए. (2010). *भू आकृतिक विश्लेषण की अभिनव प्रवृत्तियां*. नई दिल्ली, भारत: डिस्कवरी.
6. मिश्रा, पी. एल. (2013). *प्रयोगात्मक भूगोल*. नई दिल्ली, भारत: विश्वभारती.
7. वर्मा, एल. एन., एवंलोढा, आर. एम. (1999). *प्रयोगात्मक भूगोल*. जयपुर, भारत: राजस्थान हिन्दी ग्रंथ अकादमी.
8. शर्मा, जे. पी. (2011). *प्रायोगिक भूगोल* (पंचम् सं.). मेरठ, भारत: रस्तोगी.

Suggested e-learning materials:

1. Watershed Atlas of India
2. <http://cgwb.gov.in/watershed/about-ws.html>

Oceanography

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the scope of oceanography and morphology of ocean bottoms of Pacific, Atlantic and Indian oceans.
- Have knowledge about the density, salinity, temperature and its distribution in the oceans.
- Explain Coral Reefs, its types and origin.
- Describe the dynamics of the ocean and marine resources.

Course Content:

Section A

Introduction to Oceanography

Oceanography: Definition and Scope; The morphology of the Ocean Bottom: Hypsometric Curve; Bottom Reliefs of Pacific, Atlantic and Indian Oceans; Temperature of the Ocean: Factors affecting the Horizontal distribution of surface Temperature of the oceans, Importance of the ocean water Temperature; Heat Budget of the Oceans, Annual and Diurnal Range of Temperature.; Horizontal and Vertical distribution of Temperature.

Section B

Oceanic Salinity, Density and Deposits

Salinity of Ocean Water: Meaning, Sources and Controlling factors; Horizontal and Vertical distribution of Salinity; Density of Ocean Water: Meaning & controlling factors; Horizontal and Vertical distribution of Density; Ocean Deposits: Meaning and Types

Section C

Circulation of Oceanic Water and Coral Reefs

Ocean Currents: Definition, Types of ocean Currents. Generating and Modifying factors of Ocean Currents; The Currents of the Pacific, Atlantic and Indian Ocean; Tides: Tide producing Forces, Types of Tides, Theories of Ocean Tides: Equilibrium Theory, Progressive Wave Theory and Stationary Wave Theory; Coral Reefs: Required Conditions of Coral Growth, Types of Coral Reefs; Theories of Coral Reef Formation: Darwin's Subsidence Theory, The Non- Subsidence - Theory of Murray; Man and Marine Resources, Marine Pollution: causes, effects measures; Laws of Ocean Protection (UNEP).

Stencils are to be permitted during the examination.

Recommended Books :

1. Gohchingleong. (2011). *Certificate Physical and Human Geography*. New Delhi, India: Oxford University Press.
2. King, C. A. (1965). *Oceanography for Geographers*. London, UK: Edward Arnold.
3. Khullar, D. R. (2014). *Physical Geography*. Ludhiana, India: Kalyani.

4. Murray, S. J. (1913). *Ocean, A General account of the Science of the sea*. London, UK: Thorton Butter Worth.
5. Sharma, R. C., & Vatal, M. (2011). *Oceanography for Geographers*. Allahabad, India: Chaitanya.
6. Siddhartha, K. (2010). *The Earth's Dynamic surface: A textbook on Geomorphology*. New Delhi, India: Kisalya.
7. Siddhartha, K. (2014). *Oceanography. A Brief Introduction*. New Delhi, India: Kisalaya.
8. Singh, S. (2004). *Geomorphology*. Allahabad, India: Prayag.
9. Strahler, A. N., & Strahler, A. H. (2008). *Modern Physical Geography* (4thed.). New Jersey, N.J. : John Wiley & Sons.
10. लाल. डी. एस. (2013). *समुद्र विज्ञान*. इलाहाबाद, भारत: शारदा पुस्तक भवन .
11. शर्मा एच. एस. (2008). *भौतिक भूगोल*. जयपुर, भारत: पंचशील.
12. सिंह, एस. (2005). *भौतिक भूगोल का स्वरूप*. गोरखपुर, भारत: वसुन्धरा.

Suggested e- learning materials:

1. Tides
<https://www.britannica.com/science/tide>
2. Coral reefs
<https://www.britannica.com/science/coral-reef>
3. Ocean bottom reliefs
<https://www.britannica.com/place/Pacific-Ocean>

Regional Development and Planning

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe planning, its types and need.
- Explain region as a concept and describe its types.
- Delineate and demarcate regions with statistical techniques.
- Measure development statistically and have an understanding of development programmes currently existing in the county.

Course Content:

Section A

Concept of Planning and Region

Concept of Planning and its types; Levels of Planning and Need for Planning; Concept of region and its types; Delineation of Regions: Formal regions (Weighted Index method, Factor Analysis method and Composite Index method); Functional regions (Gravitational Analysis and flow analysis).

Section B

Planning Regions and Theoretical Framework

Concept of Planning Regions: Characteristics of Planning Regions; Hierarchy of Planning Regions; The need for planning regions and demarcation of planning regions with special reference to India; Theoretical framework of Regional Planning: Central Place Theory, Growth Pole Theory.

Section C

Development and Regional Disparities

Concept of Development: Indicators and Measurement of Human Development; Historical Perspective of Planning in India – Pre and Post-Independence under the Planning era; Five Year Plans in India: Current five year plan; Regional Disparities in India: Concept of imbalances and inequalities in India, Regional disparities with special reference to agriculture in Rajasthan; Development Programmes in India: Desert Development Programme and Aravalli Development Programme.

Non – scientific calculators are allowed during the exam & stencils are to be permitted during the examination.

Recommended Books:

1. Bhalla, L. R. (2015). *Geography of Rajasthan*. Jaipur, India: Kuldeep.
2. Chand, M., & Puri, V. K. (1983). *Regional Planning in India*. New Delhi, India: Allied.
3. Chandana, R. C. (2000). *Regional Planning*. Ludhiana, India: Kalyani.
4. Chandana, R. C. (2014). *Regional Planning and Development*. New Delhi, India: Kalyani.
5. Chaudhuri, R. J. (2009). *An Introduction to Development and Regional Planning with special reference to India*. Hyderabad, India: Orient Blackswan.
6. Mishra, R. P. (2002). *Regional Planning concepts, Techniques, Policies and Case studies*. New Delhi, India: Concept.
7. Nath, V. (Ed.). (2009). *Regional Development and Planning in India*. New Delhi, India: Concept.
8. Nath, V. (2011). *Administration and Development Planning in India*. New Delhi, India: Concept.

9. Shekhar, S. (2004). *Regional Planning in India*. New Delhi, India: Anmol.
10. Singh, G. (2017). *Regional Planning and Sustainable Development*. Jaipur, India : Shruti.

Suggested e-learning materials:

1. Desert Development Programmes

<http://dolr.gov.in/desert-development-programme-ddp>

2. Five year plans in India

<http://planningcommission.nic.in/plans/planrel/fiveyr/welcome.html>

Population Geography

L T P C

5 0 0 5

Max. Marks : 100

(CA:40+ESA:60)

Section - A : Scope of Population Geography & Demographic Characteristics of the World

- a) Definition and scope of Population Geography and its relation with other sciences.
- b) Recent trends in Population Geography.
- c) Factors affecting the distribution and density of the world's population.
- d) Population growth and distribution in the world.
- e) Recent demographic characteristics of developed and developing nations.

Section - B : Theories of Population Growth and Migration

- a) Theories of Population Growth - Malthusian theory, Optimum population theory and Theory of demographic transition.
- b) Factors affecting population change, Population resource regions of the world.
- c) Migration: Major factors, consequences and types of migration.
- d) Theories of migration: Lee, Ravenstein and Zelinsky's model.
- e) Important migration of the world.

Section - C : Population Geography in India

- a) Development of Population Geography in India.
- b) Population change (birth rate and death rate), Population growth and internal migration
- c) Demographic structure (sex ratio, literacy rate and occupation structure).
- d) Trends of urbanization in India
- e) Population policy of India 2000.

* Note – Stencils are to be permitted during the examination.

Books Recommended:

1. Ahmad A., Noin D., Sharma H.N. (1997): Demographic Transition- The third World Scenario (ed.) Rawat Publication
2. Chandana, R. C (2008): A Geography of population, Kalyani Publishers, New Delhi.
3. Chopra, Girish (2006): Population Geography. Commonwealth Publishers.
4. Gary, L., Peters, Robert, P. Larkin (2008): Population Geography: Problems, Concepts and Prospects. Kendall Hunt Publishing.
5. Graham, David (2009): Population Geography. Routledge.
6. Hassan, MohdIzhar (2005): Population Geography. Rawat Publications.
7. Jhingon M.L., Bhatt B.K., Desai J.N. (2011): Demography, Vrinda Publishers Pvt. Ltd.
8. K. Bruce Newbold (2010): Population Geography:- Tools and Issues. Rowman and Littlefield Publishers, Inc.
9. Khullar.D.R. (2012) India- A comprehensive Geography, Kalyani Publishers
10. Kumar S. (2014): An introduction to Population Geography, ABD Publishers, New Delhi
11. Kumar S. (2014): Basic Principles of Population Geography, ABD Publishers, New Delhi
12. Kumar S. (2014): Elements of Population Geography, ABD Publishers, New Delhi
13. Qazi, S.A. (2006): Population Geography. APH Publishing Corporation.

14. Ranade P.S. (1990): Population Dynamics in India, Ashish Publishing House, New Delhi.
15. Tripathi, R.K. (2007): Population Geography. Commonwealth Publishers.
16. Wilson, (1968): Population Geography, Nelsen Publication.
17. Woods (1982/2000): Theoretical Population Geography, Longman Publication, USA.
18. Yadav J.P. (2004): Population Geography, Anmol Pub. Pvt. Ltd.
19. पंडा, बी. पी. (2007) जनसंख्या भूगोल, मध्य प्रदेश हिन्दी ग्रन्थ अकादमी, भोपाल।

Social Geography

L T P C

5 0 0 5

Max. Marks : 100

(CA:40+ESA:60)

Section – A : Introduction to Social Geography

- a) Meaning, Scope and Aims of Social Geography.
- b) Approaches to the study of social geography: Ecological approach, Regional approach, Historical approach, Welfare approach, System approach and Behavioral approach.
- c) Society: Definition, Origin and Classification of Society.
- d) Social Process: Forms of Social Interaction (Cooperation, Accommodation, Assimilation, Competition, and Conflict).
- e) Social Stratification, Caste and Class, Social Organization and Groups.

Section – B : Society and Culture

- a) Society and Culture.
- b) Cultural Hearths.
- c) Cultural Diffusion: Definition, Elements, and causes of diffusion. Barriers of diffusion, Effects and Types of diffusion. Hagerstrand's model of diffusion.
- d) Cultural Realms: Meaning of Cultural Realms, Basis of delimitation of cultural realms, Modern classification of the cultural realms.
- e) Cultural Regions of the world: Meaning and Bases of delimitation of cultural regions, Cultural Regions United States, U.K., Mesopotamia and Indian.

Section – C : Social Geography in India

- a) Social Geography of India: Indian Society in Historical Perspective.
- b) Status of Women in India.
- c) Social Change in India.
- d) Human Development in India.
- e) Social Planning in India: Meaning, Importance and Major aspects of Social planning. Social Welfare Programmes in Planned Period (Child Welfare Programme, Women Welfare Programme, Labour Welfare Programme, Family Planning and Family Welfare Programme, Adult Education Programme).

* Note – Stencils are to be permitted during the examination.

Books Recommended:

1. Ahmad, Aijazuddin (1999): Social Geography, Rawat Publications, Jaipur And New Delhi.
2. Chris Hamnett (1996): Social Geography (Ed.): A Reader, Wiley – Blackwell, A John Wiley & Sons Lit., Publication, New York.
3. Ghurye, B. S. (1957): Caste and Class in India, Popular Book Depot, Bombay.
4. Guha, B.S. (1944): Racial Elements in India's Population, Oxford University Press, UK
5. Jones, E & Eyles, J. (1979) : An Introduction to Social Geography, Oxford University Press, UK
6. Jones, E. (ed.) (1975) : Readings in Social Geography, Oxford University Press, UK
7. Mohanty, G. S. (2005): Social & Cultural Geography (Ed.), Isha Books Publication, Adharsh Nagar, Delhi.
8. Vincent J. Del Casino Jr (2009): Social Geography - A Critical Introductions, Wiley – Blackwell, A John Wiley & Sons Lit., Publication. New York
9. डॉ. श्रीकान्त दीक्षित एवं डॉ. रामदेव त्रिपाठी(2008)सांस्कृतिक भूगोल, वसुन्धरा प्रकाशन, गोरखपुर।
10. डॉ. एस. डी. मौर्य, सामाजिक भूगोल (2010) शारदा पुस्तकभवन इलाहाबाद।

Political Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Develop an approach to study political geography.
- Describe growth of the states and concept of Geopolitics.
- Differentiate between state and nation and also explain geopolitical issues with special reference to Sino India and Indo Pak.
- Discuss world political and environmental issues.

Course Content:

Section A

Introduction to Political Geography and Geopolitics

Definition and scope of political geography; Approaches to the study of Political Geography – Political-Environmental approach, Power analysis approach, Functional approach and A unified Field Theory; Laws of Spatial Growth of states; Concept of Geopolitics.

Section B

Concept of States and Nation

States and Nation: A historical perspective; The elements of a State and difference between Nation and State; Concept and classification of Frontiers and Boundaries; Buffer states: Nepal and Bhutan; Concept of core areas.

Section C

Global Strategies and International Problems

Geo Strategic Hypothesis-Theory of Heartland and Rimland; The round world perspective: Global strategies in Air age; Concept of Federalism and Politico- Geographic factor in rise of Indian federalism; International problems related with boundaries: Sino-India and India- Pakistan border; Environmental problems and world politics

Stencils are to be permitted during the examination.

Recommended Books:

1. Blacksell, M. (2005). *Political Geography*. London, UK: Routledge.
2. Chopra, G. (2006). *Political Geography*. New Delhi, India: Commonwealth.
3. Dixit, R. D. (2006). *Political geography, the Spatiality of Politics*. New Delhi, India: Tata McGraw-Hill.
4. Flint, C., & Taylor, P. J. (2018). *Political Geography: World-economy, nation-state, and locality* (6th ed.). New Jersey, NJ: Pearson/Prentice Hall.
5. Gallaher, C., Dahlman, C. T., Gilmartin, M., & Mountz, A. (2012). *Key Concept in Political Geography*. California, CA: Sage.

6. Jones, R., Woods., Michael., & Jones., M. (2009). *An Introduction to Political Geography: Space, Place and Politics*. Abingdon, UK: Routledge.
7. Painter., Joe., Jeffrey., & Alex (2010). *Political Geography* (2nd ed.). California, CA: Sage.
8. Singh, I. (2006). *Political Geography*. New Delhi, India: Alfa.
9. Sukhwai, B. L. (1971). *India-A Political Geography*. New Delhi, India: Allied.
10. चौहान, पी. आर. (2010). *राजनीतिक भूगोल*. गोरखपुर, भारत: वसुन्धरा.
11. तिवारी, आर. सी. (2017). *राजनीतिक भूगोल*. इलाहाबाद, भारत: प्रवालिका.
12. सक्सेना, एच. (2010). *राजनीतिक भूगोल* (पंचम् सं.). मेरठ, भारत: रस्तोगी.

Suggested e-learning materials:

1. Geopolitics
[https://www.newworldencyclopedia.org/entry/Indo-pakistani Wars](https://www.newworldencyclopedia.org/entry/Indo-pakistani_Wars)
2. International problems related with boundaries: India- Pakistan border
[http://www.newworldencyclopedia.org/entry/Indo-Pakistani Wars](http://www.newworldencyclopedia.org/entry/Indo-Pakistani_Wars)

Research Methodology and Quantitative Techniques

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

5 0 0 5

Learning Outcomes:

After the completion of this course, students should be able to:

- Analyse the importance of research in geography.
- Design a research proposal and have an understanding about its structure and collection techniques for primary and secondary data.
- Calculate measures of central tendency, dispersion and correlate two phenomena.
- Test the hypothesis of varied samples sizes and nature.

Course Content:

Section A

Significance of Research

Significance of Research in Geographical Studies; Research – Selection & Identification of Research Problem; Research Design-Meaning, characteristics, steps and types; Hypothesis-Meaning, characteristics, types and testing; Data- sources, **levels**, collection techniques, processing and analysis.

Section B

Measures of Central Tendency

Frequency distribution: Histogram and Graphical Representation; Measures of Central tendency: mean, median and mode; coefficient of variation; Measures of Dispersion: Mean deviation, Standard deviation and quartile deviation; Correlation analysis: Karl Pearson's & Spearman's Rank Correlation; **Composite Index**; Sampling and its types.

Section C

Test of Significance

Student 't' test; Mann – Whitney U – Test ; 'F' test ; Chi Square test; Analysis of variance

Non – scientific calculators are allowed during the examination.

Recommended Books:

1. Ahuja, R. (2014). *Research Methods*. Jaipur, India: Rawat.
2. Alvi, Z. (2005). *Statistical Geography Methods and Applications*. Jaipur and New Delhi, India: Rawat.
3. Dadson, S. J. (2017). *Statistical Analysis of Geographical Data An Introduction*. New Jersey, N.J.: John Wiley & Sons.
4. Gupta, S. P. (2012). *Statistical methods*. New Delhi, India: Sultan Chand and sons.
5. Jackson, L. S. (2009). *Research Methods and Statistics*. New Delhi, India: Cengage Learning.
6. Kothari, C. R., & Garg, G. (2014). *Research Methodology Methods and Techniques* (3rd ed.). New Delhi, India: New age International.

7. Kumar, R. (2016). *Research Methods A step-by-step Guide for Beginners* (2nd ed.). Sydney, Australia: Pearson Education and Dorling Kindersley.
8. Mahmood, A. (2017). *Statistical Methods in Geographical studies* (6th ed.). New Delhi, India: Rajesh.
9. Mishra, H. N., & Singh, V. P. (Eds.). (1998). *Research Methodology : Social, spatial and policy dimensions*. Jaipur, India: Rawat.
10. Rao, G. N. (2012). *Research Methodology and quantitative Methods*. Hyderabad, India: B.S.
11. Sarkar, A. (2013). *Quantitative Geography- Techniques and Presentations*. New Delhi, India: Orient Blackswan.
12. नागर, के. एन. (2018). *सांख्यिकीय के मूलतत्त्व*. मेरठ, भारत: मीनाक्षी.

Suggested e-learning materials:

1. Chi-square test <http://ocw.jhsph.edu/courses/fundepiii/PDFs/Lecture17.pdf>
2. Measures of Dispersion
<https://sol.du.ac.in/mod/book/view.php?id=1317&chapterid=106>

Surveying Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students should be able to:

- Handle the surveying instruments- Theodolite, dumpy level and Indian Clinometer.
- Measure the angles and survey different areas through triangulation and traverse method.
- Plot the longitudinal profile of any region through dumpy level.
- Conduct a field survey of any region.

Course Content:

1. Surveying: Definition, Classification, Principles and Errors.
2. Theodolite and Total Station Surveying: Introduction of Theodolite and Total Station surveying, Measurement of angles, Triangulation and Traverse method of Theodolite surveying; Surface generation and contour mapping by Total station; GPS
3. Dumpy level and Auto Level Surveying: Introduction of Dumpy and Auto level surveying. Observation and recording of staff reading. Methods of leveling, Plotting of longitudinal profile by Dumpy level data. Cut & fill and Line Leveling by Auto level.
4. Indian clinometer: Brief introduction of Indian clinometer, method of use and determining the heights of distant points.
5. Field Survey : Scientific calculators are allowed during the examination.

Recommended Books:

1. Duggal, S. K. (2015). *Surveying* (4th ed., Vol. I). New Delhi, India: McGraw Hill.
2. Ghilani, C. D., & Wolf, P. R. (2015). *Elementary surveying an introduction to geomatics* (14th ed.). New Jersey, NY: Pearson.
3. Kanetkar, T. P. (1985). *Surveying and Leveling* (23rd ed., Vol. I). Pune, India: Pune Vidyarthi Griha.
4. Mishra, R. P. (2014). *Fundamentals of Cartography* (2nd ed.). New Delhi, India: Concept.
5. Punmia, B. C., Jain, A. K., & Jain, A. K. (2016). *Surveying* (17th ed., Vol. I). New Delhi, India: Laxmi.
6. पुनमिया, बी. सी., जैन, ए. के., एवं जैन, ए. के. (2016). *सर्वेक्षण एवं क्षेत्र कार्य* (अष्ट सं., प्रथम भाग). नई दिल्ली, भारत: लक्ष्मी.
7. पुनमिया, बी. सी., जैन, ए. के., एवं जैन, ए. के. (2017). *सर्वेक्षण एवं क्षेत्र कार्य* (अष्ट सं., द्वितीय भाग). नई दिल्ली, भारत: लक्ष्मी.
8. शर्मा, जे. पी. (2013). *प्रायोगिक भूगोल* (चतुर्थ सं.). मेरठ, भारत: रस्तोगी.

Suggested e-learning materials:

1. **Introduction to Surveying**

<https://nptel.ac.in/courses/105107122/1>

2. Introduction to Theodolite

<https://nptel.ac.in/courses/105107122/20>

3. Theodolite Measurement

<https://nptel.ac.in/courses/105107122/22>

4. Leveling basics

<https://nptel.ac.in/courses/105107122/13>

5. Profile leveling

<https://nptel.ac.in/courses/105107122/14>

6. Introduction to total station

<https://nptel.ac.in/courses/105107158/17>

Systematic Agricultural Geography

L T P C

5 0 0 5

Max. Marks : 100

(CA:40+ESA:60)

Section – A : Nature & Scope of Agricultural Geography

- a) Nature, scope and significance of Agricultural Geography.
- b) Approaches to the study of Agricultural Geography – Commodity Approach, Regional Approach and systematic approach.
- c) Factors influencing patterns and farm techniques.
- d) Soils – Major soil types, distribution & their characteristics.
- e) Environmental degradation – Causes and consequences.

Section – B : Agricultural Regions & Typology

- a) Whittleseys's classification of Agricultural systems of the world.
- b) Agricultural location theory of Von-thunen and their limitations.
- c) Concept of Agricultural regions and delimitation.
- d) Agricultural Typology.
- e) Methods of Delimitations of crop combination Region – J.C. Weaver's minimum deviation and K. Doi's least square method.

Section – C : Modern Concepts of Agricultural Geography

- a) Concepts in Agricultural geography – Sustainable development. Social forestry, Agribusiness, and dryland farming.
- b) Land classification and land capability.
- c) Agricultural transformation in India posts Independence – Land reforms and land use policy.
- d) Green revolution its implications in India and impact of white revolution in India.
- e) Food deficit and surplus regions of India, Problems of Indian Agriculture, management and planning, National Agriculture Policy.

* Note – Stencils are to be permitted during the examination.

Non – scientific calculators are allowed in the examination.

Books Recommended:

- 1. Ali, Mohammad (1981): Situation of Agricultural Geography, Rajesh publication, New Delhi,
- 2. Ali, Mohammad (1979) Dynamics of Agriculture Development in India, Concept Publication Co. Delhi.
- 3. Chauhan Dharmendra Singh (2010) Agricultural Geography, Ritu Publications. Jaipur

4. Chopra Girish (2006) Agricultural Geography, Commonwealth Publishers.
5. Hanif M. (2005) Encyclopedia of Agriculture Geography, Anmol Publications PVT Ltd.
6. Kostowickie, 2 (1983): Agricultural Typology, Polish Academy Warsaw.
7. Leong, Gon Cheng & Morgan, Gilliam C. (1982) Human and Economic Geography, Oxford University Press.
8. Raina J. L. (2008) Agriculture Geography, Pointer Publishers.
9. Rummey A Thomas (2005) The study of Agriculture Geography: A Scholarly guide & Bibliography, The Scarecrow press, Lnc.
10. Shafi Mohammed (2000) Agricultural Geography of South Asia., Macmillan Publishers India.
11. Singh & Dhillon (2004) Agriculture Geography (3rd Edition), Tata McGraw – Hill.
12. Singh, R.L. (Ed.) (1968) Applied Geography, BHU press, Varanasi.
13. हुसैन, माजिद (2000) कृषि भूगोल, रावत पब्लिकेशन, जयपुर।
14. कुमार, प्रमीला एवं शर्मा, श्रीकमल (2008) कृषि भूगोल, मध्य प्रदेश हिन्दी ग्रन्थ अकादमी, भोपाल।

Geography of Rural Settlements

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Develop an approach to study rural settlements.
- Depict the evolution of settlements and relate it to the geographical factors.
- Describe rural morphology, its meaning and types.
- Describe house types, hierarchy of rural settlements and rural centers.

Course Content:

Section A

Introduction to Geography of Rural settlements

Meaning, definitions and scope of geography of rural settlements; The relationship of geography of rural settlements with other branches of geography, Approaches to geography of rural settlements; Factors affecting origin and evolution of settlements; Principles of Settlement Formation.

Section B

Morphology and Types of rural settlements

Rural settlements: Types and factors of development; Types of rural settlements in India and their Distribution; Rural Morphology: Meaning, definitions and Types; Process of development of rural morphology and affecting forces; Size, Density, Spacing and Dispersion of rural settlements.

Tourism Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Propagate the idea of ecotourism and sustainable tourism.
- Depict the social and economic benefits of tourism in any tourist site.
- Explain tourism potential of deprived places.
- Describe the tourism on national and state level.

Section A

Concept of Tourism Geography

Concept of Tourism: Definition, Evolution and types of Tourism; Tourism Geography: Definition, Key Concepts; Scale, Geographical components and spatial interaction between components; Geography of demand and supply for tourism; Development of tourism in India.

Section B

Geographic Foundation of Tourism

Introduction of geographic foundation of Tourism; Physical geography of Tourism: Resources and barriers; Human Geography of Tourism: Resources and barriers; Concept of Ecotourism.

Section C

Geographical factors affecting Tourism

Economic and Social benefits & cost of Tourism; Environmental benefits, cost of Tourism and emerging implications; Tourism in India: Demand, supply, organization and Tourism Resources; Ecological and cultural tourism resources of Rajasthan.

Stencils are to be permitted during the examination.

Recommended Books:

1. Bhatia, A. K. (2012). *Tourism Development: Principles and Practices* (2nded.). New Delhi, India: Sterling.
2. Boniface, B., Cooper, C., & Cooper, R. (2016). *Worldwide Destinations: The Geography of Travel and Tourism* (7th ed., vol. I). New York, NY: Routledge.
3. Garg, D. (2009). *Geography of Tourism*. New Delhi, India: Mohit.
4. Jayapalan, N. (2013). *An Introduction to Tourism*. New Delhi, India: Atlantic.
5. Kamra, K. K. (2014). *Tourism An Overview*. New Delhi, India: Kanishka.
6. Kaushal, P., & Sharma, S. P. (2011). *Ecological and Environmental Impact of Tourism*. New Delhi, India: Kanishka.
7. Hall, M. C., & Page, J. S. (2014). *Geography of Tourism and Recreation: Environment, Place and Space* (4thed.). New York, NY: Routledge.
8. Nelson, V. (2017). *An Introduction to the Geography of Tourism* (2nded.). New York, NY: Rowman & Little field.

9. Sharma, S. P. (2011). *Tourism Education Principales, Theories and Practices* (2nd ed.). New Delhi, India: Kanishka.
10. अग्रवाल, वी. (2012). *भौगोलिक पर्यटन*. नई दिल्ली, भारत: अर्जुन.
11. नेगी, जे. (2013). *आधुनिक पर्यटन एवं यात्रा के आधारभूत सिद्धान्त* (चतुर्थ सं.). नई दिल्ली, भारत: तक्षशिला.
12. शर्मा, ए. (2012). *पर्यटन भूगोल*. जयपुर, भारत: इशिका.
13. शुक्ला, आर., एवं शुक्ला, आर. (2009). *पर्यटन भूगोल*. नई दिल्ली, भारत: अर्जुन.
14. सारण, बी. आर. (2008). *पर्यटन उत्पाद एवं प्रबन्ध*. नई दिल्ली, भारत: कनिष्क.

Suggested e- learning materials:

1. Cultural tourism in Rajasthan
<http://www.tourism.rajasthan.gov.in/>
2. Economic benefits of Tourism
<http://pib.nic.in/newsite/PrintRelease.aspx?relid=175628>
3. Tourist resources of India
<https://whc.unesco.org/en/statesparties/in>

Section C

Rural Dwellings and Service Centres

Houses: Definitions, factors affecting, classification and morphology; Distribution of houses in India on the basis of building material; Rural service centres: Definition, Identification and methods for the determination of hierarchy; Periodic markets: Definition, Characteristics and types.

Non-Scientific calculators & Stencils are to be permitted during the examination.

Recommended Books:

1. Chisholm, M. (2009). *Rural Settlement and Land Use*. New Jersey, NJ: Transaction.
2. Daniel, P. (1989). *The Geography of Settlement* (2nd ed.). Edinburg, Scotland: Oliver & Boyd.
3. Ghosh, S. (1998). *Geography of Settlements*. Kolkata, India: Orient Longman.
4. Mandal, R. B. (2001). *Introduction to Rural Settlement* (2nd ed.). New Delhi, India: Concept.
5. Mourya, S. D. (2014). *Settlement Geography*. Allahabad, India: Sharda Pustak Bhawan.
6. Oliver, P. (1987). *Dwellings: The House across the World*. Austin, TX: University of Texas Press.
7. Singh, R. Y. (2015). *Geography of Settlements*. New Delhi, India: Rawat.
8. Wanmali, S. (1983). *Service Centres in Rural India: policy, theory, and practice*. New Delhi, India: B. R.
9. तिवारी, आर. सी. (2016). *अधिवास भूगोल* (अष्ट सं.). इलाहाबाद, भारत: प्रयाग पुस्तक भवन.
10. बंसल, एस. सी. (2016). *ग्रामीण बस्ती भूगोल* (संशोधित सं.). मेरठ, भारत: मीनाक्षी.
11. मौर्य, एस. डी. (2017). *अधिवास भूगोल* (षष्ठ सं.). इलाहाबाद, भारत: शारदा पुस्तक भवन.
12. सिंह, आई. (2008). *अधिवास भूगोल*. नई दिल्ली, भारत: यूनिवर्सिटी.

13. सिंह, आर. (2005). *अधवास भूगोल*. नई दिल्ली, भारत: रावत.

Suggested e-learning materials:

1. Introduction to rural settlement

<https://books.google.co.in/books?id=SYQ1yydbDlwC&printsec=frontcover&dq=Introduction+to+rural+settlement&hl=hi&sa=X&ved=0ahUKEwiF1rOw55zhAhUZA3IKHRZpCUAQ6AEIKTAA#v=onepage&q=Introduction%20to%20rural%20settlement&f=false>

2. Settlement patterns

<https://www.britannica.com/place/India/Caste#ref487283>

Medical Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Depict spatial and temporal development of medical geography.
- Relate the course with other social sciences and develop an interdisciplinary approach.
- Relate natural, social and environmental factors with human health and diseases.
- Use statistical methods for assessing health.

Course Content:

Section A

Introduction to Medical Geography

Meaning, definitions and scope of Medical Geography; Spatio-temporal development of Medical Geography with special reference to India; Relationship of Medical geography with other disciplines – sociology, psychology, economics, political science, law, natural science; Approaches to study Medical geography; Meaning of health (physical, mental and social health), health and hygiene, disease cycle, causes of ill health, disease ecology

Section B

Geographical Factors Affecting Human Health and Diseases

Natural factors – climate, relief, soil, vegetation; Social factors – population density, literacy, social customs and traditions and poverty; Economic Factors – occupation, standard of living, food security and nutrition; Environmental Factors – urbanization and congesting, water, air and noise pollution and solid waste; Factors influencing health in India; WHO classification of diseases and their distribution (major diseases) in world.

Section C

Human Health in India

Indicators of health - changes in Birth and death rates, Infant mortality rates, life Expectancy, changes in sex ratio, population growth, Population Control; Food: classification, food stuffs, balanced diet and Basal Metabolic Rate (BMR); Nutrition – mal nutrition & under nutrition – causes & consequences, status of food and nutrition in India and personal health; Health care delivery system : areas of health education, tools for health education, Health Planning (aim, district level, block level, local level organizations); Health Care Programmes, Family Welfare Programmes, Family Planning Association of India (FPAI)

Stencils are to be permitted during the examination.

Recommended Books:

1. Akhtar, R. (1991). *Environment and Health: Themes in Medical Geography*. New Delhi, India: South Asia Books.
2. Akhtar, R. (Ed). (2016). *Climate Change and Human Health Scenario in South and Southeast Asia*. New Delhi, India: Springer Nature.
3. Hussain, M. (Ed). (1994). *Medical Geography*. New Delhi, India: Anmol.
4. May, J. M. (1970). *The World Atlas of Diseases*. New Delhi, India: Nat Book Trust.

5. Mayer, A. I. (2007). *Medical Geography*. New Delhi, India: APH.
6. Meade, M. S., & Earickson, R. J. (2006). *Medical Geography* (2nd ed.). New Delhi, India: Rawat
7. Mishra, R. P. (1969). *The Medical Geography of India*. New Delhi, India: National Book Trust.
8. Park, J. E., & Park, K. (2014). *Text Book of Community Health for Nurses*. Jabalpur, India: Ansari.
9. Park, J. E., & Park, K. (2007). *Preventive and Social Medicine*. (19th ed.). Jabalpur, India: M/s Banarsidas
10. सिंधई, जी. सी. (2010). *चिकित्सा भूगोल* (द्वितीय सं.). गोरखपुर, भारत: वसुन्धरा.

Suggested e-learning materials:

1. Indicators of Health https://www.who.int/gho/publications/world_health_statistics/EN_WHS2015_Part2.pdf
2. Family Welfare programme in India
<http://planningcommission.nic.in/plans/mta/mta-9702/mta-ch17.pdf>

Urban Geography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Depict the development of cities and relate with the classical theories of growth of cities.
- Describe the evolution and origin of cities.
- Classify cities functionally into different zones.
- Describe models in urban geography with special reference to the work of Christaller and Losch.

Course Content:

Section A

Introduction to Urban Geography

Meaning and scope of Urban Geography. Approaches to the study of Urban Geography, Development of Urban Geography; Stages of Evolution of Cities; Origin and evolution of towns: Origin, and growth of Ancient, Medieval and Modern towns (one example from each); Urbanization: Trends of Urbanization in World and India.

Section B

Urban Morphology

Urban Morphology: Meaning, affecting factors and stages of Development of Urban Morphology; Theories of Urban growth: Concentric zone theory of Burgess, Sector theory of Homer Hoyt and Multiple Nuclei theory of Harris & Ullman, Morphology of Indian Cities (one example.); Urban land use and functional zones of a city; Central Business District(CBD); Functional Classification of Cities according to C.D. Harris.

Section C

Models of Urban Geography

Concept of Urban Hierarchy: Methods of determination (on the basis of numbers and level of work); Rank size rule and the law of the Primate City; Central place theory of Walter Christaller and August Losch; Rural urban fringe: Conceptual explanation, internal structure, characteristic features, Introduction of Conurbation and Umland, methods of delimitation of Umland (breaking point theory).

Stencils are to be permitted during the examination.

Recommended Books:

1. Bansal, S. C. (2015). *Urban Geography* (2nd ed.). Meerut, India: Meenakshi.
2. Daniel, P. (2002). *Geography of Settlement*. Jaipur, India: Rawat.
3. Ghosh, S. (1999). *Geography of Settlements*. Kolkata, India: Orient Longman.
4. Hussain, M. (2003). *Urban Geography*. New Delhi, India: Anmol.
5. Mandal, R. B. (2000). *Urban Geography* (2nd ed.). New Delhi, India: Concept.

6. Singh, R.Y. (2014). *Geography of Settlements* (2nd ed.). Jaipur, India: Rawat.
7. तिवारी, आर. सी. (2016). *अधिवास भूगोल* (अष्ट सं.). इलाहाबाद, भारत: प्रयाग पुस्तक भवन.
8. बंसल, एस. सी. (2009). *नगरीय भूगोल*. मेरठ, भारत: मीनाक्षी.
9. मौर्य, एस. डी., एवं सिंह, आर.एन. (2013). *नगरीय भूगोल* (द्वितीय सं.). इलाहाबाद, भारत: शारदा पुस्तक भवन.
10. सिंह, आई. (2008). *अधिवास भूगोल*. नई दिल्ली, भारत: यूनिवर्सिटी.
11. सिंह, आर. (2005). *अधिवास भूगोल*. जयपुर, भारत: रावत.

Suggested e-learning materials:

1. Origin and evolution of towns
<http://www4.brandonu.ca/ebertsd/281/281f17unit02.pdf>
2. Functional Zones of a city <http://egyankosh.ac.in/bitstream/123456789/27649/1/Unit-11.pdf>

Environmental Geography

L T P C

5 0 0 5

Max. Marks : 100

A:40+ESA:60)

3. Section - A : Introduction to Environmental Geography

4. a) Definition and scope of Environmental Geography and its relation with environmental science.
5. b) Approaches to study of environment, Types of environment.
6. c) Factors of the environment: Physiographic, Climatic, Edaphic, Biotic and Anthropogenic.
7. d) Bio Geochemical Cycles: The Carbon cycle, the Oxygen cycle, the Nitrogen cycle.
8. e) The Hydrological cycle.

9. Section – B : Concept of Ecology and Ecosystem

10. a) Concept of Ecosystem: With special reference to desert, forest and aquatic ecosystem.
11. b) Food chain, Food web & succession.
12. c) Ecological Pyramids and their types.
13. d) Energy flow in ecosystem.
14. e) Concepts of Biomes. Major biomes of the world: Tropical forest, Temperate forest, Grassland and Tundra.

15. Section – C :Environmental Pollution and Hazards

16. a) Environmental Pollution-Pollutants and sources:
 17. 1. Water pollution,
 18. 2. Soil pollution,
 19. 3. Air pollution and,
 20. 4. Noise pollution.
21. b) Environmental Hazards :
 22. a. Natural hazards:
 23. i. Soil erosion,
 24. ii. Landslides,
 25. iii. Droughts and floods.
 26. b. Man-made hazards:
 27. i. Technological hazards: Nuclear and Industrial,
 28. ii. Green house effects and Global warming,
 29. iii. Ozone depletion.
30. c) Biodiversity : Threats and conservation
31. d) Need of Environmental Management and Planning
32. e) Concept of Environmental impact assessment (EIA).
33. *Note – Stencils are to be permitted during the examination.

34. Books Recommended:

35. 1. Anjuneyulu, Y. (2002): Environmental Impact Assessment Methodologies. B. S. Publications, Hyderabad.
36. 2. Bharucha, E., (2013) Textbook of Environmental Studies for Undergraduate Courses, Universities Press, Hyderabad

37. 3. Desombre, R.E. (2007) The Global Environment and World Politics, Continuum International Publishing Group, New York
38. 4. Gautam, A (2007): Environmental Geography, ShardaPustakBhawan, Allahabad.
39. 5. Gautam, A. (2005): Resource and Environment (in Hindi), ShardaPustakBhawan, Allahabad.
40. 6. Hughs, Foreman (2010): Biogeography & Geomorphology. Apple academics.
41. 7. Jadhav, S.B., (2012) Environmental Geography, ChandralokPrakashan, Kanpur
42. 8. Mathur, H.S.(1998) : Essentials of Biogeography, Pointer Publishers, Jaipur.
43. 9. Mehtani, S. & Sinha, A. (2010): Biogeography. Commonwealth Publisher.
44. 10. Odum, E.P.(1968) : Fundamentals of Ecology, W.B. Sanders. Company, Philadelphia and London.
45. 11. Rajagopalan, R. (2005): Environmental Studies: From Crisis to Cure, Oxford University Press, New Delhi.
46. 12. Reddy, M. A. (2004): Geoinformatics for Environmental Management. B. S. Publishers., Hyderabad.
47. 13. Sarkar, S., and Chaudhary, S. K., (2014) Textbook of Environmental Science, APH Publishing Corporation, New Delhi.
48. 14. Saxena, K.K. (2004): Environmental Studies. University Book House Private Ltd., Jaipur.
49. 15. Singh, O., Kumra V. K. and Singh J. (1988): India's Urban Environment. Pollution, Perception and Management. Tara Book Agency, Varanasi.
50. 16. Singh, R. B. (ed) (1995): Studies in Environment and Development. RakeshPrakashan, Varanasi.
51. 17. Singh, R. B. (ed.) (1990): Environmental Geography. Heritage Publication, New Delhi.
52. 18. Singh, S. (2007): ParyavaranaBhugol. PrayagPustakBhawan, Allahabad.
53. 19. Singh, S. N. (1993): Elements of Environmental Geography and Ecology (in Hindi), Tara Book Agency, Varanasi.
54. 20. Singh, S., (2012) Environmental Geography, PrayagPustakBhawan, Allahabad
55. 21. Valdiya, K. S. (1987): Environmental Geology: Indian Context. Tata McGraw Hill Publishing Company. Ltd., New Delhi
56. 22. William, M.W. and John, G (1996): Environmental Geography-Science, Landuse and Earth system, John Wiley and sons, New York.
57. 23. बाकरे, बाकरे, वाधवा (2005-06) पर्यावरणीय अध्ययन, रस्तोगी पब्लिकेशन्स, गंगोत्री, शिवाजी रोड मेरठ।
58. 24. एस. सी. कलवार (2007) पर्यावरण संरक्षण, पोइन्टर पब्लिशर्स, दिल्ली।
59. 25. बी. सी. जाट (2011) पर्यावरण भूगोल, रावत पब्लिशर्स, जयपुर।
60. 26. वीणा वाना (2002) पर्यावरण शिक्षा, रिसर्च पब्लिशर्स, जयपुर।
61. 27. अवस्थी, एन. एम. और तिवारी आर. पी. एल., (1995) पर्यावरण भूगोल, हिन्दी ग्रन्थ अकादमी, भोपाल।
62. 28. गुर्जर राजकुमार और जाट बी.सी. (2010) संस्थान एवं पर्यावरण, पंचशील प्रकाशन, जयपुर।
- 63 29. प्रसाद गायत्री और नौटियाल राजेश (2008) पर्यावरण भूगोल, शारदा पुस्तक भवन, इलाहाबाद।

Remote Sensing and GIS

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the concepts of aerial photography, Remote sensing and GIS.
- Develop background knowledge of platforms, sensors, thermal and microwave remote sensing.
- Describe concepts related to electromagnetic radiation, Spectral Signatures, thermal and microwave remote sensing.
- Apply Geospatial techniques in fields of cartography, environmental management, vegetation monitoring, forest cover depletion etc.

Course Content:

Section A

Aerial Photograph

Aerial Photographs: Definition, Basic Terms and Scale and Overlapping in aerial photographs; Classification of aerial photographs, their utility and Factors affecting the quality of an aerial photo; Fundamental of aerial photographs- Aerial camera, Time and season of photography, Planning and execution of photographic flight, Completion of photographic task; Elements of air photo interpretation and interpretation keys; Difference between aerial photograph and Topographical maps; Aerial photo mosaics

Section B

Remote Sensing

Remote sensing: Definition, process and stages; historical development; Remote sensing platforms and sensors; Remote sensing programmes of India; Electromagnetic Radiation (EMR) - Properties, Interaction of EMR with the earth's surface and atmosphere, Spectral signatures; Basic principles and applications of Thermal and Microwave Remote Sensing

Section C

GIS and GPS

GIS: Meaning and concept, historical development; Components of GIS; Data Structure and Data Models; Data Base Management System (DBMS), GIS Data manipulation and analysis; Basic Principles of GPS; GPS segments: GPS receivers; Application of GIS and GPS

Recommended Books:

1. Bhatta, B. (2011). *Remote Sensing and GIS* (2nd ed.). New Delhi, India: Oxford University Press.
2. Campbell, J. B., & Wynne, R. H. (2011). *Introduction to Remote Sensing* (5th ed.). New York, NY: Guilford
3. Ciciarelli, J. A. (1991). *A Practical Guide to Aerial Photography with an introduction to surveying*. New York, NY: Van Nostrand Reinhold.
4. Cracknell, A. P., & Hayer, L. (2009). *Introduction to Remote Sensing*, New York, NY: Taylor and Francis.
5. Ganesh, A., & Narayanakumar, R. (2006). *GPS Principles and Applications*. Delhi, India: Satish Serial.

6. George, J., & Jeganathan, C. (2018). *Fundamentals of Remote Sensing* (3rd ed.). Hyderabad, India: Universities Press.
7. Gopi, S. (2013). *Global Positioning System- Principles and Applications*. New Delhi, India: McGraw Hill.
8. Kumar, S. (2014). *Basics of Remote Sensing and GIS*, New Delhi, India: University Science Press Laxmi.
9. Lillesand T. M., Kiefer, R. W., & Chipman, J. W. (2008). *Remote Sensing and Image Interpretation* (6th ed.). New York, NY: Wiley and Sons.
10. Lo, C. P., & Albert, K. W. Y. (2002). *Concepts and Techniques of Geographic Information System* (2nd ed.). New Delhi, India: Prentice-Hall.
11. Michael, N. D. (2000). *Fundamentals of Geographic information Systems*. New York, NY: John Wiley & Sons.
12. Nag, P., & Kudrat, M. (1998). *Digital Remote Sensing*. New Delhi, India: Concept
13. Paine, D. P., & Kisher, J. D. (2012). *Aerial Photography and Image Interpretation* (3rd ed.). Victoria, Australia: John Wiley & Sons.
14. Palet, A. N. (1992). *Remote Sensing Principles & Application*, Jodhpur, India: Scientific.
15. चौनियाल, डी. डी. (2010). *सुदूर सर्वेदन एवं भौगोलिक सूचना प्रणाली*. इलाहाबाद, भारत: शारदा पुस्तक भवन.

Suggested e-learning materials:

1. [Concept of Aerial Photography](https://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/air-photos/about-aerial-photography/9687)
<https://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/air-photos/about-aerial-photography/9687>
2. [Principles And applications of GIS](https://www.environmentalscience.org/principles-applications-gis)
<https://www.environmentalscience.org/principles-applications-gis>

Remote Sensing and GIS Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

Learning Outcomes:

L	T	P	C
0	0	12	6

After the completion of this course, students should be able to:

- Perceive the depth through pocket stereoscope.
- Interpret the aerial photographs and generate Land use and Land cover map with the help of mirror stereoscope.
- Determine height, scale of aerial photographs.
- Georeference any map, create thematic maps, generate DEM and slope maps.

Course Content:

Photogrammetry:

1. Stereoscopic Vision Test: Zeiss test for depth perception.
2. Orientation of Aerial Photographs under mirror Stereoscope.
3. Determination of Scale, Stereoscopic Area, Principal point, Conjugate.principal point, Direction of Flight line and Air base.
4. Identification and Interpretation of objects/features from aerial photograph through mirror stereoscope.
5. Calculation of number of strips and number of photographs.
6. Height Determination using vertical aerial photographs.

GIS:

Basic software

1. Introduction to GIS software; Georefencing; Downloading of Satellite Imageries; Mosaicing; Subsetting; digitization Joining attribute data with spatial data, Creation of thematic maps.
2. Spatial Analysis, Classification (Supervised, Unsupervised and Accuracy Assessment), Proximity and Buffer analysis. 3D analysis in GIS: creation of aspect, Slope and DEM

Non- scientific calculators are allowed in the examination.

Recommended Books:

1. Ciciarelli, J. A. (1991). *A Practical Guide to Aerial Photography with an Introduction to Surveying*. (1st ed.). New York, NY: Van Nostrand Reinhold.
2. Kang-tsung, C. (2007). *Geographic Information System* (4th ed.). New Delhi, India: Tata-McGraw Hill.
3. Lillisand, T. M., & Kiefer, P. W. (2015). *Remote Sensing & Image Interpretation* (7th ed.). New York, NY: John Wiley & Sons.
4. Michael, N.D. (2001). *Fundamentals of Geographic information Systems* (1st ed.). New York, NY: John Wiley & Sons.

5. Paine, D. P., & Kisher, J.D. (2012). *Aerial Photography and Image Interpretation* (3rded.). Victoria, Australia: John Wiley & Sons.
6. Sarkar, A. (2015). *Practical Geography A Systematic Approach* (3rd ed.). Kolkata, India: Orient Blackswan.
7. Singh, L. R. (2011), *Fundamentals of Practical Geography*. Allahabad, India: Sharda Pustak Bhawan.
8. Wolf, P. R., Dewitt, B. A., & Wilkinson, B. E. (2014). *Elements of Photogrammetry with Applications in GIS* (4thed.). New York, NY: Mc. Graw Hill Education.

Suggested e-learning materials:

1. Principles of Aerial Photography
<http://www.sfu.ca/~hickin/Maps/Chapter%208.pdf>
2. Image classification http://www.csre.iitb.ac.in/~avikb/GNR401/DIP/DIP_401_lecture_7.pdf

Suggested e-learning materials:

5. Monsoon

<https://www.britannica.com/science/Indian-monsoon>

6. Drainage system of India

<https://iasscore.in/pdf/samplenotes/4.%20Drainage.pdf>

7. Indira Gandhi canal

<https://nroer.gov.in/55ab34ff81fccb4f1d806025/file/57cff6e816b51c038dedd394>

8. Human Resources of Rajasthan

<http://worldpopulationreview.com/countries/india-population/>

15. १.

16. सिंह, जे., एवं राव, बी. पी. (2007). *तीन दक्षिणी महाद्वीप* (सप्तम् सं.). गोरखपुर, भारत: वसुन्धरा.

Suggested e-learning materials:

5. Drainage of Australia

<https://www.7continentslist.com/australia/rivers-in-australia.php>

6. Drainage of North America

<https://www.7continentslist.com/north-america/rivers-in-north-america.php>

7. Physical features and climate of Australia

https://saylordotorg.github.io/text_world-regional-geography-people-places-and-globalization/s15-australia-and-new-zealand.html

8. Climate, natural vegetation

<https://na.unep.net/atlas/africa/downloads/chapters/Africa Atlas English Chapter 1.pdf>

Sessional and Lab Work (Teaching Practice)

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Practice in Simulation	15 Pds.
2. Methods based planning	10 Pds.
3. Practice in real classroom	20 Pds.
Seminar	15 Pds.

Teacher, Teaching and Higher Education

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives: The objective of this course is to acquaint the students with the scenario of higher education in India and expected teacher's role in higher education. It enables students to identify and use different teaching competencies, methods and media required for effective teaching. It enhances the ability to instruct and evaluate, as a teacher in higher education. It also attempts to develop sensitivity towards major issues related to different dimensions of higher education.

Course Outline:

- 1. Overview of Higher Education in India:** Purpose and Functions of Higher Education. Functions of Regulatory Bodies - UGC, AICTE, NCTE, DEC, NAAC.
- 2. Role of Teacher in Higher Education:** Teacher's Role - Curriculum development, Instructional, Institutional, Research related and Social. Professional Development of Teachers - Role of ASC.
- 3. Pre-requisites of Teacher in Higher Education:** Teaching Competencies - Introduction, Questioning, Board Work, Explanation, Use of Support Material, Stimulus Variation, Probing and Closure. Methods for teaching - Lecture, Discussion, Project, Workshop and Seminar. Media for effective teaching.
- 4. Designing of Instruction and Evaluation:** Instructional Planning. Modes of Evaluation in Higher Education.
- 5. Major issues in Higher Education:** Government and Private Participation, Women Participation, Globalization of Higher Education, Quality Issues.

References:

1. Aggarwal, J.C., (2012), "Principles, Methods & Techniques of Teaching," Vikas Publishing House Pvt. Ltd., New Delhi.
2. Association of Indian Universities, (2003), "Globalization of Indian Higher Education", New Delhi.
3. Bawa, M.S., Nagpal, B.M., (2011), "Developing Teaching Competencies," Viva Books, New Delhi.
4. Dhar, B.B., (2009), "Higher Education System," A.P.H. Publishing Corporation, New Delhi.
5. Dhir, R.N., (2006), "Higher Education", Abhishek Publications, Chandigarh.
6. Kamalkar, G., (2014), "Higher Education in Indian-Emerging Challenges", Commonwealth Publishers Pvt. Ltd., New Delhi.
7. Kidwani, A.R., (2011), "Higher Education- Issues and Challenges", Viva Books, New Delhi.
8. Kidwani, A.R., (2014), "New Directions in Higher Education", Viva Books, New Delhi.
9. Mangal, S.K., Manga. U., (2014), "Essentials of Educational Technology", PHI Learning Private Limited, Delhi.

10. Manoharan, P.K., (2009), "Higher Education," A.P.H. Publishing Corporation, New Delhi.
11. Panchmukhi, P.R. Debi,S. (2008), "Educational Data Bank for Higher Education", Serials Publications, New Delhi.
12. Patnaik, J. (2001), "Higher Education in Information Age", Authors Press, New Delhi.
13. Sen, R., (2009), "Women and Higher Education System," Crescent Publishing Corporation, New Delhi.
14. Shafi, Z.S. (2008), " Reforms and Innovations in Higher Education", Association of Indian Universities, New Delhi.
15. Sharma, S.R., (2000), "Effective Classroom Teaching-Modern Methods, Tools & Techniques," Mangal Deep Publications, Jaipur.
16. Thamarasseri, I., (2012), "Essentials of Educational Evaluation," Kanishka Publishers, New Delhi.

Research Methodology and Statistical Analysis in Geography

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Research: Meaning and types of Research; Literature Review, Research Methodology
2. Hypothesis: Meaning and Basic concept of hypothesis testing
3. Research Design: Meaning, need and Importance
4. Data Collection : Types and sources of data, Methods of Data collection, classification of data; designing of a Questionnaire; Data Interpretation Analysis
5. Sampling: Meaning and Types of Sampling
6. Chapter scheme, Review of literature
7. Concept of Plagiarism
8. Multi-variate Analysis
9. Statistical Applications Adopting
 - I. Multiple correlation & Regression Analysis
 - II. Composite Indices
 - III. Basics of Principal Component Analysis
 - IV. Time Series Analysis (Temporal Analysis)
10. Preparation and Writing of abstract, Articles, report format and thesis

Books Recommended:

1. Ahuja, R., (2009), Research Methods, Rawat Publications, Jaipur.
2. Cole, John P. and Cuchlaine a. M. King (1968) Quantitative Geography, Techniques and Theories in Geography, John Wiley and Sons Ltd., London.
3. Elhance, D.N. (1972): Fundamentals of Statistics, Kitab Mahal, Allahabad.
4. Frank Harry and Steven C. Althoen (1994): Statistics Concepts and Applications, Cambridge University Press.
5. Gupta, S.P., (1979) and revised edition, Statistical Methods, Sultan Chand and sons, New Delhi.
6. Guthrie, G., (2010), Basic Research Methods – An entry to Social Science Research, Sage Publications, New Delhi.
7. Hammond, R. and Patrik McCullagh (1974): Quantitative Methods in Geography, Clarendon Press, Oxford.
8. Kothari, C.R., (1990), Research Methodology Methods and Techniques, Wishwa Prakashan, New Delhi.
9. Mahmood, A., (1998), Statistical Methods in Geographical studies, Rajesh Publications, New Delhi.
10. Mishra, H.N. and Singh, V.P, (1998), Research Methodology, Rawat Publications, Jaipur.
11. Mishra, R.P., (1989), Research Methodology, Concept Publishing Company, New Delhi.
12. Prasad, H., (1992), Research Methods and Techniques in Geography, Rawat Publications, Jaipur.
13. Sarkar, A, (2013), Quantitative Geography; Techniques and Presentations, Orient Blackswan, Pvt. Ltd., New Delhi.
14. Smith, David M. (1975): Patterns in Human Geography, An introduction to Numerical Methods, Crane Russak & Company, Inc New York.
15. Taylor G., Peter J. (1977): Quantitative Methods in Geography, An Introduction to Spatial Analysis. Houghton Mifflin Company, Boston, USA.

Advanced Economic Geography

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Concept of Economic Geography, nature and pattern of economic activities: primary, secondary and tertiary activities.
2. Recent themes and concepts in Economic Geography,
3. Concept of economic resource, Resource evaluation, Resource planning and management
4. Economic Development: Theories and Measures of economic development.
5. Theories of Industrial Location and Localization(Weber, Hoover, Losch, Pred), Industrial Regions of the World and India,
6. World Trade Organization, Globalization and its impact on World Economy.
7. Agricultural land use and cropping pattern, measures of Agricultural efficiency, crop combination regions (J. C. Weaver and K. K. Doi).
8. Concept of location of Agricultural activities, Agricultural typology, changing cropping pattern.
9. Modern concepts in Agriculture Geography: sustainable development, agribusiness, contract farming, dry land farming, cropping systems.

Books Recommended:

1. Clark, G. L., Feldman, M.P. and Gertler, M.S. (eds.) (2000): The Oxford Handbook of Economic Geography. Oxford University Press, Oxford and New York.
2. Conking, E. C. and Yeates, M. (1996) "Man's Economic Environment" McGraw – Hill Book Company.
3. Freeman, T. W. (1972): Geography and Planning. Freeman and Company, New York.
4. Friedman, J. and Alonso, W. (1964) Regional Development and Planning: A Reader, The M. I. T.
5. Gautam, Alka, (2010), Advanced Economic Geography, Sharda Pustak Bhawan, Allahabad
6. Guha, J.L. and P.R.Chatturaj (1994) Economic geography- A Study of Resources, The World Press Pvt. Ltd. Calcutta
7. Gupta, P and Sadasyuk, G. (1968): Economic Regionalization of India: Problems and Prospects. Census of India, New Delhi
8. Hanif M. (2005): Encyclopedia of Agriculture Geography, Anmol Publications PVT Ltd.
9. Hartshorn, T. A. and Alexander, J. W. (1988) 'Economic Geography', Prentice Hall, New Delhi.
10. Leong, Gon Cheng & Morgan, Gilliam C.: (1973) Human and Economic Geography, Oxford University Press.
11. Ramesh, A. (ed.) (1984): Resource Geography. Heritage Publishers, New Delhi.
12. Shafi Mohammed (2000): Agricultural Geography of South Asia., MacMillan Publishers India

13. Siddharth, K. (2006) Economic Geography, Kishalaya Publications, New Delhi. Singh & Dhillon (2004): Agriculture Geography (3rd Edition), Tata McGraw – Hill.
14. Singh, R.L. (Ed.): (1966) Applied Geography, BHU press, Varanasi.
15. Wheeler J. O. Mullar, O. M. Thrall, G. I. and Timothy, J. F. (1988) “Economic Geography”, John Wiley and Sons Inc. New York.
16. कुमार, प्रमीला एवं शर्मा, श्री कमल (2008) कृषि भूगोल, मध्य प्रदेश हिन्दी ग्रन्थ अकादमी, भोपाल।
17. जाट, बी. सी. (2006) आर्थिक भूगोल, पंचशील प्रकाशन, जयपुर।
18. हुसैन, माजिद (2000) कृषि भूगोल, रावत पब्लिकेशन, जयपुर।
19. मामोरिया, चतुर्भुज (2008) आर्थिक भूगोल, साहित्य भवन पब्लिकेशन, आगरा।
20. एस. डी. कौशिक एवं डॉ. अल्का गोतम (2011) संसाधन भूगोल, रस्तोगी एण्ड रस्तोगी पब्लिकेशन।
21. शर्मा, हरिशचंद्र, (1983) भारत का आर्थिक भूगोल तथा भारतीय अर्थशास्त्र, रमेश बुक डिपो, जयपुर।
22. सिंह जे. (2009) संसाधन भूगोल, राधा पब्लिकेशन, नई दिल्ली।
23. सिंह के. एन., और सिंह जे. (2003) आर्थिक भूगोल के मूल तत्व, ज्ञानोदय प्रकाशन, गोरखपुर।
24. सिंह, काशीनाथ (2009) आर्थिक भूगोल के मूल तत्व : संसाधन उपयोग, संरक्षण एवं आर्थिक विकास का अध्ययन, ज्ञानोदय प्रकाशन।

Advanced Geomorphology

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

1. Scope of Geomorphology, methods and approaches to the study of landforms.
2. Fundamentals concepts of Geomorphology
3. Evolution of landforms according to Davis, Penck and King.
4. Geomorphic processes and their classification.
5. Endogenitic Forces: Secular and Sudden forces; Earthquakes and Volcanic activities.
6. Exogenitic Forces: Weathering and mass wasting. Erosional processes: river, glacial, coastal, Karst and wind.
7. Slopes forms and processes: Models of slope development, views of Davis, Penck, Wood and King.
8. Erosion Surface; Techniques of identification and correlation.
9. Introduction to Geomorphological mapping methods and application of GIS in geomorphology (Concept of DEM & DTM)
10. Regional geomorphology – Case study of Kumaun Himalay, Chotanagpur region and Lower Chambal Valley.
11. Application of Geomorphology in Agriculture, Urbanization, Hydrology and Hazard management.

Books Recommended:

1. Ahmed, E. (1985): Geomorphology. Kalyani Publishers, New Delhi.
2. Bloom.A. L. (1998/ 2001): Geomorphology. 3rd edition. Prentice Hall of India, New Delhi.
3. Chorley, R.J., Schumm S A and Sugden D E. (1984): Geomorphology. Methuen and Company Ltd., London.
4. Dayal, P. (1994): A Text Book of Geomorphology. Kalyani Publishers, New Delhi.
5. Fairbridge, R.W. (ed.) (1968): Encyclopaedia of Geomorphology, Reinhold Book Corporation., New York
6. Gregory, K.J. and Walling, D.E. (1973): Drainage Basin Form and Process. Edward Arnold, London.
7. Jog, S. R. (ed.) (1995): Indian Geomorphology (2 vols.). Rawat Publications, Jaipur
8. Kale, V. and Gupta, A. (2001): Introduction to Geomorphology. Orient Longman, Hyderabad.
9. King, C.A.M. (1966): Techniques in Geomorphology. Edward Arnold, London.
10. Pethick, J. (2000): An Introduction to Coastal Geomorphology. Arnold, London.
11. Sharma, H. S., (1980): Perspective of Geomorphology (4 Volumes), Concept Publications, New Delhi
12. Sharma, H. S., (1987): Tropical Geomorphology – Study of Morpohogenitic Regionalization of Rajasthan, Concept Publications, New Delhi
13. Sharma, P. R. (ed.), (1993): Applied Geomorphology in Tropics. Rishi Publications, Varanasi.
14. Singh, S. (2004): Geomorphology. Prayag Pustak Bhawan, Allahabad.
15. Sparks, B.W. (1986): Geomorphology. Longmans, London.
16. Thornbury, W.D. (2005): Principles of Geomorphology. John Wiley and Sons, New York.
17. Wooldridge, S.W. and Morgan, R.S. (1959): The Physical Basis of Geography- An Outline of Geomorphology. Longman, London.

Geography of Environmental Management

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Environment: Fundamentals of Environment
2. Biodiversity: meaning, importance and types; Biodiversity hot spots; Loss of Biodiversity and its conservation
3. Environmental Degradation: Meaning and types of degradation; Quality Assessment of Soil and Water.
4. Environmental Impact Assessment and Strategies; Case Studies: Tehri Dam, Sardar Sarovar Project
5. Concept of Sustainable Development
6. Concept of Eco-feminism and Eco-socialism
7. Environmental Challenges and Management in India: Desertification, Mining, Deforestation, Waste Disposal and Big Dam Controversy – Issues related with high dams (Narmada Sagar Project, Silent Valley); Eutrophication of Wetlands
8. Environmental Movements in India: Chipko Movement and Narmada Bachao Andolan
9. Case studies Associated with Environmental Degradation: Famines in Tribal belt of Rajasthan; Jhum Cultivation in Meghalaya
10. Disaster: A case study of Uttarakhand disaster (Kedarnath disaster, 2013).

Books Recommended:

1. Bhattacharya, N.N. (2011), Biogeography, Rajesh Publications, New Delhi.
2. Chandna R.C., (2010), Environmental Geography, Kalyani publishers, New Delhi.
3. Gautam A., (2010), Environmental Geography, Sharda Pustak Bhavan, Allahabad.
4. Jadhav, S.B., (2012), Environmental Geography, Chandralok Prakashan, Kanpur.
5. Moirangleima, Kh. (2010), Sustainable Management of Wetlands Central Valley of Manipur, B.R. Publishers, New Delhi.
6. Nag, P., et.al, (1997), Geography and Environment, (ed.) Concept Publishing Company, New Delhi.
7. Raghavan, .K. M., (2014), Environmental Geography and Disaster Management, Navyug Books International, Delhi.
8. Salahuddin, M., (2011), Waste Management in an Urban Area, B.R. Publishers, New Delhi.
9. Saxena H.M., (2011), Environmental Geography, Rawat Publications, Jaipur.
10. Singh Onkar, et.al. 1993, Frontiers in Environmental Geography, (ed.) Concept Publishing Company, New Delhi.
11. Singh Savindra, (2010), Environmental Geography, Prayag Pustak Bhavan, Allahabad.

Population Studies

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

1. Population Geography: Nature, Approaches (Behavioural and System)
2. Methodological Problems in data collection
3. Basic Source of Data with special reference to India, Problems of handling population data. Mapping and presentation of population data.
4. Population Change and its Measures: Crude Birth Rate, Fertility Rate, Age Specific Birth Rate, Total Fertility Rate, Crude Death Rate, Infant Mortality Rate, Maternal Mortality Rate
5. Determinants of Fertility and Mortality
6. Migration- Type, Determinants and Consequences, Models (W.J. Reilly, George K. Zipf, S.A. Stouffer, Ravenstein, and Lee)
7. Population factors in development planning
8. Population Growth and Distribution in India
9. Fertility and Mortality in India
10. Urbanization in India
11. Population compositions in India: Literacy rate, Sex ratio and Work force
12. Child marriage and Female foeticide in India
13. Poverty alleviation and employment generation in India,
14. National Population policy of India 2000.

Books Recommended:

1. Chandna, R.C, (2009) A Geography of Population, 8th edition, Kalyani Publishers, New Delhi.
2. Hassan, M.I (2009) Population Geography, Rawat Publication, Jaipur
3. Jhingan, M.L., Bhatt. B.K., Desai, J.N: (2005) Demography, Vriada Publication
4. M. Raza and Y.P. Aggrwal (1984), "Inequalities in the levels of Literacy in India: The regional Dimension," in Shafi and Raza (eds.), Spectrum of Modern Geography, Concept: New Delhi.
5. Newbold Bruce, K.: (2012) Population geography, Rawat Publication, Jaipur
6. Ranade, P.S: (1990) Population Dynamics in India, Ashish Publishing House, Delhi
7. Sharma R.K: (2007) Demography and Population Problems, Atlantic Publishers, Delhi
8. Tripathi R.K: (2008) Population Geography, Commonwealth Publication, Delhi

Rurban Geography

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Geographical dimensions of settlements, techniques and tools of settlement geography,
2. Settlements: origin and evolution, classification and dispersion of settlements,
3. Rural settlements: Pattern and morphological components of rural settlements,
4. Process of development of rural morphology, morphology of an Indian village and rural dwelling, rural service centres and their identification,
5. Rural Problems, schemes and developmental programmes,
6. Origin and evolution of towns, stages of evolution of cities,
7. Urbanization, urban morphology, stages of development of urban morphology, theories of urban morphology (Concentric Zone theory, Sector theory and Multiple Nuclei theory)
8. Urban land use, morphology of an Indian city (Jaipur)
9. Urban system analysis : Rank size rule, the Law of Primate city
10. Rural urban fringe, suburb, satellite town, conurbation, umland
11. Urban problems, Urban planning and Master plan, Sustainable urban planning, National Urbanization policy.

Books Recommended:

1. Bansal, Suresh Chandra, (2010), Urban geography, Meenakshi Prakashan, Meerut
2. Mandal, R.B., (2010), Urban Geography: a text-book, Concept Publications, New Delhi,
3. Pacione, Michael, (2009), Urban geography: a global Perspective, Routledge, London.
4. Singh, R.Y. (2005): Geography of Settlements. Rawat Publications, Jaipur and New Delhi.
5. Singh, S.B. (1977): Rural Settlement Geography. U.B.B.P., Publications, Gorakhpur.
6. Tiwari, R. C. (2000): Settlement Geography; Prayag Pustak Bhawan Allahabad.
7. Taylor, Griffith, (1958), Urban geography, Methuen, London
8. Verma, L.N., (2008), Urban geography, Rawat Publications, Jaipur.
9. मौर्य एस.डी. (2009) : अधिवास भूगोल, शारदा पुस्तक भवन, इलाहाबाद।
10. बंसल सुरेश चन्द्र (2009) : ग्रामीण बस्ती भूगोल, मिनाक्षी प्रकाशन, मेरठ।
11. तिवारी आर. सी. (2006) : अधिवास भूगोल, प्रयाग पुस्तक भवन, इलाहाबाद।
12. सिंह रामयज्ञ (2005) : अधिवास भूगोल, रावत पब्लिकेशन, जयपुर एवं नई दिल्ली
13. सिंह इन्दिरा (2008) : अधिवास भूगोल, यूनिवर्सिटी पब्लिकेशन, नई दिल्ली।

Social Geography

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section – A

- a) Nature & Approaches to the study of Social Geography
- b) Definition, origin and types of society
- c) Social process – social interaction
- d) Social stratification
- e) Caste – Origin and its theories, Recent changes in caste system

Section – B

- a) Social organization & Groups
- b) Social well being
- c) Human Development – Parameter and Index. Recent Trends in Human Development
- d) Population growth, Distribution & Problems
- e) Human Races : Origin, Evolution and classification of Human Races According to G. Taylor
- f) Quality of Socially Environment : Globalization and social transformation

Section – C

- a) Indian Society in Historical Perspective
- b) Social changes in India
- c) Human Development in India
- d) Gender issues and status of woman in India
- e) Social Planning in India

Books Recommended:

1. Ahmad Aijazuddin, (1999) Social Geography. Rawat Publications, Jaipur.
2. Ballabh Anand, (2005) A Handbook of Social Geography, Akansha Publishing House, New Delhi
3. Hamnett Chris, (1996) Social Geography, A Reader, Arnold, Co-published in The US, New York.
4. Jr. Del Casino & J. Vincent, (2009) Social Geography, A Critical Introduction. Wiley-Blackwell, A John Wiley & Sons, Ltd. Publication, United Kingdom
5. Kumar Ashok, (2004) Social Geography of India, Anmol Publication Pvt. Ltd., New Delhi.
6. Mehtani Subhah & Sinha, (2010) Social Geography. Commonwealth Publishers Pvt. Ltd., New Delhi.
7. Mohanthy G.S., (2005) Social & Cultural Geography, Isha Books, Delhi
8. Pandit Apoorva, (2010) Watershed Development Inputs & Social Change, Understanding the Changing Culture of Child Nutrition. Rawat Publications, Jaipur.
9. Peet Richard, (2003) Radical Geography, Alternative Viewpoints on Contemporary Social Issues, Rawat Publications, Jaipur.
10. मौर्य एस. डी. (2010) सामाजिक भूगोल, शारदा पुस्तक भवन, इलाहाबाद।

Advanced Geography of India

L T P C

2 2 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

1. India as a geographical unit and geopolitics of the Indian Ocean
2. Physiographic divisions and Geology of India
3. Climate of India: Diversity in the unity of Indian Monsoon
4. Forest Resource: Forest conservation and Social forestry
5. General demographic status with special reference to sex ratio and literacy
6. Trends of urbanization in India.
7. Human development index of India
8. Multipurpose projects with special reference to Tehri and Chambal Project
9. Land utilization
10. Agricultural Regions of India according to ICAR
11. Mineral Resource of India and Problems of mining activities
12. Historical perspective of Indian Industries
13. Trends and pattern of foreign trade of India
14. Emerging tourism industry of India
15. Management of Urban solid waste

Books Recommended:

1. Khullar D.R. (2014) India : a Comprehensive Geography, Kalyani Publication, Ludhiyana
2. Krishnan, M.S., (2012) Geology of India and Burma, CBS Publication, New Delhi.
3. Mishra, V.C. (1967) Geography of Rajasthan, National Book Trust, New Delhi.
4. Puri, G. S. (1960) Indian forest Ecology, Oxford Book and Stationary, New Delhi.
5. Raychaudhary. S.P. (1966) Land and Soil, National Book Trust, New Delhi.
6. Singh Gopal, (2010) Geography of India, Atma Ram Publication, Delhi
7. Spate, O. H. K., & Learrmonth, A.T.A., India & Pakistan, London.
8. Wadia, D. N., (1957) Geology of India, Macmillan, London.
9. हुसैन माज़िद, सिंह रमेश (2015) भारत का भूगोल, टाटा मैक्ग्राहिल प्रकाशन, नई दिल्ली।
10. मामोरिया चतुर्भुज (2009) भारत का व हत भूगोल, साहित्य भवन आगरा।
11. बंसल सुरेश चन्द्र (2011) भारत का भूगोल, मीनाक्षी प्रकाशन, मेरठ।
12. सिंह गोपाल (2006) भारत का भूगोल, आत्माराम, दिल्ली।
13. सक्सैना हरिमोहन (2014) राजस्थान का भूगोल, राजस्थान हिन्दी ग्रंथ अकादमी प्रकाशन।
14. शर्मा राजकुमार (2010) राजस्थान का भूगोल, हिमाशु पब्लिकेशन, उदयपुर।
15. शर्मा एच. एस. एवं शर्मा एम.एल. (2015) राजस्थान का भूगोल, पंचशील प्रकाशन, जयपुर

Study of Geosphere

L T P C

2 2 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

1. General introduction of solar system and its origin by inter-Stellar Dust Hypothesis of Otto Schmid.
2. Study of Geological Time scale.
3. Interior of the Earth according to Seismology.
4. Plate tectonic theory and its applications.
5. Normal Cycle of Erosion and interruptions in Erosion cycle.
6. Introduction of general features of ocean floor and origin of continental Shelf, continental slope, Abyssal plain and Oceanic Deep.
7. Introduction of ocean deposits and their classification on the basis of sources and depth.
8. Causes of origin of currents and currents of the Atlantic, Pacific and Indian Ocean.
9. Types and Origin of Tides (Equilibrium and Stationary wave theories)
10. Type of coral reefs and their origin (Daly's Glacial control theory)
11. Factors controlling solar insolation, heating and cooling of atmosphere, regional distribution of Temperature.
12. Introduction of pressure and wind belts, shifting of pressure belts,
13. Introduction of cyclone and anticyclone and origin of temperate cyclone.
14. Causes and effects of global environmental Problems; Ozone depletion, Green House effect, Global warming
15. Climate change; Evidences and Consequences

Books Recommended:

1. Alka, G., (2011), Bhoutik Bhoogol, Rastogi Publications, Meerut.
2. Critchfield, H., (1975) General Climatology, Prentice-Hall, New York.
3. Dayal, P., (1996) A Text book of Geomorphology, Shukla Book Depot, Patna,
4. Khullar, D.R., (2012), Physical Geography, Kalyani Publishers, New Delhi.
5. King, C. A. M., (1975) Oceanography for Geographers, E. Arnold, London.
6. Sharma, H.S., (2012) Bhoutik Bhoogol, Panchshil Publications, Jaipur
7. Singh, S., (2009), Bhoutik Bhoogol, Vasundhara Prakashan, Gorakhpur.
8. Singh, S., (2009), Physical Geography, Prayag Pustak Bhawan, Allahabad.
9. Strahler A.N. and Strahler, A.H. (1984): Elements of Physical geography, John Wiley & Sons. New York
10. Strahler, A. N. and A. H. Strahler, (1992) Modern Physical Geography, John Wiley & Sons.

Digital Cartography and Geoinformatics

L T P C

2 0 0 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Remote Sensing

1. Remote Sensing : Functioning and Platforms
2. Properties of EMR and Electromagnetic Spectrum, Interaction of EMR with earth's surface and atmosphere,
3. Spectral Signatures
4. Basic principle of Thermal and Microwave Remote Sensing
5. Applications of Remote Sensing in Agriculture, Forestry, Urban Studies and Water Resource.

Books Recommended:

1. C.P. Lo and Albert K.W. Yeung (2002): Concepts and Techniques of Geographic Information System, Prentice-Hall of India Private Limited, New Delhi.
2. Dent Borden D. (1990): Cartography, Thematic Map Design, Wm.C. Brown Publishers.
3. Ian-Haybood et.al. (2002): An Introduction to Geographical Information System.
4. Kang-tsung Chang (2002): Geographic Information System, Tata-McGraw Hill, New Delhi.
5. Keats, J.S. (1973): Cartographic Design and production Longman, London
6. Keith C. Clarke (1997): Getting Started with Geographic Information Systems, Prentice Hall, New Jersey.
7. Krack, M.J. and Ferjan Ormeling (2003): Cartography, Visualization of Geospatial Data, Pearson Education Limited, Patparganj, Delhi, India.
8. Michael N. Demers (2000): Fundamentals of Geographic information Systems, John Wiley and Sons, Inc, New York.
9. Misra R.P. and A. Ramesh (1989): Fundamentals of Cartography, Concept Publishing Company New Delhi.
10. Monkhouse, F.J. and H.R. Wilkinson (1967) Maps and Diagrams, B.T. Publications Pvt. Ltd., Delhi 1989.
11. Paul, A. Longley et.al. (2011): Geographic Information Systems and Science, John Wiley and Sons Ltd. New York.
12. Peter A. Burrough and Rachael A. McDonnell (1998): Principles of Geographic Information Systems, Oxford University Press.
13. Raisz Erwin (1962): Principles of Cartography, McGraw Hill, New York.
14. Robinson, Arthur and et.al.(2005): Elements of Cartography, John Wiley and Sons, New York.
15. Singh L.R. and R.N. Singh (1975): Map work and Practical Geography, Central Book Depot, Allahabad.
16. Singh R.L. (1979): Elements of Practical Geography, Kalyani Publishers, New Delhi.

Digital Cartography and Geoinformatics Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Introduction to Cartography

A. Digital Cartography (Lab.)

1. Introduction of digital cartography
2. Graphical Presentation of Data: Line diagram, Bar diagram, Pie diagram, Pyramid diagram
3. Map Generalization: Map layout

B. GIS and GPS: (Lab.)

1. Components of GIS
2. Data Base Management system
3. Drafting materials: Base map, Completion for thematic mapping, Preparation of thematic maps.
4. Introduction to GPS and its Applications

Books Recommended:

1. C.P. Lo and Albert K.W. Yeung (2002): Concepts and Techniques of Geographic Information System, Prentice-Hall of India Private Limited, New Delhi.
2. Dent Borden D. (1990): Cartography, Thematic Map Design, Wm.C. Brown Publishers.
3. Ian-Haybood et.al. (2002): An Introduction to Geographical Information System.
4. Kang-tsung Chang (2002): Geographic Information System, Tata-McGraw Hill, New Delhi.
5. Keats, J.S. (1973): Cartographic Design and production Longman, London
6. Keith C. Clarke (1997): Getting Started with Geographic Information Systems, Prentice Hall, New Jersey.
7. Krack, M.J. and Ferjan Ormeling (2003): Cartography, Visualization of Geospatial Data, Pearson Education Limited, Patparganj, Delhi, India.
8. Michael N. Demers (2000): Fundamentals of Geographic information Systems, John Wiley and Sons, Inc, New York.
9. Misra R.P. and A. Ramesh (1989): Fundamentals of Cartography, Concept Publishing Company New Delhi.
10. Monkhouse, F.J. and H.R. Wilkinson (1967) Maps and Diagrams, B.T. Publications Pvt. Ltd., Delhi 1989.
11. Paul, A. Longley et.al. (2011): Geographic Information Systems and Science, John Wiley and Sons Ltd. New York.
12. Peter A. Burrough and Rachael A. McDonnell (1998): Principles of Geographic Information Systems, Oxford University Press.
13. Raisz Erwin (1962): Principles of Cartography, McGraw Hill, New York.

Fuel Geology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Explore coal deposits, their mode of occurrences, structures in coal seams and application of coal petrography.
- Describe the geology of petroleum reservoirs, prospective and their exploration techniques.
- Describe the source of radioactive minerals, chemistry, prospects and exploration techniques.
- Provide feasible solutions for radioactive waste management.

Course Content:

Section A

Definition, origin, types and rank of coal. Mode of occurrences and structures in coal seam. Coal petrography. Indian coal deposits. Introduction to Coal bed methane.

Section B

Origin, composition, migration and entrapment of natural hydrocarbons. Properties of source and reservoir rocks. Porosity: Types and classification and Permeability: Types. Reservoir traps: structural, stratigraphic and combination traps. Geographical and geological distributions of onshore and offshore petroliferous basins of India.

Section C

Mineralogy and geochemistry of radioactive minerals. Distribution of radioactive minerals in India. Sources and classification of radioactive waste. Radioactive waste management.

Recommended Books:

1. Acharyya, S. K. (2000). *Coal and Lignite Resources of India: An overview*. Bangalore, India: Geological Society of India.
2. Aswathanarayana, U. (1985). *Principles of Nuclear Geology*. New Delhi, India: Oxford Press.
3. Boyle, R. W. (1982). *Geochemical prospecting for Thorium and uranium deposits*. Amsterdam & New York, Elsevier.
4. Chandra, D., Singh, R. M., & Singh, M. P. (2000). *Textbook of coal (Indian context)*. Varanasi, India: Tara.
5. Dahlkamp, F. J. (1993). *Uranium Ore Deposits*, Berlin Heidelberg, Germany: Springer-Verlag.
6. Durance, E. M. (1986). *Radioactivity in Geology-principles and application*. Chichester, UK: Ellis Horwood.
7. Francis, W. (1961). *Coal*. London, UK: Edward Arnold.
8. Holson, G. D., & Tiratso E. N. (1985). *Introduction to Petroleum Geology*, Houston, TX: Gulf.
9. KDMIPE ONGC. (1986). *Petroliferous basins of India*: Dehradun, India: India Petroleum.
10. Krishnaswamy, S. (1979). *India's Mineral Resources*. New Delhi, India: Oxford IBH.
11. Levorsen, A. L. (1967). *Geology of Petroleum* (2nded.). San Francisco, CA: Freeman.
12. Selley, R. C. (1998). *Elements of Petroleum Geology*. San Diego, CA: Academic Press.
13. Singh, M. P. (1998). *Coal and Organic Petrology*. New Delhi, India: Hindustan.
14. Tissot, B. P., & Welte D.H. (1984). *Petroleum formation and occurrence* (2nded.). Berlin Heidelberg, Germany: Springer-Verlag.

Suggested e-learning materials:

1. Fossil fuels

<https://opentextbc.ca/geology/chapter/20-3-fossil-fuels/>

2. Petroleum and CBM

<http://oilandgasgeology.com/>

Geology Lab-I with Field Work

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students should be able to:

- Interpret the toposheets for civil engineering purposes.
- Interpret the geological history of the given area supplemented with structural data in geological maps.
- Make systematic descriptions of minerals in hand-specimen & thin-section and elaborate the laboratory methods for preparation of mineral or rock sections.
- Determine the average slope angle and river morphometry.
- Describe the petrography of common sedimentary rocks both at macroscopic and microscopic level.
- Analyze and interpret geochemistry of common sedimentary rocks using various plots and graphs.

Course Content:

Geotectonics and Structural Geology

1. Toposheet Indexing
2. Study of symbols used in Structural maps
3. Preparation of geological map, cross profile and their interpretation
4. β & π diagrams
 - a) Plotting of Planes and Line
 - b) Plunging and non-plunging folds
 - c) Determination of angle between planes
 - d) Determination of pitch and plunge
 - e) Determination of positions of σ_1 σ_2 σ_3 in conjugate fracture planes
5. Preparation of map showing tectonic and seismic zones of India
6. Elementary Idea of stereo plot software

Mineralogy and Analytical Techniques

1. Identification of rock forming minerals in hand specimens and under polarizing microscope
2. Goniometer and its use in measuring interfacial angle of crystals and calculation of axial ratio
3. Preparation of thin sections of rocks and minerals

Geomorphology

1. Drainage morphometry and determination of average slope angle

Sedimentary Petrology

1. Megascopic and microscopic study of clastic and non-clastic rocks

2. Grain size analysis by sieving method: Plotting of size distribution data as frequency and cumulative curves, computation of statistical parameters and interpretation

Geological Field Work

* Note: Scientific calculators are permitted during examination.

Recommended Books:

1. Billings, M. P. (1972). *Structural Geology* (3rded.). New York, NY: Prentice Hall.
2. Blatt, H., Middleton, G.V., & Murray, R.C. (1980). *Origin of Sedimentary Rocks*. New Jersey, NJ: Prentice Hall.
3. Cornelis, K., & Barbara, D. (2007). *Mineral science*. New York, NY: John Wiley & Sons.
4. Folk, R.L. (1981). *Petrology of Sedimentary Rocks* (2nded.). Austin, TX: Hemphill.
5. Gribble, C.D. (1991). *Rutley's Element of Mineralogy* (27thed.). Delhi, India: CBS.
6. Kerr, P.F. (1959). *Optical Mineralogy* (4thed.). New Jersey, NJ: McGraw Hill.
7. Lisle, R. J., Brabham, P.J., & Barnes J. W. (2011). *Basic Geological Mapping* (5thed.). London, UK: Wiley Blackwell.
8. Perry, D.L. (1990). *Instrumental Surface Analysis of Geologic Materials*. New York, NY: VCH.
9. Pettijohn, F.J. (1975). *Sedimentary Rocks* (3rded.). New Delhi, India: Harper and Row.
10. Phillips, W. R., & Griffen, D.T. (1986). *Optical Mineralogy* (5thed.). New Delhi, India: CBS.
11. Ragan, M. D. (2009). *Structural Geology an Introduction to Geometrical Techniques* (3rded.). New York, NY: Cambridge University Press.
12. Rowland, S.M., Duebendorfer, E. M., & Ilsa, M. S. (2007). *Structural Analysis and Synthesis A Laboratory Course in Structural Geology* (3rded.). Victoria, Australia: Blackwell.
13. Survey of India Toposheets
14. Thornbury, W.D. (1980). *Principles of Geomorphology* (2nded.). New York, NY: Wiley Eastern.
15. Tucker, M.E. (1981). *Sedimentary Petrology: An Introduction* (3rded.). New York, NY: Wiley & Sons.

Suggested e-learning materials:

1. Stereonet Software
<https://app.visiblegeology.com/stereonetApp.html>
2. Mineral forms
<http://www.webmineral.com/>
3. Map interpretation
<https://ocw.tudelft.nl/courses/structural-geology-map-interpretation/>
4. Field Mapping <http://www.geosci.usyd.edu.au/users/prey/FieldTrips/BrokenHillOlary/Mapping.html>
5. Geologic maps and stratigraphic Sections, Mineralogy and Sedimentary petrology
<https://nptel.ac.in/courses/105105106/3>

Geotectonics and Structural Geology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Recognize and interpret the geological structure of deformed continental regimes, from mildly deformed upper crustal regimes to complexly deformed deeper crustal regimes.
- Interpret the relative timing of formation of structures, the kinematics of deformation, and the progressive deformation histories in these regimes.
- Interpret stress regimes strain rate and fluid pressure histories during continental deformation.
- Apply the information of structural geology in the mining and resource exploration environment.

Course Content:

Section A

Introduction and tectonic framework of Earth crust. Continental drift hypothesis, Supporting evidences and criticism. Convection currents, Sea floor spreading and Palaeomagnetism. Introduction to plate tectonics: types of plate boundaries and plate boundary processes. Tectonic features of extensional, compressional and strike-slip terrain. Hotspots and mantle plumes. Tectono-structural subdivisions of Himalaya and Himalayan Orogeny.

Section B

Mechanical properties of rocks. Concept of stress and strain. Behavior of material under stress. Theory of rock failure. Brittle and Ductile deformation. Classification and Mechanism of Folding and Faulting. Recognition criteria of faulting. Boudinage structures.

Section C

Unconformities: types, formation and significance in stratigraphic correlation. Joints: Genetic classification, criteria for recognition and tectonic significance. Concept and types of Lineation, Foliations, Cleavages and their significance. Shear Zones: Characteristics, Geometry and types. Brittle and ductile shear sense indicators.

Recommended Books:

1. Billings, M.P. (1972). *Structural Geology* (3rded.). New York, NY: Prentice Hall.
2. Condie, K.C. (2016). *Earth as An Evolving Planetary System* (3rd ed.). Amsterdam, Netherland: Elsevier Academic Press.
3. Dennis, G.J. (1987). *Structural Geology An Introduction*. Iowa, IA: Wm. C. Brown.
4. Fossen, H. (2010). *Structural Geology* (2nded.). Cambridge, UK: Cambridge University Press.
5. George, H. D., Stephen J. R., & Charles F. K. (2013). *Structural Geology of Rocks and Region* (3rded.). New York, NY: John Wiley and Sons.
6. Ghosh, S. K. (1993), *Structural Geology Fundamentals and Modern Developments*. London, UK: Pergamon Press.

7. Hobbs, B.E., Means, W.D., & Williams, P. F. (1976). *An Outline of Structural Geology*. New York, NY: John Wiley and Sons.
8. Kerey, P., Kleperis, & K. A., Vine, J. F. (2009). *Global Tectonics* (3rded.). New Jersey, NJ: Wiley Blackwell.
9. Park, R.G. (1989). *Foundations of Structural Geology*, (3rded.). New York, NY: Chapman & Hall.
10. Passchier, C. W., & Trouw, R. A. J. (2005). *Microtectonics* (2nded.). New York, NY: Springer Berlin Heidelberg.
11. Pluijm B. A., & Marshak, S. (2004). *Earth Structure An Introduction to Structural Geology and Tectonics*(2nd ed.). New York, NY: W. W. Norton & Company.
12. Ramsay, J.G., & Huber, M. I. (1987). *The Techniques of Modern Structural Geology: Strain Analysis* (Vol. 1). New York, NY: McGraw Hill.
13. Ramsay, J.G., & Huber, M. I. (1987). *The Techniques of Modern Structural Geology: Folds and Fractures* (Vol. 2). New York, NY: McGraw Hill.
14. Ramsay, J.G., & Lisle, R. J. (2000). *The Techniques of Modern Structural Geology: Application of Continuum Mechanics in Structural Geology* (Vol. 3). London, UK: Elsevier Academic Press.
15. Twiss, R. J., & Moores, E. M. (2007). *Structural Geology*. (2nded.). New York, NY: WH Freeman.

Suggested e-learning materials:

1. Geological Map Interpretation

<https://ocw.tudelft.nl/courses/structural-geology-map-interpretation/>

2. Geologic Structures

<https://nptel.ac.in/courses/105105106/2>, <https://nptel.ac.in/courses/105104152/18>

3. Continuum mechanics, Fault and Ductile Deformation Notes <https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-113-structural-geology-fall-2005/lecture-notes/>

Structural Geology and Tectonics <http://www.uh.edu/~jbutler/anon/anoncoursestructure.html>

Mineralogy and Analytical Techniques

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Explain the crystal structure, physical and optical properties of minerals.
- Demonstrate the relationship between the internal structure of minerals with their external form and effect on physical properties.
- Explain the mineralogical concepts of polymorphism, solid solution, exsolution and twinning.
- Discuss the various analytical technique used for identification and detection of minerals and rocks.

Course Content:

Section A

Introduction and scope. Isomorphism and Polymorphism, Exsolution and Solid solution. Physical properties of minerals. Polarization of light. Behaviour of isotropic and anisotropic minerals in polarized light. Double refraction and birefringence. Sign of elongation. Interference figures. Extinction and its types. Relief and Pleochroism. Twinning: Cause, types and laws. Accessory Plates.

Section B

Silicates: structure and classification. A detailed study of the following important minerals with reference to structural formulae, crystal structure, chemistry, physical and optical properties and mode of occurrence.

Silicates: Olivine, Garnet, Melilite, Kyanite, Andalusite, Sillimanite, Beryl, Pyroxene, Amphibole, Serpentine, Mica, Kaolinite, Chlorite, Talc, Feldspar.

Non-silicates: Calcite, Aragonite, Dolomite, Apatite, Gypsum, Barite, Spinel, Rutile.

Section C

Definition of Crystal. Classification of crystal into crystal systems. Introduction to analytical techniques like XRD (X-ray diffraction), Scanning Electron Microscope (SEM), Electron Probe Micro Analyser (EPMA), Thermogravimetric Analysis (TGA), Transmission Electron Microscope (TEM), Mass spectrometry (MS), Atomic absorption spectrometry (AAS) and their application in mineral characterization.

Recommended Books:

1. Berry, L.G, Mason, B., & Dietrich, R. V. (1982). *Mineralogy*. New Delhi, India: CBS.
2. Gill, R. (1977). *Modern analytical geochemistry*. London, UK: Roulledge.
3. Gribble, C.D. (1991). *Rutley's Element of Mineralogy* (27thed.). Delhi, India: CBS.
4. Kerr, P.F. (1959). *Optical Mineralogy* (4thed.). New Delhi, India: McGraw Hill.
5. Klein, C., & Dutrow, B. (2007). *Mineral science* (23rded.). New York, NY: John Wiley & Sons.

6. Perkins, D. (2010). *Mineralogy* (3rded.). USA, Pearson.
7. Perry, D.L. (1990). *Instrumental Surface Analysis of Geologic Materials*. New York, NY:VCH.
8. Phillips, Wm, R., &Griffen, D.T. (1986). *Optical Mineralogy* (5thed.). New Delhi, India: CBS.
9. Read, H.H. (Ed.). (1968). *Rutley's Element of Mineralogy* (24thed.). London, UK: Thomas Murby and Co.
10. Rollinson, H. (1993). *Using Geochemical Data-Evaluation, Presentation, Interpretation*. New York, NY: Longman Scientific & Technical.
11. Skoog, D.A., West, D. M., Holler, F.J., & Crouch, S.R. (2004). *Fundamentals of analytical chemistry*. (8thed.). California, CA: Thomson Brooks Cole.

Suggested e-learning materials:

1. Mineral forms
<http://www.galleries.com/minerals>
2. Gemstones and gemology resources
<http://www.galleries.com/gemstones>
<http://farlang.com/gems>
3. Mineral properties
<https://naturalhistory.si.edu/research/mineral-sciences>

Ore Genesis and Economic Geology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the minerals that can be used for economic and/or industrial purposes.
- Identify and describe the precious and base metals, nonmetallic minerals and building stone.
- Explain the ore formation processes and its geological setting.
- Estimate the resource and reserves availability

Course Content:

Section A

Introduction to Ore forming processes, Magmatic processes of mineralization, hydrothermal mineralization, oxidation and supergene enrichment. Prophyry, skarn. Fluid inclusion studies. Stratiform and stratabound ores.

Section B

Occurrence and distribution of metalliferous deposits of India: iron, manganese, aluminium, chromium, gold, nickel, lead, zinc, copper, tungsten. Indian deposits of non-metals: mica, asbestos, barytes, gypsum, graphite. Minerals used in different industries: fertilizer, paint, ceramic and cement industries.

Section C

Resources, Reserve and Classification of Ore Reserve (Russian, UNFC System and USGS/USBM Classification), Parameters for Reserve Estimation, Stages of Exploration, Ore Reserve Calculation Methods, National Mineral Policy. Mineral Concession Rules. Marine Mineral Resources and Law of Sea.

Recommended Books:

1. Evans, A.M. (1993). *Ore Geology and Industrial Minerals* (3rded.). London, UK: Blackwell.
2. Gokhale, K.Y.G.K., & Rao, T.C. (1978). *Ore deposits of India their distribution and processing*. New Delhi, India: Tata-McGraw Hill.
3. Guilbert, J.M., & Park Jr., C.F. (1986). *The Geology of Ore deposits*. New York, NY: Freeman & Co.
4. Jensen, M.L. & Bateman, A.M. (1981). *Economic Mineral Deposits* (3rded.). New York, NY: John Wiley.
5. Krishnaswamy, S. (1979). *India's Mineral resources*. New Delhi, India: Oxford & IBH.
6. Mookherjee, A. (2000). *Ore Genesis-A holistic approach*. New Delhi, India: Allied.
7. Prasad, U. (2015). *Economic Geology: Economic Mineral Deposits* (2nded.). New Delhi, India: CBS.
8. Sen, A.K., & Guha P.K. (1981). *A Handbook of Economic Geology*. Calcutta, India: Modern Book Agency.

9. Tiwari, S. K. (2010). *Ore Geology, Economic Minerals and Mineral Economics* (Vol. 1). New Delhi, India: Atlantic.
10. Tiwari, S. K. (2010). *Ore Geology, Economic Minerals and Mineral Economics* (Vol. 2). New Delhi, India: Atlantic.

Suggested e-learning materials:

1. Economic Minerals
<https://epgp.inflibnet.ac.in/ahl.php?csrno=448>
2. Indian mineral occurrence
<https://nptel.ac.in/courses/105105170/>

Geology Lab-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the petrography of common igneous and metamorphic rocks both at macroscopic and microscopic level.
- Interpret the gravity, bore-hole and seismic data used in exploration geophysics.
- Analyze and interpret geochemistry of common igneous and metamorphic rocks using various plots and graphs.
- Identify different rock types in various stratigraphic horizons of India.
- Develop a systematic procedure for megascopic identification and description of economic fuel minerals their origin, mode of occurrence and utilization.
- Prepare map showing distribution of metallic, non-metallic, fuel and Industrial mineral in India.

Course Content:

Geophysics and Exploration Method

1. Interpretation of Seismic and resistivity data
2. Study of gravity data maps and their interpretation

Igneous Petrology

1. Megascopic and microscopic study of different igneous rocks
2. Calculation of CIPW Norms

Metamorphic Petrology

1. Megascopic and microscopic study of different metamorphic rocks
2. Graphic construction of ACF, AKF and AFM diagrams

Stratigraphy

1. Study of rocks in hand specimens from known Indian Stratigraphic horizons and type localities
2. Map Preparation of important lithotectonic units of India

Ore Genesis and Economic Geology

1. Megascopic study of metallic ore minerals in hand specimen
2. Preparation of maps showing distribution of metallic, non metallic and industrial minerals in India
3. Numericals based on reserve estimation
4. Megascopic study of different types of coal

5. Study of geological maps and sections of important oilfields of India, petroliferous basins, coal seams and radioactive minerals (U and Th) in India

*** Note: Scientific calculators are permitted during examination.**

Recommended Books:

1. Bose, M. K. (1997). *Igneous Petrology*. Kolkata, India: World Press.
2. Bucher, K., & Frey, M. (1994). *Petrogenesis of Metamorphic Rocks* (6thed.). New York, NY: Springer-Verlag.
3. Chandra, D., Singh, R.M., & Singh, M.P. (2000). *Textbook of coal* (Indian context), Varanasi, India: Tara.
4. Krishnaswamy, S., (1979). *India's Mineral Resources*. New Delhi, India: Oxford IBH.
5. Kumar, R. (1978). *Historical Geology and Stratigraphy of India*. New Delhi, India: New Age International.
6. LeMaitre, R.W. (2002) *Igneous Rocks: A classification and glossary of Terms* (2nded.). New York, NY: Cambridge University Press.
7. Lowrie, W. (1997). *Fundamentals of Geophysics* (2nded.). London, UK: Cambridge University press.
8. Singh, M.P. (1998). *Coal and Organic Petrology*. New Delhi, India: Hindustan.
9. Spry, A. (1969). *Metamorphic Textures*. UK, Pergamon Press. Turner, F.J. (1998). *Metamorphic Petrology*, New York, NY: McGraw Hill.
10. Wilson, M. (1989). *Igneous Petrogenesis*, London, UK: Unwin Hyman.
11. Yardley, B.W.D. (1990). *An Introduction to Metamorphic Petrology*. London, UK: ELBS, Longman.

Suggested e-learning materials:

1. Magnetic North, Geomagnetic and Magnetic Poles <http://wdc.kugi.kyoto-u.ac.jp/igrf/index.html>
2. World Magnetic Model Calculator

http://www.geomag.bgs.ac.uk/data_service/models_compass/igrf.html

Geophysics and Exploration Method

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Develop integrated overview of exploration methods and the physics of waves, focusing on seismic reflection and refraction.
- Explain the principal theories and specialized techniques used in land and marine survey.
- Detect economically viable deposits such as ore minerals, fossil fuels and reservoirs.
- Work in academic, research and industries related with geophysical exploration.

Course Content:

Section A

Introduction to Geophysics. Shape and size of Earth. Gravitational field of the Earth. Variation of gravity on the Earth. Principles of gravity methods and instruments used. Gravity field surveys. Corrections applied to gravity data: Bouguer anomaly, Regional and residual anomalies, Gravity anomaly, anomaly maps and their interpretation.

Section B

Geomagnetic field of the Earth. Magnetic properties of rocks. Principles of magnetic methods. Instruments of magnetic surveying. Fluxgate magnetometer, Proton precision magnetometer, Alkali vapour magnetometer. Aeromagnetic surveys

.Section C

Electrical methods: Basic principles and various types of electrode configuration. Electrical and resistivity surveying. Field procedures: profiling and sounding. Seismic methods: principles and instruments used. Seismic velocity and interpretation of seismic data. Seismic refraction and reflection method. Well logging: Types.

Recommended Books:

1. Dobrin, M. B. (1976). *Introduction to Geophysical Prospecting* (4thed.). London, UK: McGraw Hill.
2. Haldar, S. K. (2013). *Mineral Exploration: Principles and Applications*. Amsterdam, Netherland: Elsevier.
3. Lilly, R. J. (1998). *Whole Earth Geophysics*. London, UK: Pearson.
4. Lowrie, W. (1997). *Fundamentals of Geophysics* (2nded.). London, UK: Cambridge University press.
5. Mishra, D. C. (2011). *Gravity and Magnetic Methods for Geological Studies: Principles, Integrated Exploration and Plate Tectonics*, Hyderabad, India: CRC Press.
6. Parasnis, D.S. (1975). *Principles to applied Geophysics* (5thed.). New Delhi, India: Chapman and Hall.
7. Ramakrishna T.S. (2006). *Geophysical Practice in mineral exploration and mapping*. Banglore, India: Geological Society of India, Memoir 62.

8. Sharma, P.V. (1986). *Geophysical Methods in Geology*. London, UK: Elsevier.
9. Telford, W.M., Geldart L.P., & Sheriff, R.E. (1990). *Applied Geophysics* (2nd ed.). Cambridge, UK: Cambridge University Press.

Suggested e-learning materials:

1. International Geomagnetic Reference Field <http://wdc.kugi.kyoto-u.ac.jp/igrf/index.html>
2. World Magnetic Model Calculator
http://www.geomag.bgs.ac.uk/data_service/models_compass/wmm_calc.html

Igneous Petrology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Explain the various physical and chemical processes forming igneous rocks.
- Describe and apply phase equilibria principles to common igneous rock.
- Describe the various geochemical indices for mineralogical and petrological evolution of igneous rocks.
- Describe the petrography and petrogenesis of important igneous rocks of Indian occurrence.

Course Content:

Section A

Magma- its nature and composition. Generation of magma. Factors controlling evolution of magma. Influence of volatiles and role of oxygen fugacity in magmatic crystallizations. Phase equilibrium studies of binary and ternary systems (Di-Ab-An and An-Di-Fo).

Section B

Major and minor elements. Trace and Rare Earth elements. Trace element partitioning. Normative minerals. Variation diagrams and discrimination diagrams. Forms, textures and structures of igneous rocks. IUGS classification of Igneous rocks. Plutonic, Volcanic and Ultramafic and Mafic.

Section C

Petrology and petrogenesis of major igneous rock types giving Indian examples of ultramafic, basaltic, granitic, ophiolite, carbonatite, lamprophyres and layered mafic intrusions.

Recommended Books:

1. Best M. G. (2002). *Igneous and Metamorphic Petrology* (2nded.). Oxford, UK: Wiley-Blackwell.
2. Blatt, H., Tracy, R.J., & Owens, B.E. (2006). *Petrology: Igneous, Sedimentary and Metamorphic* (3rded.). New York, NY: W.H. Freeman and Company.
3. Bose, M.K. (1997). *Igneous Petrology*. Kolkata, India: World Press.
4. Hall, A. (1997). *Igneous Petrology*. Harlow, UK: Longman.
5. LeMaitre, R.W. (2002). *Igneous Rocks: A classification and glossary of Terms* (2nded.). New York, NY: Cambridge University Press.
6. Phillpotts, A.R. (1994). *Principles of Igneous and Metamorphic Petrology* (2nded.). Cambridge, UK: Cambridge University Press.
7. Wilson, M. (1989). *Igneous Petrogenesis*. London, Unwin Hyman.
8. Winter, J.D. (2001). *An Introduction to Igneous and Metamorphic Petrology* (2nded.). New Jersey, NJ: Prentice hall.

Suggested e-learning materials:

1. Igneous- textures
<https://swayam.gov.in/course/3948-petrology>
2. Igneous rock-slides
<http://funnel.sfsu.edu/courses/geol426/>
<http://www.geolab.ie/>

Metamorphic Petrology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Identify metamorphic mineral assemblages, texture, structures to decipher the order of crystallization of minerals.
- Describe the metamorphic reaction responsible for metamorphism of rock.
- Recognize pressure-temperature-time (P-T-t) path associated with tectonic setting of metamorphosed rocks.
- Describe composition of the fluid phase in the rock during metamorphism.

Course Content:

Section A

Metamorphism and metamorphic processes. Mineralogical phase rule of closed and open system and its application. Metamorphic Reactions. Reaction mechanisms and types. Evolution of facies concept, metamorphic facies series and concept of paired metamorphic belts. Metamorphic zones and Isograds.

Section B

Metamorphic structures and textures. Replacement textures and reaction rims. Diagrammatic representation of mineral reactions and paragenesis: ACF, AKF, AFM diagrams. Progressive, regional and thermal metamorphism of pelitic, calcareous and basic igneous rocks. Charnockites.

Section C

Experimental petrology and its application to anatexis and formation of granitic magmas. Geothermometer and Geobarometer. Pressure-Temperature-Time-Depth path models for metamorphism. Regional metamorphism in relation to the theory of Plate Tectonics. Ocean floor metamorphism. Metamorphic Processes associated with Orogenic Belts of India.

Recommended Books:

1. Best, M. G. (2002). *Igneous and Metamorphic Petrology* (2nded.). Oxford, UK, Blackwell Science.
2. BhaskarR. B. (1986). *Metamorphic Petrology*. New Delhi, India:Oxford& IBH.
3. Blatt, H., Tracy, R. J., & Owens, B. E. (2006). *Petrology: Igneous, Sedimentary and Metamorphic* (3rded.). New York, NY: W.H. Freeman and Company.
4. Bucher, K., & Frey, M. (1994). *Petrogenesis of Metamorphic Rocks*. (6thed.). New York, NY: Springer-Verlag.
5. Edger, A.D. (1973). *Experimental Petrology*. Oxford, UK: Clarendon Press.
6. Phillpotts, A.R. (1994). *Principles of Igneous & Metamorphic Petrology* (2nded.). Cambridge, UK: Cambridge University Press.

7. Spry, A. (1969). *Metamorphic Textures*. London, UK: Pergamon Press.
8. Turner, F.J. (1968). *Metamorphic Petrology. Mineralogical and Field Aspects*. New York, NY: McGraw Hill.
9. Winkler, H.G.E. (1979). *Petrogenesis of metamorphic rocks*. New York, NY: Springer Verlag.
10. Winter, J.D. (2001). *An introduction to Igneous and Metamorphic Petrology* (2nded.). New Jersey, NJ: Prentice hall.
11. Yardley, B.W.D. (1990). *An Introduction to Metamorphic Petrology*. London, UK: ELBS, Longman.

Sedimentary Petrology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the principles of sedimentary petrology, the characteristics and the origin of the sedimentary rocks.
- Explain formation of sediments, transportation, deposition and formation of sedimentary rocks.
- Depict the classification of sedimentary basins with reference to plate tectonics and sedimentation.
- Identify the provenance for the sediments.

Course Content:

Section A

Sedimentary rocks: Textures, structure and classification. Grain size analysis. Palaeocurrent analysis. Trace fossils and stromatolites: classification and environment of deposition. Provenance and diagenesis of sediments. Heavy mineral analysis.

Section B

Field and laboratory techniques in sedimentology. Genesis and classification of sedimentary rocks: Clastic rocks- conglomerate, breccia, sandstone and shale. Non-clastic rocks- limestone, dolomite, evaporite, phosphorite, chert.

Section C

Definition and classification of sedimentary basins. Sedimentary basins of India. Principles and applications of C-14 and OSL dating. Sedimentary environment and facies modeling for marine, non-marine and mixed sediments.

Recommended Books:

1. Blatt, H., Middleton, G.V., & Murray, R.C. (1980). *Origin of Sedimentary Rocks*. New Jersey, NJ: Prentice Hall.
2. Blatt, H., Tracy, R.J., & Owens, B.E. (2006). *Petrology: Igneous, Sedimentary and Metamorphic* (3rded.). New York, NY: W.H. Freeman and Company.
3. Collins, J.D., & Thompson, D.B. (1982). *Sedimentary Structures*. London, UK: George Allen & Unwin.
4. Pettijohn, F.J. (1975). *Sedimentary Rocks* (3rded.). New Delhi, India: Harper and Row.
5. Reineck, H.E., & Singh, I.B. (1973). *Depositional Sedimentary Environments*. Berlin, Germany: Springer-Verlag.
6. Folk, R.L. (1981). *Petrology of Sedimentary Rocks* (2nded.). Austin, TX: Hemphill.
7. Selley, R.C. (2000). *Applied Sedimentology*. San Diego, CA: Academic Press.
8. Tucker, M.E. (1981). *Sedimentary Petrology: An Introduction* (3rded.). New York, NY: Wiley & Sons.

Suggested e-learning materials:

1. Sedimentary Texture and Structures

https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000448GO/P000594/M022660/ET/1505973116E-TextSedimentaryStructures.pdf

2. Basin depositional environment https://link.springer.com/chapter/10.1007/978-3-662-04029-4_1

Geochemistry and Isotope Geology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the composition of the Earth and processes by which the chemical elements have been synthesized over the history of the cosmos.
- Explain the origin and geochemical evolution of atmosphere, biosphere, hydrosphere and major global geochemical cycles.
- Describe the major principles and methods involved in geochemical prospecting.
- Explain the structure of atomic nuclei, its effects on nuclear stability, fractionation of stable isotopes, radiogenic isotopes geochemistry and their application in dating and palaeoclimate reconstruction.

Course Content:

Section A

Introduction to Geochemistry : Origin of elements. Cosmic abundance of elements. Pregeological history of the Earth. Structure and composition of Earth. Geochemical classification of elements. Principles of ionic substitutions in minerals.

Section B

Geochemistry of hydrosphere, biosphere and atmosphere. Geochemical cycles: Carbon, Oxygen, Nitrogen, Phosphate. Geochemical prospecting. Geochemical anomalies. Meteorites: classification, mineralogy, origin, and significance of meteorites.

Section C

Isotope Geochemistry: Introduction and physics of the nucleus. Radioactive decay and Law. Radioactive decay scheme of Rb-Sr method, Sm-Nd method, K-Ar method, Ar-Ar method, U-Th-Pb method, Fission tracking dating. Stable isotope geochemistry of oxygen, nitrogen, carbon and sulphur.

Recommended Books:

1. Albarede, F. (2003). *An introduction to geochemistry* (2nd ed.). New York, NY: Cambridge University Press.
2. Faure, G. & Mensing, T.M. (2005). *Isotope, principles and applications* (3rd ed.). New York, NY: John Wiley & Sons.
3. Hoefs, J. (1986). *Stable isotope geochemistry* (3rd ed.). Berlin, Germany: Springer- Verlag,
4. Krauskopf, K. B. (1979). *Introduction to Geochemistry*. New York, NY: McGraw Hill.
5. Mason, B., & Moore, C.B. (1982). *Introduction to Geochemistry* (2nd ed.). New York, NY : Wiley Eastern.
6. Mason, B. (1982). *Principles of Geochemistry* (3rd ed.). New York, NY: John Wiley & Sons.

Suggested e-learning materials:

1. Geochemical Prospecting
<https://pubs.usgs.gov/bul/1000f/report.pdf>
2. Origin of Elements <https://www2.lbl.gov/abc/wallchart/chapters/10/0.html>

Geology Lab-III with Field Work

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe the morphological characters of invertebrates and vertebrate fossils.
- Identify microfossils and their separation from matrix through microscope.
- Assessment of water quality and determination of aquifer properties.
- Process and analyze remote sensing data.

Course Content:

Remote Sensing and GIS in Geology

1. Procurement of satellite data.
2. Creating a standard FCC from satellite imagery.
3. Creating spectral profiles using satellite imagery and its interpretation.
4. Identification of landforms on topographic maps and satellite imagery.
5. Registration of satellite data with a toposheet of the area
6. Generating contrast stretched images.
7. Classification of images based on supervised and unsupervised and accuracy assessment.
8. Creation of DEM and draping of satellite imagery.
9. Generating slope map, aspect map and drainage network map

Hydrogeology

1. Delineation of hydrological boundaries on water table contour maps
2. Determination of porosity of rocks.
3. Determination of permeability of rocks.
4. Estimation of specific retention and specific yield.
5. Calculation of storage coefficient and transmissivity.
6. Physical analysis of water (pH, EC and TDS).
7. Chemical analysis of water (Anions and cations).
8. Determination of relative hardness of water.

Palaeontology

1. Study of morphological characters of some important Invertebrates fossils belonging to Brachiopoda, Gastropoda, Ammonoidea, Echinoidea and Corals.
2. Techniques of separation of Microfossils from matrix.

3. Study of larger benthic foraminifera.
4. Morphological study of microfossils.

Geological Field Work

*** Note:** Scientific calculators are permitted during examination.

Recommended Books:

1. Bignot, B. (1985). *Elements of Microplaeontology*. London, UK: Grahm and Trotman.
2. Braiser, M. D. (1980). *Microfossils*. London, UK: Geogrg Allen and Unwin.
3. Clarkson, E. N. K. (1998). *Invertebrate Palaeontology and Evolution*. Singapore: Wiley-Blackwell
4. Cushman, J. A. (1940). *The Foramanifera, their classification and use*. Cambridge, UK: Harvard University Press.
5. Drury, S. A. (1987). *Image Interpretation in Geology*. London, UK: Allen and Unwin.
6. Glaessner, M. F. (1945). *Principles of Micropalaeontology*. Melbourne, Australia: Melbourne University Press.
7. Karanth, K.R. (1989). *Hydrogeology*. New Delhi, India: Tata McGraw Hill.
8. Nagabhushaniah, H. S. (2001). *Groundwater in Hydrosphere*. New Delhi, India: CBS.
9. Pandey, S. N. (1987). *Principles and Application of Photogeology*. New Delhi, India: Wiley Eastern.
10. Raghunath, H. M. (2014). *Groundwater*. New Delhi, India: New Age International.
11. Ray, R. G. (1969). *Aerial Photographs in Geologic Interpretations*. USGS Prof. Paper 373.
12. Sabbins, F. F. (1985). *Remote Sensing-Principles and applications*. New York, NY: Freeman.
13. Siegal, B.S., & Gillespie, A.R. (1980) *Remote Sensing in Geology*. New York, NY: John Wiley.
14. Todd, D. K., & Mays, L. W. (2004). *Groundwater Hydrology*. New Delhi, India: Wiley India.

Suggested e-learning materials:

1. Microfossils
<http://www.ga.gov.au/scientific-topics/disciplines/palaeontology>
2. Fossils Morphology
<https://www.palaeontologyonline.com/>
3. Introduction to GIS and hydrogeology
<https://epgp.inflibnet.ac.in/ahl.php?csrno=448>

Mining and Engineering Geology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Recognize geochemical, geological, geophysical sampling method to locate ore bodies.
- Describe the suitable mining methods and time-plan to carry out mining activity on different sites.
- Explain the methods of ore processing and beneficiation.
- Consider the geological factors controlling the site selection for civil engineering projects.

Course Content:

Section A

Introduction: Definition, basic concepts and classification of mining methods. Detail study of surface mining methods: Open pit, Quarrying, Auger and placer Mining. Underground Mining Methods: Room and Pillar method, Sublevel stopping, cut and fill stopping, Square set stopping and Block Caving Methods.

Section B

Ore dressing and its importance. Basic ore dressing operations viz. crushing, grinding, sizing, screening and classification. Concentration process, Magnetic and electrostatic separation, Gravity concentration, Froth Floatation, Amalgamation and Agglomeration.

Section C

Engineering properties of rocks and physical characteristics of building stones, concretes and other aggregates. Geological and geotechnical investigations, types and problems of major civil engineering structures: dams and reservoirs, bridges, highways and tunnels. Mass movement with special emphasis on landslides and causes of hillslope instability. Seismic design of buildings.

Recommended Books:

1. Arogyaswamy, R. N. P. (1995). *Courses in Mining Geology* (4thed.). New Delhi, India: Oxford and IBH.
2. Bell, F. G. (2009). *Fundamentals of engineering Geology*. Hyderabad, India: BS.
3. Clark, G. B. (1967). *Elements of Mining* (3rded.). New Delhi, India: John Wiley.
4. Gangopadhyay, S. (2013). *Engineering Geology*. New Delhi, India: Oxford University Press.
5. Gaudin, A. M. (1939). *Principles of Mineral Dressing*. Bombay, India: McGraw Hill.
6. Kesavulu, C. N. (2009). *Text Book of Engineering Geology* (2nded.). New Delhi, India: Trinity Press.
7. Krynine, D. P., & Judd W.R. (1957). *Principles of Engineering Geology and Geotechnique*. New York, NY: McGrawHill.
8. McKinsty, H. E. (1972). *Mining Geology*. New York, NY: Prentice-Hall Inc.
9. Prabin, S. (2014). *Engineering and General Geology*. New Delhi, India: S K Kataria& Sons.
10. Reddy, M.M.T. (2007). *A Text Book of Applied Engineering Geology*. New Delhi, India: New Age International.

11. Thomas, L. J. (1978). *An Introduction to Mining: exploration, feasibility, extraction, rock mechanics*. Sydney, Methuen of Australia.
12. Vallejo, L. G. D., & Ferrer, M. (2011). *Geological Engineering*. Netherland: CRC.

Suggested e-learning materials:

1. Prospecting for Economic Minerals-Drilling, Sampling, Assaying
<http://vidyamitra.inflibnet.ac.in/content/index/5a6f0e258007bef961f76b4f/SL>
2. Stress and strain behavior of material <https://nptel.ac.in/courses/105105106/20#>
3. Dam
<https://epgp.inflibnet.ac.in/ahl.php?csrno=448>

Palaeontology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Describe the characteristics and preservation of fossils.
- Explain the evolution of life and their environment forms from fossil records.
- Explain the morphology of microfossils and their application in determining palaeoclimate, sea level change.
- Elucidate the geology of oil and gas reservoirs and their location.

Course Content:

Section A

Introduction and scope of Palaeontology. Concepts of taphonomy and biostratigraphy. Principles of palaeoecology. Theories of origin of life. Principles of biogeography. Patterns and causes of Extinction. Concept and mechanism of speciation.

Section B

Modes of preservation of fossils. Collection, preservation and preparation of fossils. Fossil record and geological time scale. Evolution of Man, Horse and Elephant. Siwalik vertebrate fauna and Gondwana flora. Trace fossils.

Section C

Definition and scope of micro-palaeontology. Techniques in micro-palaeontology. Morphotaxonomy of Foraminifera, Ostracodes, Conodonts, Radiolaria and diatoms. Importance of microfossils in stratigraphy, determination of palaeo environments and sea level changes in the geological past and the role of micro-palaeontology in oil exploration.

Recommended Books:

1. Armstrong, H. A., & Braiser, M. D. (2005). *Microfossil* (2nded.). Oxford, UK: Blackwell.
2. Bignot, B. (1985). *Elements of Micropalaeontology*. London, UK: Graham and Trotman.
3. Clarkson, E. N. K. (1998). *Invertebrate Palaeontology and Evolution* (4thed.). Singapore: Wiley-Blackwell.
4. Cushman, J. A. (1948). *The Foraminifera, their classification and use* (4thed.). Cambridge, UK: Harvard University Press.
5. Glaessner, M. F. (1945). *Principles of Micropalaeontology*. Melbourne, Australia: Melbourne University Press.
6. Jain, P. C., & Anantharaman, M. S. (2005). *Palaeontology: Evolution and Animal Distribution* (6thed.). New Delhi, India: Vishal.
7. Moore, R. C., Lalicker, C.G. & Fisher, A.G. (1997). *Invertebrate fossils*. New Delhi, India: CBS.
8. Prothero, D. R. (2003). *Bringing Fossil to Life-An Introduction to Palaeontology* (3rded.). New York, NY: Columbia University Press.

9. Raup, D. M., & Stanley, S. M. (1985). *Principles of Palaeontology* (2nded.). New Delhi, India: CBS.
10. Shrock, R. R., & Twenhofel, W. H. (2005). *Principles of Invertebrate Paleontology* (2nded.). New York, NY: CBS.

Suggested e-learning materials:

1. Fossils morphology
<https://www.palaeontologyonline.com/>
2. Origin of life and evolution <https://nptel.ac.in/courses/122103039/module2/lec6/4.html>
3. Taphonomy
<https://www.encyclopedia.com/science-and-technology/biology-and-genetics/biology-general/taphonomy>

Stratigraphy

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Explain rock successions and their interpretation in terms of geological time scale.
- Elaborate its application in petroleum geology and archaeology.
- Identify various sedimentary basins of India.
- Explain the stratigraphic boundary problems in India.

Course Content:

Section A

Stratigraphic classification (Lithostratigraphy, Biostratigraphy and Chronostratigraphy). Sequence stratigraphy, magneto-stratigraphy, Earth's climatic history.

Section B

Nature and evolution of early crust. Cratons: Dharwar, Bastar, Singhbhum, Aravalli and fold belts: Eastern Ghat Mobile Belt (EGMB), Pandyan Mobile Belt and Satpura Mobile Belt of India with special reference to tectonics and stratigraphy.

Section C

Stratigraphy of the Palaeozoic, Mesozoic and Cenozoic formations of India. Stratigraphic boundary problems in India: demarcation of Precambrian-Cambrian, Permian-Triassic, Cretaceous-Tertiary and Neogene-Quaternary boundaries in relation to mechanisms of extinction and evolution.

Recommended Books:

1. Boggs, S. (2014). *Principles of Sedimentology and Stratigraphy* (5th ed.). New York, NY: Merrill.
2. Catuneanu, O. (2006). *Principles of Sequence Stratigraphy*. Oxford, UK: Elsevier.
3. Danbar, C.O., & Rodgers, J. (1957). *Principles of Stratigraphy*. New York, NY: John Wiley & Sons.
4. Krishnan, M. S. (2012). *Geology of India and Burma* (6th ed.). Delhi, India: CBS.
5. Kumar R. (1978). *Historical Geology and Stratigraphy of India*. New Delhi, India: New Age International.
6. Lemon, R.R. (1990). *Principles of Stratigraphy*. New York, NY: Merrill.
7. Naqvi, S.M., & Rogers, J.J.W. (1987). *Precambrian Geology of India*. New York, NY: Oxford University Press.
8. Ramakrishnan, M., & Vaidyanathan, R. (2010). *Geology of India* (Vol. 1). Bangalore, India: Geological Society of India.
9. Ramakrishnan, M., & Vaidyanathan, R. (2010). *Geology of India* (Vol. 2). Bangalore, India: Geological Society of India.
10. Rogers, J.J.W. (1993). *A history of Earth*. Cambridge, UK: Cambridge University Press.
11. Roy, A.B., & Jakhar, S.R. (2012). *Geology of Rajasthan (Northwest India) Precambrian to Recent*. Jodhpur, India: Scientific.

Suggested e-learning materials:

1. Boundary Problems https://books.google.co.in/books/about/Stratigraphic_Boundary_Problem_in_India.html

Remote Sensing and GIS in Geology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students should be able to:

- Explain the principles of platforms and sensor characteristics, satellite orbits and data characteristics.
- Elucidate principles and applications of advance techniques including multispectral, hyperspectral, thermal-infrared, microwave remote sensing.
- Describe the concepts and components of GIS and GPS.
- Describe the applications of Geographical Information System in various fields of geology.

Course Content:

Section A

Remote Sensing (RS): Principle and scope. Electromagnetic radiation– types and sources, Black body radiation. Absorption bands and Atmospheric windows. Remote Sensing Sensor: types and their resolution. General Orbital characteristics of satellites. Sensor characteristics of remote sensing satellites: LANDSAT, IRS series (LISS and AWiFS), ASTER, Quickbird. Indian Planetary Missions.

Section B

Multispectral, Hyperspectral, Thermal Infrared, Microwave remote sensing: Introduction, Principle and applications in geology. Global Positioning System (GPS): Introduction and application in geology. Fundamentals of Digital Image Processing (DIP): Image rectification, Image enhancement and Image classification.

Section C

Principles and application of Geographic Information System (GIS). Components of GIS. Map projections-Types and properties. Raster and vector data models. Digital Elevation Model (DEM) and its applications in Geology.

Recommended Books:

1. Bonham-Carter, G. F. (1994). *Geographic Information System for Geoscientists: Modelling with GIS*. London, UK: Oxford Pergamon Press.
2. Clarbe, C. K. (1997). *Getting started with Geographic Information System*. New York, NY: Prentice Hall.
3. Demers, M.N. (1997). *Fundamentals of Geographic Information System*. New York, NY: John Wiley & Sons.
4. Drury, S.A. (1987). *Image Interpretation in Geology*. London, UK: Allen and Unwin.
5. George, J. (2005). *Fundamentals of Remote Sensing*. Hyderabad, India: Universities Press.
6. Gupta, R. P. (2003). *Remote Sensing Geology*. Berlin, Germany: Springer–Verlag.
7. Jain, A.K. (1989). *Fundamentals of digital image processing*. New Delhi, India: Prentice Hall.
8. Jensen, J.R. (1996). *Introductory Digital Image Processing: A Remote Sensing Perspective*. Berlin, Germany: Springer-Verlag.
9. Lillesand, T. M., & Kiefer, R.W. (2007). *Remote Sensing and Image Interpretation*. New York, NY: John Wiley.

10. Pandey, S.N. (1987). *Principles and Application of Photogeology*. New Delhi, India:Wiley Eastern.
11. Prost, G.L. (1994). *Remote Sensing for Geologists: A guide to Image Interpretation*. London, UK: CRC Press.
12. Reddy, M.A. (2002). *Text book of Remote Sensing and Geographic Information System*. Hyderabad, India: B.S.
13. Sabbins, F.F. (1985). *Remote Sensing-Principles and applications*. New York, NY: Freeman.
14. Siegal, B.S., & Gillespie, A.R. (1980). *Remote Sensing in Geology*. New York, NY: John Wiley.

Suggested e-learning materials:

1. Introduction to GIS
<http://www.gisresources.com/iirs-e-learning-certificate-programmes-remote-sensing-geoinformation-sciences/>
2. Remote Sensing Basics
<https://www.iirs.gov.in/EDUSAT>
3. Introduction to GIS and hydrogeology <https://epgp.inflibnet.ac.in/ahl.php?csrno=448>

Ecology and Environment

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe the interaction of organisms with their environment.
- Identify the various threats to biodiversity.
- Explain the concept of biomes.
- Describe the various biogeochemical cycles.

Course Content:

Section A

Introduction to Environment:

Concept of Environment, Factors of the environment: Physiographic, Climatic, Edaphic, Biotic and Anthropogenic. Bio Geochemical Cycles: The Carbon cycle, the Oxygen cycle, the Nitrogen cycle, The Hydrological cycle.

Section B

Concept of Ecology, Ecosystem and Biomes:

Concept of Ecosystem: With special reference to desert, forest and aquatic ecosystem. Food chain, Food web & succession. Ecological Pyramids and their types. Energy flow in ecosystem, Concepts of Biomes. Major biomes of the world: Tropical forest, temperate forest, Grassland and Tundra.

Section C

Environmental Pollution and its Effect

Environmental pollution: Pollutants and sources: Water pollution, Soil pollution, Air pollution and Noise pollution. Greenhouse Effect, Global warming, Biodiversity: Threats and Conservation.

Recommended Books:

1. Atkinson, Raw, M. (2007). *Biogeography*. Philip Allan Updates.
2. Gautam, A. (2007). *Environmental Geography*. Allahabad, India: Sharda Pustak Bhawan.
3. Huggett, R. J. (1998). *Fundamental of Biogeography*. London, UK:Routledge.
4. Kayastha, S.L., & Kumra, V.K. (1986). *Environmental Studies*. Varanasi, India: Tara Book Agency.
5. Mathur, H.S. (1998). *Essentials of Biogeography*. Jaipur, India: Pointer.
6. Mehtani, S., & Sinha, A. (2010). *Biogeography*. Commonwealth.
7. Odum, E. P. (1975). *Ecology*. Lanham, MD:Rowman and Littlefield.
8. Odum, E.P. (1968). *Fundamentals of Ecology*. London, UK:W.B. Sanders Company
9. Saxena, H. M. (1999). *Environmental Geography*. Jaipur, India:Rawat.

10. Saxena, H. M. (2000). *Environmental Management*. Jaipur, India:Rawat.

Suggested e-learning materials:

1. Environment and Ecology

<https://nptel.ac.in/courses/122102006/16>

2. Ecology and Environment

<https://swayam.gov.in/courses/4905-july-2018-ecology-and-environment>

Environment Lab – I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students will be able to:

- Conduct soil sample analysis.
- Conduct water sample analysis.
- Use MS office Package, CorelDraw, Internet services.
- Create and interpret geospatial data.

Course Content:

1. Working with Windows.
2. Working with MS office Package (MS-Word, Excel, Power Point).
3. Working with CorelDraw
4. Using Internet services
5. Using subject specific application packages.
6. Determination of conductivity of water/soil samples.
7. Determination of pH for water/soil samples.
8. Determination of TSS and TDS in water samples.
9. Determination of turbidity in water/soil samples.
10. Determination of BOD in water samples.
11. Determination of Dissolved Oxygen (DO) in water samples.
12. Determination of Sodium, (Na) in water samples.
13. Determination of Potassium, (K) in water samples.
14. Determination of Acidity in water samples
15. Determination of Total Hardness in water samples.
16. Determination of Magnesium Hardness in water samples.
17. Determination of Total Metals (Cr, Fe and Cd) in water samples.
18. Determination of Grain size of soil samples.
19. Determination of leaf area.
20. Introduction to Satellite Images, TCC, FCC
21. Visual Interpretation
22. Stereoscopic Vision

23. Object Identification with Aerial Photograph
24. Introduction to GIS Software
25. Georeferencing
26. Creation of spatial data
27. Joining Non spatial with spatial data
28. Buffering
29. Map layout

Recommended Books:

1. Narasalah, G. L. (2012). *Environmental Science : A Practical Manual*. Delhi, India. : B.S.
2. Maiti, S.K. (2011). *Handbook of Methods in Environmental Studies. Vol. 2: Soil and Air Analysis*. Jaipur, India: Oxford Book Company.
3. Rajaraman, V., & Adabala, N. (2014) *Fundamentals of Computers* (6th ed.). New Delhi, India: Prentice Hall.

Suggested e-learning materials:

1. Water Quality Monitoring
<https://nptel.ac.in/courses/103107084/4>
2. Particle Size Distribution
<https://nptel.ac.in/courses/105103097/10>

Environmental Chemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe the various chemical processes occurring in the air, water and soil.
- Explain the effect of hydrocarbons and synthetic compounds on biological organisms.
- Explain the degradation of hydrocarbon and synthetic compounds.
- Illustrate the working principle, merits and demerits of analytical techniques.

Course Content:

Section A

Concept and Scope of Environmental Chemistry: Definition and explanation for various terms, segments of environment. Principles and cyclic pathways in the environment: Sulphur, Oxygen, Nitrogen, Phosphorous cycle.

Chemistry of Water: Unusual physical properties, unusual solvent properties, changes in water properties by addition of solute.

Soil Chemistry: Formation, constituents and properties of soils, adsorption of contaminants in soil, soil fertility, surface exchange reaction, soil redox potential and adsorption-desorption.

Section B

Chemistry of various organic, inorganic, carcinogenic compounds and their effects. Hydrocarbons: Chemistry of hydrocarbon decay, environmental effects, effects on macro and micro organisms. Surfactants: Cationic, anionic and nonionic detergents, modified detergents.

Pesticides: Classification, degradation, analysis, pollution due to pesticides and DDT problems.

Synthetic Polymers: Microbial decomposition, polymer decay, ecological and consideration, Photosensitize additives.

Aflatoxin occurrence, chemical composition and properties metabolism.

Section C

Physico-Chemical methods for analysis of environmental samples: Definition and determination of conductivity, pH, COD, BOD.

Principle, merits and demerits of Centrifuge, and Ultra centrifuge.

Principle, merits and demerits of the techniques: colorimetry, atomic absorption spectroscopy, Atomic emission Spectroscopy, gas chromatography, HPLC, ion exchange chromatography.

Recommended Books:

1. Bhatia, S. C. (2006). *Environmental Chemistry*. New Delhi, India: CBS.

2. De, A. K., & De, A. K. (2007). *Environmental Chemistry*. New Delhi, India: New Age International.
3. Gary, W.V., & Stephen, J. D. (2010). *Environmental Chemistry. A global perspective* (3rd ed.). London, UK: Oxford University Press.
4. Rao, P. V. (2006). *Principles of Environmental Science and Engineering*. New Delhi, India: PHI.
5. Séamus, P. J. H. (2003). *Analytical Chemistry*. London, UK: Oxford University Press.
6. Manahan, S., & Manahan, S. E. (2009). *Environmental Chemistry (Ninth Edition)*. Florida, FL: CRC Press.
7. Wilson, K., & Walker, J. (2010). *Principals and Techiniques of Biochemistry and Molecular Biology*. New York, NY: Cambridge University Press.

Suggested e-learning materials:

1. Environmental Chemistry and Analysis <https://nptel.ac.in/courses/122106030/>
2. Environmental Chemistry
<https://swayam.gov.in/course/251-environmental-chemistry>

Fundamentals of Remote Sensing and GIS

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Explain about Remote Sensing, Geographical Information System and Global Positioning System.
- Outline and interpret the elements of aerial photographs.
- Describe principles and applications of thermal and microwave remote sensing.
- Differentiate GIS and science of map making, non spatial versus spatial data

Course Content:

Section A

Aerial Photograph

Aerial Photographs: Definition, Basic Terms and Scale. Classification of aerial photographs. Overlapping in aerial photographs and aerial photo mosaics. Elements of aerial photo interpretation

Section B

Remote Sensing

Remote sensing: Definition, Process and Stages. Remote sensing platforms. Electromagnetic Radiation (EMR) - Properties, Interaction of EMR with the earth's surface and atmosphere. Basic Principles and Applications of Thermal and Microwave Remote Sensing

Section C

GIS and GPS

GIS: Concept, Components and Application of GIS. Data Base Management System (DBMS) in GIS. Spatial analysis in GIS. Basic Principles, Segments and Application of GPS

Recommended Books:

1. Abbasi, S. A. (2005). *Application of G I S & Remote Sensing in Environment Managements*. New Delhi, India:Discovery.
2. Avery, T. E., & Berlin, G. L. (1985). *Interpretation of Aerial photographs* (4thed.). Minneapolis, Minnesota: Burgess.
3. Bhatta, B. (2011). *Remote Sensing and GIS* (2nded). New Delhi, India: Oxford University Press.
4. Burrough, P.A., & Rachael A. M. (2015). *Principles of Geographic Information Systems* (3rded.).Oxford, UK: Oxford University Press.
5. Ciciarelli, J. A. (1991). *A Practical Guide to Aerial Photography with an Introduction to Surveying*.US: Springer.

6. Curran, P. J. (1985). *Principles of Remote Sensing*. London, UK:Longman.
7. Fazal, S. (2008). *GIS Basics*. New Delhi, India: New Age International.
8. Ganesh, A., & Narayanakumat, R. (2006). *GPS Principles and Applications*. Satish Serial.
9. George, J. (2008). *Fundamentals of Remote Sensing*. Hyderabad, India: Universities Press.
10. Heywood, I., Cornelius, S., & Carver, S. (2000). *Introduction to GIS*. New York, NY: Addison Wesley Longman.
11. Lillesand, T.M., Kiefer, & R.W., Chipman, J.W. (2011). *Remote Sensing and Image interpretation*. Hoboken, NJ: Wiley and Sons.
12. Lo, C.P., & Yeung, A.K.W. (2004). *Concepts and Techniques of GIS*. New Delhi, India: Prentice-Hall of India.
13. Paine, D. P., & Kiser, J. D. (2012). *Aerial Photograph and Image interpretation*. New Jersey, NJ: John Wiley and Sons.
14. Palet, A.N. (1992). *Remote Sensing-Principles & Application*. Jodhpur, India: Scientific.

Suggested e-learning materials:

1. Introduction to Remote Sensing
<https://swayam.gov.in/course/3612-introduction-to-remote-sensing>
2. Introduction to Geographic Information Systems
https://onlinecourses.nptel.ac.in/noc16_ce12/preview

Section A

Physical Dimensions

- Endogenetic Process: Concept of Plate Tectonics, Earthquakes and Volcanoes
- Exogenetic process: Weathering and Mass wasting
- Geomorphic processes and resulting landforms : Fluvial, Arid and Coastal
- Composition and Stratification of Atmosphere, Insolation and Heat Budget, Temperature
- Bottom Relief of Ocean, Oceanic Temperature and Salinity

Section B

Human Dimensions

- Human Population: Growth and Distribution
- Population Growth and Environmental Deterioration
- Man Induced Environmental Changes
- Types of Human Activities
- Impact of Human Activities: Deforestation, Mining and Industrialization

Section C

Environmental Awareness and Policies

- Environmental Awareness- Need and Role in Amelioration of Environment
- Concept and Significance of Environmental Movements, Environmental Movements in India with special reference to the Chipko Movement, Narmada Bachao Andolan
- Environmental Protection Efforts in India
- International Environmental Policy with special reference to THE AGENDA 21 EARTH SUMMIT
- National Environmental Policy of India

Books Recommended:

- Bal Anand S. (2005) An Introduction to Environmental Management, Himalaya Publishing House Mumbai
- Bloom, A. L. (1998/ 2001): Geomorphology. 3rd edition. Prentice Hall of India, New Delhi.
- Chandana, R. C (2008): A Geography of population, Kalyani Publishers, New Delhi.
- Chopra, Girish (2006): Population Geography. Commonwealth Publishers
- Chorley, R.J., Schumm S A and Sugden D E. (1984). Geomorphology. Methuen and Company Ltd., London.
- Dayal, P. (1994): A Text Book of Geomorphology. Kalyani Publishers, New Delhi.
- Husain Majid (2002), Fundamentals of Physical Geography, 2nd Ed. Rawat Pub. Jaipur and New Delhi.
- Jadhav H.V. and Purohit S.H. (2011): Environmental Studies, Himalaya Publishing House, Mumbai
- Kale, V. and Gupta, A. (2001): Introduction to Geomorphology. Orient Longman, Hyderabad.
- King, C.A.M. (1966): Techniques in Geomorphology. Edward Arnold, London.
- Kumar Satish (2011): Protecting Environmental Issues- A Quest for NGO's, AVON Publication, New Delhi
- Levag & Goh Cherry (1982), Human & Economic Geography, Oxford University, Press Oxford London
- Rajagopalan R. (2014): Environmental Studies- 2nd Ed. Oxford University Press, Delhi
- Singh, S. (2004): Geomorphology. Prayag Pustak Bhawan, Allahabad.
- Singh, S. [1993]: Physical Geography. Prayag Pustak Bhawan, Allahabad.
- Singh, S. [1993]: Environmental Geography. Prayag Pustak Bhawan, Allahabad
- Strahler, A.N. (1988) Earth Science, Harper and Row Publishers, New Delhi (India reprint).
- Strahler, A.N. and Strahler, A.H.(1996), Introducing Physical Geography. John Wiley and Sons, New York.
- Thornbury, W.D. (2005): Principles of Geomorphology. John Wiley and Sons, New Delhi (India Reprint).
- उपाध्याय एल. एन. : भौतिक भूगोल राजस्थान हिन्दी ग्रन्थ अकादमी. जयपुर।
- चतर्भज मामोरिया एवं जैन (1961) : भौतिक भूगोल एवं जीव मण्डल. सहित्य भवन. आगरा।
- तिक्खा. रामनाथ : भौतिक भूगोल. केदारनाथ रामनाथ. मेरठ।
- पी. दयाल : भूआकृतिविज्ञान. शक्ला बक डिपो।

24. शर्मा एच. एस., शर्मा एम. एल. और मिश्रा आर. एल. : "भौतिक भूगोल" पंचशील प्रकाशन जयपुर।
25. सविन्द्र सिंह : भूआकृतिविज्ञान, प्रयाग पुस्तक भवन, इलाहाबाद।
26. सविन्द्र सिंह (1971) : भौतिक भूगोल, वसन्धरा प्रकाशन, गोरखपुर।

Introduction to Computer for Environmental Science

L T P C
4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction to Computers

- a) Elements of a Computer System, Block diagram of Computer System and functions of its components.
- b) Evolution of computers and classification, concept of hardware and software.
- c) Introduction to Operating Systems (DOS, Windows and UNIX).

Section B

PC Software

- a) Word Processing: Creating and Saving documents, formatting, Inserting Tables and Pictures and Mail Merge.
- b) Spread sheet: Creating worksheet, Use of functions and Creating Charts.
- c) Introduction to Presentation Packages, Graphics and Animation packages.

Introduction to Computing

- a) Programming languages, system and application software, compiler and interpreters.
- b) Concept of a program, program design & development, algorithms and flowchart development.

Section C

Internet & Web

Introduction to popular packages on concept of computer communication, computer network (LAN, WAN, MAN), Internet, Internet Services-www, email etc.

Introduction to Computer Applications in Environmental Science

Data Base Management Systems,
Statistical Packages,
Expert Systems,
Multilingual Applications.

Books Recommended:

1. Sinha, P.K., Computer Fundamentals., BPB Publication, New Delhi.
2. Taxali, R.K., PC Software for window - made simple, Tata Macgraw Hill Publication.

Environmental Biology and Toxicology

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

- a) Concept of energy, conventional & non-conventional energy sources. Fossil fuels, hydro, wind and nuclear power, geothermal, solar and bioenergy.
- b) Energy flow in organisms, energy pathways & models, energy efficiencies, conservation of energy.
- c) Classification & characteristics of resources: water, soil, forest, wild life and land use.
- d) Conservation of natural resources: water, soil, forest and wild life.

Section B

- a) Origin of pollutants: industrial, agricultural, domestic and vehicular sources.
- b) Pollutant & their toxicology: Heavy metals and trace elements, agrochemicals (Pesticides, herbicides, rodenticides & fungicides, detergents) & particulate matter.
- c) Types of radiations including ionizing & non-ionizing radiations & their interaction with matter.
- d) Radiations as environmental pollutants.
- e) Effects of radiations at cellular, molecular & genetic level.

Section C

- a) Mutagenicity, carcinogenicity.
- b) Green house effect, acid rains.
- c) Ozone layer depletion, photochemical smog.
- d) Types of solid wastes, transport, reuse & recycling.

Books Recommended:

1. Clark, Bissel & Watham , Environmental Impact Assessment.
2. Encyclopedia of pollution & its control : Vol. I-VI
3. Eugene P. Odum., Fundamentals of Ecology
4. R.L. Smith, Field Biology
5. Timberell J.A, Introduction to Toxicology

Applications of Remote Sensing for Natural Resource Management

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

INTRODUCTION

- a) Emergence of Remote Sensing technology in application areas,
- b) Understanding potentials of Remote Sensing in allied sectors,
- c) Indian satellite missions with focused applications,
- d) Recent trends in Remote Sensing applications.

Section B

APPLICATION IN LAND AND WATER RESOURCE

- a) Remote sensing in mapping Land use / land cover classification and monitoring,
- b) Crop forecasting, Forest resources management, soil taxonomy and degradation, geomorphology and surface mining on land resources, groundwater modelling,
- c) Water quality Monitoring, Reservoir sedimentation,
- d) Snow covers mapping and modelling approaches

Section C

APPLICATION IN CLIMATE CHANGE AND DISASTER MANAGEMENT

- a) Concept of climate and weather, Climatic classification, paleo-climate
- b) Adaptation and vulnerability
- c) Mapping of landslide, Floods, Cyclones, Forest fire and Drought.

APPLICATION IN ENVIRONMENTAL MANAGEMENT

- a) Selection of disposal sites for industrial and municipal wastes,
- b) Solid waste management,
- c) Environmental Impact Assessment (EIA)

Books Recommended:

1. Jenson, J.R. 2000. Remote Sensing of the environment-An Earth Resource Perspective, Prentice Hall Inc.
2. Kumar P., Rani M, Pandey P (2012) "Conservation areas to beat the heat", Lambert Publication, Germani.
3. Lillisand, T. M. and Keifer, R. W. 1994. Remote Sensing and Image interpretation', John Willey and Sons, New York, Third Edition.
4. P. S. Roy (2000). Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing (IIRS), 2000.
5. P.K. Joshi and T.P. Singh (2011). Geoinformatics for Climate Change Studies, TERI Press, New Delhi.
6. P.K. Joshi, P. Pani, S. N. Mohapatra and T.P. Singh, Ed 2010 "Geoinformatics for Natural Resource Management", Nova Publishers, India
7. Schultz, G. A. and Engman, E. T. 2000. Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, German.
8. Spatial Technologies for Natural Hazard Management. Proceedings of ISRS National Symposium, Nov. 21-22 2000, IIT, Kharagpur.

Environment Lab-II

L	T	P	C
0	0	12	6

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Measurement of size of particles by laser technique
2. Measurement of thermal conductivity of different materials
3. Measurement of speed of electromagnetic radiations of different frequencies
4. Measurement of nuclear radiations in environment
5. Study of heat transfer by radiations and convections
6. To Determine the Hydraulic Conductivity
7. To verify Stefan's law
8. To verify Planck's law
9. Estimation of total hardness.
10. Estimation of Calcium content.
11. Estimation of Magnesium content.
12. Estimation of Chloride content.
13. Estimation of Sulphate content.
14. Estimation of Alkalinity.
15. Estimation of dissolved Oxygen.
16. Estimation of Fluoride.
17. Effect of toxicants on insects.
18. Experiment based on food preferences in insects.
19. Land Use/ Land Cover mapping
20. Crop area estimation using remote sensing
21. Forest cover and density mapping
22. Water quality modelling using remote sensing and GIS
23. Flood hazard analysis using multi- temporal imagery
24. Site suitability for solid waste management

Environmental Legislation

L T P C
4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Fundamental Principles of Domestic and International Environmental Law

- a) State sovereignty, co-operation, Indian Constitutional provision (Fundamental rights, Directive principal of State Policy and Fundamental duties) role of courts
- b) Key elements of some International Declarations (Stockholm, Rio declaration, Agenda 21, Kyoto protocol on Climate Change)
- c) Sustainable development: Polluter Pay Principle, Precautionary Principle, Preventive Principle, Intergenerational Equity

Section B

Domestic Laws on Environment

- a) The Environmental Protection Act 1986, Definition of pollution and pollutant
- b) Power of Central government, The water (Prevention and Control of Pollution) Act 1974 – Definitions, Construction Power and functions of Boards
- c) The Air (Prevention and control of Pollution) Act, 1981 – Definitions, Constitution Power and functions of Boards, National environmental Tribunal Act 1995
- d) The National Environmental Appellate Authority Act 1997

Section C

Environment Related Other Laws and Policies

- a) The Forest conservation Act 1980,
- b) The Wildlife Act 1972, the Cruelty against Animal Act 1960
- c) Environmental Impact Assessment Rules 2006,
- d) Bio-Medical waste (management & handling) rules 1998,
- e) Hazardous waste (Management and Handling) Rules 1989 and 2000

Books Recommended:

1. Diwan, Shyam and Rosencranz, Armin (2002) : Environmental Law and Policy in India, New Delhi, Oxford University Press.
2. Krishna, Leela. Environmental Law in India, Delhi, Lexis Nexis, Butterworth wadhwa ,
3. S.Santakumar's Introduction to Environmental Law, Nagpur, Lexis Nexis, Butterworth wadhwa
4. Sahasranaman, (2009) : P.B. Handbook of Environmental Law in India , New Delhi , Oxford University Press.

Environmental Physics

L	T	P	C
4	0	0	4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section-A

- a) The scope of environmental physics
- b) Laws of thermodynamics, reversible and irreversible thermodynamical process and entropy, Specific heats, Gas Laws for isothermal and adiabatic processes, Lapse rate
- c) Water and Water Vapour: vapour pressure, dew point, saturation vapour pressure defect, specific and relative humidity
- d) Transport laws: General transfer equation, molecular transfer process, diffusion coefficients
- e) Radiation Laws: black body radiations, Wien's law, Stefan's law, Planck's law, Cosine law for emission and absorption, reflectivity, radiance and irradiance, Wind chill, Hypothermia

Section-B

- a) Radiation Environment- Solar Radiation: solar constant, sun-earth geometry, attenuation in the atmosphere, solar radiation at the ground; Terrestrial Radiation; Cloudless skies, Cloudy skies
- b) Microclimatology of radiations (interception): Direct and diffused solar radiations, Shape factors, canopies of black leaves
- c) Microclimatology of radiations (absorption and reflection): radiative properties of natural materials

Section-C

- a) Laser applications, Laser light transmission through the atmosphere, molecular absorption and particle scattering techniques for detection of molecules of pollutants by absorption of laser,
- b) Remote monitoring capabilities of laser systems, LIDAR technique and its applications
- c) Microwaves; Environmental aspects of microwave radiations, Microwave decomposition of toxic vapour stimulants.

Reference/Text Books:

- 1. Garg S. C., Bansal R. M., Ghosh C. K, Thermal Physics;; Publisher: McGraw Hill Education (India).
- 2. John, Monteith L. and Unsworth M.H., Principles of Environmental Physics; Publisher: Eastern Book Linkers, London (2nd Edition)
- 3. Orazio S., Principles of Laser, Publisher: Springer.
- 4. Wei G., Schmoldt D., Slusser J.R., UV Radiation in Global Climate Change: Measurements, Modeling and Effects on Ecosystem; Publisher: Springer (2010).

Environmental Toxicology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Recognize dangerous toxic compounds and what properties make them toxic.
- Discuss the toxicological concepts of different toxic substances.
- Predict the transport and fate of toxicants in environment.
- Assess the effect of toxic substances on the environment health.

Course Content:

Section A

Principles in toxicology; Definition of Xenobiotics. Concepts of LD50; Dose-effect and dose-response relationship.

Biological and chemical factors that influence toxicity; Bio-transformation and bio-accumulation.

Eco-system influence on the fate and transport of toxicants

Abiotic Stress response in living systems.

Section B

Origin of pollutants: industrial, agricultural, domestic and vehicular sources. Pollutant & their toxicology: Heavy metals (Pb and Cr) and trace elements. agrochemicals (Pesticides, herbicides, & fungicides, detergents) & particulate matter.

Global dispersion of toxic substance

Types of radiations including ionizing & non-ionizing radiations & their interaction with matter.

Section C

Radiations as environmental pollutants. Effects of radiations at cellular, molecular & genetic level, Mutagenesis. Carcinogenicity.

Recommended Books:

1. Ahmad, P., & Prasad, M. N. V. (2012). *Abiotic Stress Responses in Plants: Metabolism, Productivity and Sustainability*. New York, NY: Springer-Verlag.
2. Ahmad, P., Ahanger, M.A., Singh, V.P., Tripathi, D.K., Alam, P., & Alyemeni, M.N. (2018). *Plant Metabolites and Regulation under Environmental Stress*. Massachusetts, MA : Academic Press.
3. Cockerham, L.G., & Shane, B.S. (1993). *Basic Environmental Toxicology*. Florida, FL: CRC Press.
4. Gaur, R.K., & Sharma, P. (2013). *Molecular Approaches in Plant Abiotic Stress*. Florida, FL: CRC Press.
5. Gaur, R.K., & Sharma, P. (2014). *Approaches to Plant Stress and their Management*. New Delhi, India: Springer.
6. Newman, M.C. (2014). *Fundamentals of Ecotoxicology: The Science of Pollution 4th ed.*. Florida, FL: CRC Press.

Suggested e-learning materials:

1. Environmental Toxicology

<https://nptel.ac.in/courses/120108002/>

2. Toxicological Chemistry

<https://nptel.ac.in/courses/122106030/>

Biodiversity and Conservation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Explain importance of biological diversity.
- Describe major threats to biodiversity.
- Recognize and implement the various methods of biodiversity conservation with co-existence of various environmental pressures.
- Identify different geographical biodiversity hotspots and mega-diversity centers.

Course Content:

Section A

Introduction to biodiversity concepts, significance, magnitude and distribution.

Biodiversity trends, diversity gradients and related hypotheses methods for monitoring biodiversity trends.

Threats to biodiversity, major causes, extinction's, vulnerability of species to extinction, IUCN threat categories, Red data book.

Section B

Principles of biodiversity conservation Ex situ and In situ methods of conservation, Genetical and evolutionary principles in conservation. Conservation of biological diversity and its significance- source of food, medicine, raw material, aesthetic, cultural and ecosystem services.

Concepts, distribution and importance of Hot spots.

Strategies for sustainable exploitation of biodiversity.

Section C

Conservation – efforts in India, Endangered flora & fauna of India. ethnobotany in India & selected medicinal plants.

Wildlife conservation in India- Project Tiger, Project crocodile, silent valley controversy. Conservation of Himalayan, Gangetic ecosystems.

Recommended Books:

1. Kumar, U. & Asija, M.J. (2007). *Biodiversity – Principles and conservation* (2nded.). Jodhpur, India: Agrobios.
2. Mishra, R. (1968). *Ecology Workbook* (2nd ed.). Calcutta, India: Oxford and IBH.
3. Odum, E.P. (1983). *Basic Ecology* (2nd ed.). Philadelphia,PA: Holt-Saunders International.
4. Odum, E.P. (2004). *Fundamentals of Ecology*. Dehradun, India: Natraj.
5. Singh, M.P., Singh, J.K., Mohanka, R., & Sah, R.B. (2007). *Forest environment and biodiversity* (2nded.). New Delhi, India: Daya.
6. Sinha, B.N. (1990). *Ecosystem Degradation in India*. New Delhi, India: Ashish.

7. Tewari, D.N. (1994) *Biodiversity and forest genetic resources*. Dehradun, India: International Book.

Suggested e-learning materials:

1. Aquatic Biodiversity and Environmental Pollution <https://nptel.ac.in/courses/120108002/16>
2. Wildlife Conservation https://nptel.ac.in/noc/individual_course.php?id=noc18-bt26

Biotechnology Application to Environmental Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	48	24

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe heavy metal pollution and outline control measure of global warming.
- Describe ozone depletion, acid rain and nuclear accidents
- Describe biosensor development to monitor pollution.
- Explain the management of sludge and biodegradation of hydrocarbons.

Course Content:

Section A

Definition and Scope of Environmental Biotechnology

Environmental Pollution; Types, Causes and Effects of Soil, air, water, oil and heavy metal. Pollution, control measures.

Social Issues- Green House Gases, Global Warming, Acid Rain, Ozone depletion, nuclear accidents and holocaust.

Purification of waste water; Aerobic and anaerobic treatments; Laboratory methods for the detection of coli form organisms in water; Water recycling methods; Management of radioactive pollutants in water, VOC, COD BOD and BOD sensors.

Section B

Molecular biology tools for Environmental management, rDNA technology in waste treatment, Genetically modified organisms in Waste management, Genetic Sensors, Metagenomics, Bioprospecting, Nanoscience in Environmental management, Phytoremediation for heavy metal pollution, Biosensor development to monitor pollution.

Biomass waste as renewable source of energy, Cellulose and Hemi cellulose as source of energy Biocomposting, Vermiculture, Biofertilizers, Organic farming, Biofuels, Biomineralization, Bioethanol and Biohydrogen,

Section C

Bioelectricity through microbial fuel cell, Conversion of Solid Waste to Methane; Biogas production, Management of Sludge and Solid waste treatment- Land filling, lagooning, Ecofriendly agriculture.

Definition, Types- Ex situ and In situ Bioremediation; genetically Engineered Microbes for Bioremediation; Bioremediation of Ground Water;

Biodegradation of Hydrocarbons, Pesticides, Herbicides, Insecticides and Xenobiotics.

Environmental Health Management

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Explain the concept of environmental health.
- Identify different environmental factors that affect health.
- Discuss the preventive and protection measures for various water borne diseases.
- Describe the seasonal changes and protection measures for various air borne bio-allergen.

Course Content:

Section A

Meaning of health: Physical, Mental and Social, Environmental factors influencing health: Urbanization & congestion, pollution.

Environmental health criteria, Concept of environmental health management

Section B

WHO classification of diseases and their distribution: Water borne diseases;

Prevention and protection of community health from water borne diseases. Air borne bio-allergens; present in the ambient air, seasonal changes, mode of dispersal, disease intensity and control.

Section C

Effects of Physical Environment on Accidents, Crime, Suicide and Diseases of Man

Effects of temperature, humidity, ionization, ultra violet radiation and acidity of air on skin, lungs, throat, nose, eye, nervous system.

Effects of weather and climate on diseases, mental processes, working efficiency, traffic and industrial accidents, behaviour, suicide and suicide attempts, effect of thermal stress and altitude on the action of drug.

Recommended Books:

1. Abdul, M. et.al. (2014). *Environmental Deterioration and Human Health*. Dordrecht Heidelberg London, England: Springer.
2. Ahluwalia, V. K. (2015). *Environmental Pollution and Health*. New Delhi, India:TERI.
3. Annalee, Y. et.al. (2001). *Basic Environmental Health*. New York, NY: Oxford University Press.
4. Kathryn, H. (2006). *Environmental Health Ecological Perspective*. Sudbury, Massachussetts, MA: Jones & Bartlett.
5. Robert, H. F. (2012). *Essentials of Environmental Health*(2nd ed.). Sudbury, Massachussetts, MA: Jones & Bartlett.
6. Singh, A. L. (2010). *Environment and Health*. New Delhi, India:B.R.

Suggested e-learning materials:

1. Indoor Environmental Delhi
<http://textofvideo.nptel.ac.in/112107208/lec38.pdf>
2. Introduction to Environmental Health
<http://ocw.jhsph.edu/courses/environmentalhealth/lectureNotes.cfm>
3. The effects of temperature on human health
https://www.oulu.fi/sites/default/files/content/Ikaheimo_TM_Temperature_and_human_health_28102014.pdf

Recommended Books:

1. Chakraborty, K. D., & Omen, G. S. (1989). *Biotechnology and Bio degradation*, Advances in Applied Biotechnology series. London, UK:Gulf.
2. Rittmann, B. E. (2018). *Environmental Biotechnology*. New York, NY: McGraw-hill education.
3. Sharma, D. L. (2002). *Organic farming*. Rajasthan: India: Agro-Bios.
4. Thakur, I. S. (2006). *Environmental Biotechnology- Basic concepts and Applications*. New Delhi, India: I K International.

Suggested e-learning materials:

1. Nanobiotechnology in Environment
<https://nptel.ac.in/courses/102103045/download/mod6.pdf>
2. Biotechnology
<https://nptel.ac.in/courses/118107015/33>
3. Gene therapy in the treatment of disease
<https://nptel.ac.in/courses/102103013/39>

Water Pollution Monitoring, Control Technology and Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe water pollution and water resource management
- Describe waste water sampling method
- Illustrate characterization of waste water.
- Distinguish primary, secondary and tertiary waste water treatment methods.

Course Content:

Section A

Water pollution- Causes and Pollutants, Categories of waste water, generation of waste water, Water resource management.

Section B

Waste water sampling and monitoring, Methods of analysis, determination of organic matter, inorganic substances, Physical characteristics of bacterial measurements.

Section C

Waste water treatment, Basic processes of primary treatments; Pretreatment, sedimentation and floatation.

Secondary treatments; Activated sludge process, Trickling filter, sludge treatment and disposal.

Advanced waste water treatment, N-removal, P-removal, Advanced Biological Systems, Chemical oxidation, Removal of suspended solids, Dissolved solids.

Recommended Books:

1. Bartram, J., & Balance, R. (2007). *Water Quality Monitoring. A practical guide to the design and implementation of freshwater quality studies and monitoring programmes*. London, UK: Chapman & Hall.
2. Burke, G., Singh, B. R., & Theodore, L. (2000). *Handbook of Environmental Management and Technology*(2nded.).New York, NY: John Wiley & Sons.
3. Eilbeck, W. J. & Mattock, G. (1987). *Chemical Processes in Waste Water Treatment*.Chichester, UK:Ellis Horwood Limited.
4. Gray, N. F. (1990). *Activated Sludge, Theory and Practice*. Oxford, UK:Oxford University Press.
5. Helmer, R., & Hespanhol, I. (1997).*Water Pollution Control - A Guide to the Use of Water Quality Management Principles*.UNEP. Suffolk, Great Britain: St Edmundsbury Press.
6. Kostas, V., & Dimitra, V. (2012). *Water Quality Monitoring and Assessment*.Rijeka, Croatia:InTechOpen.
7. Loucks, D. P., &Beek, E. V. (2005).*Water Resources Systems Planning and Management An Introduction to Methods, Models and Applications, Studies and Reports in Hydrology*. UNESCO.
8. UNEP, (2008). *Water Quality for Ecosystem and Human Health*(2nd ed.). Ontario, Canada: UNEP
9. UNICEF, (2008). *Handbook on Water Quality*.New York. NY: Children's Fund UNICEF.

Suggested e-learning materials:

1. Wastewater Management
<https://nptel.ac.in/courses/105105048/>
2. Water and Waste Water Engineering
<https://nptel.ac.in/courses/105104102/>
3. Industrial Waste Water Engineering
<https://nptel.ac.in/courses/105106119/36>
4. Waste water sampling procedure
http://www.epa.ie/licences/lic_eDMS/090151b28036bb01.pdf
5. Waste water Nutrient Removal
https://www.des.nh.gov/organization/divisions/water/wmb/rivers/watershed_conference/documents/2009_fri_infrastructure_3.pdf

Disaster Management and Mitigation Strategies

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Explain natural and manmade disaster and associated socio economic impact.
- Discuss key concepts, definitions and perspectives of disaster Management
- Describe the Disaster Management Cycle.
- Describe planning for hazard mitigation.

Course Content:

Section A

Introduction to Disaster and Hazards

Hazards and Disaster: Definition and Difference; Types of Hazards and Disaster; causes and consequences, Prediction and Indicators of Natural Disasters, Natural Disasters – Earthquakes, Cyclones, Floods, Drought and Landslides, Man Made Disaster – Nuclear and Chemical

Section B

Impact of Disaster and Case Studies

Social, Economic and Health impacts of Disaster, Floods - one case study with special reference to Brahmaputra Basin, Drought – one case study with special reference to Vidarbha and Telangana region, Earthquake – one case study with special reference to Himalayan region, Nuclear – Hiroshima and Nagasaki

Section C

Natural Disaster Management and Preparedness

Disaster Management: Prevention, Preparedness and Mitigation, Planning and control of Natural Disaster, National and State level planning for Hazard Mitigation, Role of Natural Disaster Management Authority

Recommended Books:

1. BMTPC & CDMM (2003). *Landslide Hazard Zonation of India*. New Delhi, India.
2. Decker, R. W. & Decker, B. B. (1998): *Volcanoes* (3rded.). NY, New York: WH Freeman & Company.
3. Dowrick, D. (2003). *Earthquake Risk Reduction Zone*. Sussex, England: Wiley & Sons.
4. Drake, F. (2000). *Global Warming the Science of Climate Change*. New York, NY: Oxford University Press.
5. Gere, J. M. & Shah, H.C. (1984). *Terra Non Firme Understanding and Preparing for Earthquakes*. New York, NY: WH Freeman & Company.
6. Govt. of India, (2002). *Drought 2002 a Report (part I)*, Ministry of Agriculture, Dept. of Agriculture and Cooperation. New Delhi, India.

7. Govt. of India, (2002). *Drought 2002 States Report (part II), Ministry of Agriculture, Dept. of Agriculture and Cooperation*. New Delhi, India.
8. Govt. of India, (2004). *Annual Reports, Ministry of Agriculture, Dept. of Agriculture and Cooperation, 1999-2000, 2002-2003, 2003-2004*. New Delhi, India.
9. IGNOU (2005). *Understanding Natural Disasters*. Noida, India: Shagun Offset Press.
10. IMD (1972) *Cyclone and safeguards*. New Delhi, India.
11. Inca, M. (1990). *The Rising Seas*. London, UK: Earthscan.
12. Prakash, I. (1994). *Disaster Management*. Ghaziabad, India: RastriyaPrahari.
13. Roy, S. (2004). *Natural Disaster Management – a case study of Tornado*. New Delhi, India: Abhijit.
14. Savindra, S. (2015). *Environmental Geography*. Allahabad, India: Pravika.
15. Sharma, V. K. (1995). *Disaster Management*. New Delhi, India: IIPA.
16. Singh, T. (2006). *Disaster Management Approaches and Strategies*. New Delhi, India: Akanksha.
17. Sinha, D. K. (2006). *Towards Basics of Natural Disaster Reduction*. New Delhi, India: Reasearch.
18. Thomas, B. (1993). *Disaster Response: A Handbook for Emergencies*. New Delhi, India: CASA.

Suggested e-learning materials:

1. Disaster Management
<https://swayam.gov.in/courses/4983-disaster-management>
2. Natural and Man-Made Environment and Disasters <https://nptel.ac.in/courses/122102006/9>
3. Floods and Cyclones
<https://www.sac.gov.in/SACSITE/SAC-Flyers/menulinks/society/9.1%20FLOODS%20&%20CYCLONES.pdf>
4. Surface and Ground water resources
<https://nptel.ac.in/courses/105105110/pdf/m6l02.pdf>
5. Introduction to Engineering Seismology
<http://nptel.ac.in/courses/105108076/module6/lecture16.pdf>

Energy Auditing and Conservation

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe Energy audits for building.
- Describe energy conservation measures.
- Explain energy efficient lighting technologies and its application in commercial and residential sectors.
- Describe Energy storage technologies and Energy Auditing.

Course Content:

Section A

Barriers to energy conservation, Key energy issues to 2025, Carbon dioxide emission, Energy Audits for building (Background, Energy Audit Procedures, Energy Management Programs & Energy Conservation Measures).Electrical Energy Management in Buildings (Principal Electricity Uses in Building, Strategies for Electricity End-Use Management), Heating, Ventilating and Air-Conditioning Control Systems (Modes of Feedback Control, Basic Control Hardware, Basic Control Systems Design Considerations & Example of HVAC Control Systems).Energy Efficient Lighting Technologies and Their Applications in the Commercial And Residential Sectors (Design of Energy-Efficient Lighting Systems, Lighting Technologies, Efficient Lighting Operation, Current Lighting Markets and Trends

Section B

Energy Efficient Technologies: Major Appliances and Space Conditioning Equipment (Description of Major Appliances and Space Conditioning Equipment, Current Production & Efficient Designs), Heat Pumps (Basic Principles, Solar-Assisted Heat Pump Systems & Geothermal Heat Pumps). Industrial Energy Efficiency and Energy Management (Energy Efficiency and Energy Management Improvement, Improving Energy Audits, Electricity End Uses and Electrical Energy Management).

Section C

Electric Motor System Efficiency (Motor System Efficiency & Energy Saving Applications). Energy Storage Technologies (Overview of Storage Technologies, Principal Forms of Stored Energy, Applications of Energy Storage, Specifying Energy Storage Devices, Specifying Fuels, Energy Storage: Direct Electric, Electrochemical, Mechanical, Direct Thermal & Thermochemical).

Recommended Books:

1. Abbi, Y.P., & Jain S. (2006). *Handbook on Energy Audit and Environment Management*. Delhi, India: TERI Press.
2. Goswami, D. Y., & Frank K. (2015). *Energy Efficiency & Renewable Energy Handbook*. Florida,FL: CRC Press (Taylor & Francis Group).
3. Polimeros, G., (1981). *Energy Cogeneration Handbook*. New York, NY: Industrial Press.

4. Threlkeld, L. (1970): *Thermal Environmental Engineering* (2nd Ed.). New Jersey, NJ: Prentice Hall.
5. Trinks, W., Mawhinney, M. H., Shannon, R. A. & Reed, R. J., & Garvey J. R. (2003). *Industrial Furnaces* (6th ed.). New Jersey, NJ: John Wiley & Sons.
6. Turner, W. C. (2007). *Energy Management Handbook* (7th ed.). Georgia, USA: Fairmont Press.
7. Witte, L. C., Schmidt, P. S., & Brown, D. R. (1998). *Industrial Energy Management and Utilization*. Washington, WA: Hemisphere.

Suggested e-learning materials:

1. Energy Efficiency, Acoustics and daylighting in Building,
[https://onlinecourses.nptel.ac.in/noc18_ce06/preview\](https://onlinecourses.nptel.ac.in/noc18_ce06/preview/)
2. Environment Management
<https://nptel.ac.in/courses/120108004/module9/lecture12.pdf>
3. Energy Audit
<https://ecozensolutions.com/audit.pdf>
4. Energy Management and Audit <https://beeindia.gov.in/sites/default/files/1Ch3.pdf>
5. Energy Conservation and waste heat recovery <https://nptel.ac.in/courses/112105221>

Environment Lab-III

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After the completion of this course, students will be able to:

- Illustrate physical and chemical characterization of waste.
- Illustrate the process of vermiculture.
- Enlist major steps of Environmental Impact Assessment (EIA) process.
- Determine sound level from various sources.

Course Content:

1. Determination of Flouride in water sample.
2. Determination of Sulphate in water sample.
3. Physical characterization of solid waste / refuse.
4. To determine COD in waste water samples.
5. Determination of VSS and TSS in soil/sludge samples
6. Determination of available Phosphorous in soil/sludge samples
7. EIA methods in Solid waste disposal- Leopold matrix and overlay.
8. To measure the intensity of sound from different sources.
9. To analyze Particulate matter in air samples.
10. To analyse SO₂ in air samples.
11. To analyse NO₂ in air samples.
12. To estimate Proline in plant leaves.
13. To record and analysis of climate trends by taking meteorological data of rainfall and temperature.
14. Construct the composting pit.
15. Construct the pit for vermiculture.
16. Planning and design of landfill sites.
17. Study of biogas plant.
18. Field Survey

Recommended Books:

1. Lakshmi, G. S. (2012). *Environmental Science : A Practical Manual*. Delhi, India: B.S.
2. Maiti, S.K. (2011). *Handbook of Methods in Environmental Studies*. Vol. 1: Water and Wastewater Analysis. Jaipur, India: Oxford Book Company.
3. Maiti, S.K. (2011). *Handbook of Methods in Environmental Studies*. Vol. 2: Soil and Air Analysis. Jaipur, India: Oxford Book Company
4. Narasalah, G. L. (2012). *Environmental Science : A Practical Manual*. Delhi, India: B.S.

Suggested e-learning materials:

1. Environmental Science, http://download.nos.org/333course/prac_manual.pdf
2. Virtual Lab
<http://www.vlab.co.in/>
3. Environmental Science Basics
[https://www.nios.ac.in/online-course-material/sr-secondary-courses/enviornmental-science-\(333\).aspx](https://www.nios.ac.in/online-course-material/sr-secondary-courses/enviornmental-science-(333).aspx)

Environmental Impact Assessment and Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe Scope of Environmental Impact Assessment and its Objectives.
- Describe various approaches for various environmental impact studies
- Illustrate various steps of Environmental Impact Assessment and its methodologies.
- Construct Environmental Impact Assessment plan for Industrial projects

Course Content:

Section A

Introduction:

Historical development of Environmental Impact Assessment (EIA)

Definition and scope of EIA, Objectives of EIA, Basic EIA principles.

Impact study:

Approach for environmental impact studies, EIA as planning tool

EIA Methodology, Predictive model of impact assessment.

Section B

Impact Prediction and assessment for air, water and noise:

Air: Knowledge of air quality, Air quality standards, Sources of pollutants,

Effects of pollutions, Conceptual approach for air impacts prediction.

Water: Information on water quality (Surface water and ground water), water quality standards, Identification and prediction of impact and assessment.

Noise: Information on noise legislation and guidelines, Methodology for noise-impacts prediction, Assessment of impact significance.

Section C

Environmental Risk Assessment (ERA) and Management in EIA:

Environmental risk assessment, treatment of uncertainty, key steps.

Management Plan: Impact prediction, evaluation and mitigation

Preparation of EIA plan for industrial project and functions

Factors for consideration, managing the EIA process, Monitoring and auditing.

Recommended Books:

1. Anjaneyulu, Y. (2003). *Environmental Impact Assessment* (2nd ed.). Hyderabad, India: B.S.
2. Attri S. D., & Tyagi A. (2010). *Climate Profile of India*. Ministry of Earth Sciences, New Delhi, India
3. Glasson J., Therivel R. & Chadwick A. (1999). *Introduction to Environmental Impact Assessment*(4th ed.). London, UK: Routledge.
4. Lawrence, D. P. (2003). *Environmental Impact Assessment – Practical solutions to recurrent problems*. New Jersey, NJ: Wiley-Interscience.
5. Petts, J. (1999). *Handbook of Environmental Impact Assessment*. New Jersey, NJ: Blackwell Science.

Suggested e-learning materials:

1. Environment Impact Assessment
<http://www.moef.nic.in/division/introduction-8>
<https://nptel.ac.in/courses/120108004/module3/lecture3.pdf>
2. EIA Documentation and Processes
<https://nptel.ac.in/courses/120108004/module4/lecture4.pdf>
3. EIA, EMP and EA
<https://nptel.ac.in/courses/123105001/36>

Solid Waste Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of this course, students will be able to:

- Describe solid waste generation, composition and characterization.
- Describe waste recycling, 3R technology and fly ash management.
- Outline the landfill design.
- Discuss monitoring and control of radiation pollution.

Course Content:

Section A

Concept of solid waste, Types, composition and classification of solid waste, Effects of solid waste generation on quality of air, water and public health. Need of Solid Waste Management. Principal of Solid Waste Management, Technical approach for solid waste management: collection, transportation, Disposal, Recovery and recycling of organic waste.

3R Principle (Reduce, Reuse and Recycle).

Section B

Solid waste disposal and Management methods – Recycling, Vermi composting and incineration, pyrolysis, biogas generation, solid waste as a source of raw material (light weight bricks from fly ash, composting)

Landfill Planning and designing, Act and rules for Solid waste management.

Case studies on solid wastes (Jaipur city and Vishakhapatnam city)

Section C

Hazardous waste, types of hazardous waste and its classification, Management of hazardous wastes. Biomedical waste and its management

Radioactive waste and pollution – concept, sources, types and possible hazardous of radioactive substances, measurement of radiation intensity.

Monitoring and control of radiation pollution, Effects of radioactive waste.

Recommended Books:

1. Agarwal, S. K. (1997). *Environmental Issues and Threats*. New Delhi, India: A P H.
2. Barrow, C. (1993). *Developing the Environment Problems and Management*. Abingdon UK: Routledge
3. Dhamija, U. (2006). *Sustainable Solid Waste Management-Issues Policies and Structures*. New Delhi, India: Academic Foundation.
4. Hosetti, B. B., & Kumar, D. (1998). *Environmental Impact Assessment and Management*. New Delhi, India: Daya.
5. Manual on Municipal Solid Waste Management (2011). *Prepared by the Expert Committee constituted by the Government of India*, Ministry of Urban Development.

6. Peter, C. (1998). *Handbook of Environmental risk Assessment and Management*. New Jersey, NJ: Blackwell Science.
7. Rasure, K. A. (2007). *Solid Waste Management, Environment and Sustainable Development*. New Delhi, India: Serials.
8. Salomons, W. & Forstner, S. L. (1990). *Environmental Management of Solid waste*. Heidelberg, Berlin: Springer-Verlag.
9. Sundaresan, A. D., & Bhide, B. B. (1987). *Solid Waste Management in Developing countries*. New Delhi, India: INSDOC.

Suggested e-learning materials:

1. Solid waste Management
<https://nptel.ac.in/courses/104103020/42>
2. Hazardous waste Management
<https://nptel.ac.in/courses/120108005/module9/lecture9.pdf>
3. Landfill Engineering System
<https://nptel.ac.in/courses/105106052/downloads/Lecture-40.pdf>
4. Landfill Type and Liner Systems
<http://ce561.ce.metu.edu.tr/files/2013/11/liner-1.pdf>
5. Types of Landfill
<http://www.mfe.govt.nz/waste/guidance-and-technical-information/types-of-landfills>
6. Management of High Level Radioactive waste
<http://www.barc.gov.in/pubaware/nw.html>
7. Radioactive waste Management
http://www.barc.gov.in/pubaware/nw_n3.html

Biology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand the basic organization and classification of living organisms.
- Describe fundamental cellular functions.
- Learn the basic concept of molecular biology and recombinant DNA technology.

Section A

- Brief idea of origin of life, Viruses (TMV, HIV, Bacteriophages), overview and brief introduction to five kingdom classification, characteristic features of Protista, Plantae and Animalia.
- Morphology and functions of different parts of flowering plants: Root, stem, leaf, major inflorescence (Spike, Raceme, Corymb and Umbel), flower, fruit and seed.
- Brief about the components and functions of different systems of humans.

Section B

- The cell concept, prokaryotic (Bacteria, cell structure) and eukaryotic cell (plant and animal cell). Cell organelles and their functions.
- Brief introduction and significance of carbohydrates, lipids, proteins and enzymes.
- Mendelian inheritance chromosome theory of inheritance, deviations from mendelian ratio (Incomplete dominance, co-dominance, complementary genes, multiple alleles). Linkage and crossing over, sex determination, sex linked inheritance, genetic counseling.

Section C

- Structure and replication of DNA, structure of RNA and brief concept of transcription and translation in prokaryotes and comparison with eukaryotes, Genetic code, Basic concept of recombinant DNA Technology and its applications. Overview of Human Genome Project, Biosafety issues.

Suggested Books:

- Green, N. P. O., Stout, G. W., Taylor, D. J. & Soper, R. (2005). *Biological Sciences*. Cambridge University Press.
- Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R.B. (2013). *Campbell Biology*. Pearson Publisher, India.

Suggested e-Resources:

- **Structural organization of plants and animals** <https://www.emedicalprep.com/study-material/biology/structural-organization-in-plants-and-animals/>
- **Morphology, anatomy and functions of different systems of humans:**
<https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-body-structure-and-homeostasis/a/tissues-organs-organ-systems>
- **Basic concept of cell**

<https://biologydictionary.net/cell/>

- **Gene-gene interaction** <http://www.biologydiscussion.com/genetics/ gene-interactions/gene-interactions-allelic-and-non-allelic-cell-biology/38795>
- **Human genome project**
<https://www.genome.gov/12011238/an-overview-of-the-human-genome-project/>
- **Application of recombinant DNA technology:**
<https://medcraveonline.com/JABB/JABB-01-00013>

Principles of Chemical Processes

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand basic concept of biochemical equation and material balance.
- Develop concept of energy balance, thermodynamic approaches, unit operations.
- Apply the gained knowledge in bioprocess industries.

Section A

- Basic Concepts, Units and Dimensions, Basic chemical calculations, Steady state and dynamic processes, Lumped and distributed processes, Single and multiphase systems.
- Types of Variables, Intensive and extensive variables, Specific properties, State Variables. Types of Equation: Mass and energy conservation, equilibrium relations.

Section B

- Process Classification, material balances for steady state processes, properties of gases, liquids and solids, equations of state, phase equilibria for ideal mixtures.
- Reactions and stoichiometry, Non-Reacting single phase systems; Single and multiple units without recycle, with recycle, bypass and purge, Non-Reacting multiphase systems.

Section C

- Processes involving vaporization and condensation, reacting systems.
- Energy Balances for Steady State Processes: Specific heat capacity, Enthalpy, Heat of reaction, thermo chemistry, Isothermal systems, Adiabatic Systems, Simultaneous material and energy balances.
- Unsteady State Material Balances, Reaction rate laws, Introduction to Modeling simulation for chemical processes: Basic idea about Model representation, types of modeling equations, types of mathematical models: Linear model vs nonlinear model, Static model vs dynamic model, Lumped parameter model vs Distributed model and Fundamental model vs empirical model, role of computer simulation in chemical processes.

Suggested Books:

- Bailey, J.E., & Ollis, D.F. (1944). *Biochemical Engineering Fundamentals* (2nd ed.). New York: McGraw-Hill Book Company.
- Bhatt, B.I., & Vora, S.M. (2008). *Stoichiometry* (4th ed.). New Delhi: Tata McGraw-Hill Publishing Company Limited.
- Dutta, R. (2007). *Fundamentals of Biochemical Engineering*. Ane Books India.
- Felder, R.M., & Rousseau, R.W. (2000). *Elementary Principles of Chemical Processes* (3rd ed.). Wiley India.
- Jana, A.K. (2008). *Chemical process Modelling and computer Simulation*. New Delhi: Prentice Hall of India private Limited.

Suggested e-Resources:

- **Energy Balance**
<https://www.che.iitb.ac.in/faculty/madhu/CL152/Handouts/Handout%206.pdf>
- **Lumped and Distributed model**
http://web.engr.oregonstate.edu/~traylor/ece391/Andreas_slides/ECE391-S14-Lect1-web.pdf

Biochemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Learn about the biomolecules forming the cellular structure.
- Identify and compare the various biochemical pathways and their use.
- Translate skills in research, quality control, production and diagnostics.

Section A

- Carbohydrates: Classification, structure and properties, glycolysis and fermentation and their regulations, gluconeogenesis and glycogenolysis, metabolism of galactose and galactosemia, pentosephosphate pathway.
- Citric Acid Cycle: Significance, reactions and energetics of the cycle, amphibolic role of the cycle. Glyoxylic acid cycle
- Enzymes: Nomenclature, classification, characteristics, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis. Co-enzymes and Cofactors: Role of Vitamins, metals ions, significance.

Section B

- Lipids: Classification, structure and properties of lipids. Oxidation of fatty acids, beta oxidation and its energetics, alpha oxidation of fatty acids, omega oxidation. Biosynthesis of ketone bodies and their utilization, biosynthesis of saturated and unsaturated fatty acids, control of lipid metabolism, essential fatty acids and eicosanoids, phospholipids and sphingolipids.
- Proteins and Metabolism of Amino acids: Classification, structure and properties, nitrogen balance, biosynthesis of amino acids, catabolism of amino acids, conversion of amino acids to specialized products.
- Biological Oxidation: Redox-potential, the respiratory chain, its role in energy capture and its control. Energetics of oxidative phosphorylation, inhibitors of respiratory chain and oxidative phosphorylation, Chemiosmotic coupling theory and mechanism of ATP production in oxidative phosphorylation.

Section C

- Metabolism of Ammonia and Nitrogen containing Monomers: Assimilation of ammonia, urea cycle, metabolic disorders of urea cycle, porphyrin biosynthesis, formation of bile pigments, hyperbilirubinemia, purine biosynthesis, purine nucleotides interconversion, pyrimidine biosynthesis, formation of deoxyribonucleotides.
- Nucleic acids: Structure of DNA and RNA, Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Genetic code, transcription and translation, replication of DNA, mutation, physical and chemical mutagenesis / carcinogenesis, DNA repair mechanism, biosynthesis of tRNA and rRNA.

Suggested Books:

- Berg, J.M., Tymoczko, J.L., Gatto Jr., G.J & Stryer, L. (2015). *Biochemistry* (8th ed.). W.H. Freeman and Company.
- Garrett, R.H. & Grisham, C.M. (2012). *Biochemistry* (5th ed.). Wadsworth Publishing Co Inc.
- Nelson, D.L. & Cox, M.M. (2012). *Lehninger Principles of Biochemistry* (6th ed.). W.H. Freeman.
- Palmer, T (2004). *Enzymes: Biochemistry, Biotechnology and Clinical Chemistry* (Horwood Chemical Science) Reprint Edition. Albion.

- Rodwell, V.W., Bender, D., Botham, K.M., Kenelly, P.J., & Weil, P.A. (2018). *Harper's illustrated Biochemistry* (31st ed.). McGraw-Hill Education / Medical.
- Voet, D. & Voet, J.G. (2010). *Biochemistry* (4th ed). Wiley.

Suggested e-Resources

- **Metabolic pathways, Biomolecules**
<https://epgp.inflibnet.ac.in/ahl.php?csrno=2>
- **Glycolysis**
<https://www.khanacademy.org/science/biology/cellular-respiration-and-fermentation/glycolysis/a/glycolysis>
- **Mechanism of enzyme action**
<http://www.biologydiscussion.com/enzymes/enzymes-properties-and-mechanism-of-enzyme-action/6145>
- **Enzyme action**
<http://chemistry.elmhurst.edu/vchembook/571lockkey.html>

Biotechnology Lab-I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course, students should be able to:

- Gain hands on training to quantitatively analyze biomolecules.
- Demonstrate an understanding of spectrophotometrically analysis biomolecules.
- Hands on training on measuring techniques.
- Solve problems for mass balance and energy balance and equations numerically.

Biochemistry

1. Estimation of proteins by Lowry's and TCA methods.
2. Estimation of carbohydrates: Total sugars by Anthrone method.
3. Reducing sugars by Nelson Somogyi method.
4. Estimation of serum cholesterol.
5. Preparation and purification of casein from buffalo milk.
6. Determination of titrable acidity of milk
7. To find $\lambda_{\max}$ for proteins.
8. To find $\lambda_{\max}$ for nucleic acids.

Principles of Chemical Processes Lab

Experiments based on measuring techniques

9. Measurement of temperature by Thermocouple.
10. Measurement of pressure by Manometer.
11. Measurement of RPM.
12. Determination of mass flow rate.
13. Calculation of TOC and ThOD of organic compounds present in the solution.
14. Mass balance problems.
15. Energy balance problems.
16. Newton Raphson (NR) optimization.

Suggested Books:

- Biradar, V.K., & Samshe, A. (2016). *Practical Biochemistry*. New Delhi: APH Publishing Corporation.
- Kumar, A., Garg, S., & Garg, N. (2017). *Biochemical Tests: Principles & Protocols*. New Delhi: Viva Books.-all
- Saxena, J., Baunthiyal., & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.
- Sharma, S., & Sharma, R. (2016). *Practical Manual of Biochemistry* (II Ed.). New Delhi: Medtech.
- Shuler, M.L., & Kargi, F. (2002). *Bioprocess Engineering Basic Concepts* (2nd ed.). Prentice Hall PTR Upper Saddle River, NJ, USA.
- Vats, S. (2015). *A laboratory Text book of Biochemistry, Molecular Biology and Microbiology*. Germany: GRIN Verlag.

Yadav, V.K., & Yadav, N. (2018). *Biochemistry & Biotechnology: A Laboratory Manual*. Jaipur: Pointer Publisher.

Biophysics and Structural Biology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Develop a basic understanding of molecular and quantum mechanics in studying biomolecules.
- Solve questions of macromolecular folding and interactions.
- Understand the molecular processes behind locomotion, neuronal signaling and vision.

Section A

- Elements of Quantum Mechanics: Quantization of energy, Atomic structure wave equation, Quantum Mechanical Tunnelling.
- Energies, forces and Bonds: inter-atomic potentials for strong and weak bonds, non central forces, bond energies, spring constant.
- Basic principle of protein structure: Ramachandran plot, motifs, folds, fibrous proteins, membrane proteins.

Section B

- Configuration of DNA, RNA, Glycosidic bond rotation and base stacking.
- Zwitterionic properties of amino acids, peptide bonds, and disulfide cross links.
- Basic principles of X-ray diffraction studies, calculation and interpretation of electron density map.
- Protein secondary structure prediction methods: Chou and Fasman, Garnier-Osguthorpe-Robson.
- Classification of three-dimensional structure of protein: HSSP, SCOP.

Section C

- Muscular movement: molecular structure of skeletal muscle, mechanical events of muscle contraction, force velocity, power velocity and tension- length relationship curves.
- Neuronal physics: Ion channels, structure of Neurons, Synapse, Action potential and its propagation through nerve fiber. Post synaptic potential and Neural networking.
- Photoreception: Structure of photoreceptors and photo chemical events of vision.
- Molecular interaction: Protein-Protein interactions, Protein-DNA interactions.
- Techniques for the studies of these interactions.

Suggested Books:

- Atkins, P., & Paula, J.D. (2009). *Atkins Physical Chemistry* (9th ed.). OUP Oxford.
- Ber, J.M., Tymoczko, J.L., Gatto, G.J. & Stryer, L. (2015). *Biochemistry* (8th ed.) WH Freeman & Co.
- Brenden, C., & Tooze, J. (1998). *Introduction to Protein Structure* (2nd ed.) Garland Science.
- Cotterill, R. (2002). *Biophysics: An Introduction*. Wiley Press.
- Creighton, T.E. (1992). *Proteins: Structures and Molecular Properties*. WH Freeman & Co.
- Hall, J.E. (2015). *Guyton and Hall Textbook of Medical Physiology* (13th ed.). Saunders Press.
- Nelson, D. L., & Cox, M.M. (2017). *Lehninger Principles of Biochemistry* (7th ed.) WH Freeman & Co.
- Voet, D., Voet, J.D., & Pratt, C.W. (2016). *Fundamentals of Biochemistry* (5th ed.). John Wiley.

- Wilson, K., & Walker, J. (2010). *Principles and Techniques of Biochemistry and Molecular Biology*. Cambridge University Press.

Suggested e-Resources:

- **Muscular and Neuronal Physiology**

<https://www.khanacademy.org/science/biology/human-biology>

- **Proteins**

<https://study.com/academy/lesson/proteins-structure-function-types.html>

- **Nucleic Acids**

<https://chemistry.tutorvista.com/biochemistry/nucleic-acid-function.html>

Cell and Molecular Biology – II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand functions of cell organelles and regulation of cellular processes.
- Explain the role and mechanism of cell signaling.
- Develop detailed understanding of fundamental processes viz., replication, transcription and translation.

Biotechnology Lab-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course, students should be able to:

- Learn techniques related to histochemical localization of biomolecules.
- Gain hand on training to analyze stages of cell division.
- Predict structure of biomolecules using bioinformatics tools.

Cell and Molecular Biology

1. Estimation of DNA by DPA method.
2. Determination of Logic properties (pH value of glycine by titration).
3. Study of the stages of mitotic and meiotic cell division.
4. Separation of different organelles/molecules by sucrose density gradient/differential gradient.
5. Histochemical localization of biomolecules (protein, carbohydrate or any other).

Biophysics

6. Download PDB files for protein complexes with proteins (haemoglobin, myoglobin, insulin), nucleic acid and do various exercises using:
 - Rasmol
 - SPDBV

Suggested Books:

- Saxena, J., Baunthiyal, M. & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.
- Sharma, R.K., Sangha, S.P.S. (2009). *Basic Techniques in Biochemistry & Molecular Biology*. New Delhi: I.K. International Publisher.
- Swamy, P.M. *Laboratory Manual on Biotechnology* (1st ed.). Meerut: Rastogi Publication.

Section A

- Cell: Prokaryotic and eukaryotic cell, cell compartmentalization, cytoskeleton.
- Molecular structure and functional aspects of plasma membrane, carrier proteins and active membrane transport.
- Endocytosis and exocytosis.
- Autocrine, paracrine and endocrine stimulation.
- Cell Signaling: G-protein linked receptors, enzyme linked cell surface receptors (tyrosine kinases), structural features of trans membrane receptors, secondary messengers, role of Ca^{2+} ions, MAP kinase cascade.
- Cell cycle and division.

Section B

- The Nucleus, nucleolus, structure of chromosomes, nucleosomes, chromosomal DNA and its packaging.
- Mitochondria and chloroplast organization transport of proteins, genome of mitochondria and chloroplast.
- Endoplasmic reticulum, golgi apparatus, role in protein processing and transport.

- Lysosomes, intracellular digestion, sorting of lysosomal enzymes in golgi, lysosomal storage diseases.

Section C

- Central dogma and genetic code.
- DNA replication.
- Transcription: The transfer of DNA sequence information to RNA, exon, intron, tRNA and rRNA, mRNA processing.
- Translation: mRNA translation in prokaryotes and eukaryotes, notable features of the translation process.
- Inhibitors of transcription and translation.
- The fate of newly synthesized protein.

Suggested Books:

- Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2008). *Molecular Biology of the Cell* (5th ed.). New York: Garland Science.
- Cooper, G. M., & Hausman, R. E. (2013). *The Cell: a Molecular Approach* (6th ed.). Washington: ASM; Sunderland.
- Hardin, J., Bertoni, G., Kleinsmith, L. J., & Becker, W. M. (2012). *Becker's World of the Cell. Boston* (8th ed.). Benjamin Cummings.
- Karp, G. (2008). *Cell and molecular biology: Concepts and experiments*. John New Jersey: Wiley and Sons.
- Krebs, J. E., Lewin, B., Kilpatrick, S. T., & Goldstein, E. S. (2014). *Lewin's Genes XI*. Burlington, MA: Jones & Bartlett Learning.
- Lodish, H. F. (2016). *Molecular Cell Biology* (8th ed.). New York: W.H. Freeman.
- Watson, J. D. (2008). *Molecular Biology of the Gene* (5th ed.). Menlo Park, CA: Benjamin/Cummings.

Suggested e-Resources:

- **Macromolecular assembly**
<https://www.sciencedirect.com/science/article/pii/B9780323341264000050>
- **Cell division**
<https://www2.le.ac.uk/projects/vgec/highereducation/topics/cellcycle-mitosis-meiosis>
- **Lysosomal storage disorders**
<https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1365-2141.2004.05293.x>

Biotechnology Lab-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

After successful completion of the course, students should be able to:

- Learn techniques related to histochemical localization of biomolecules.
- Gain hand on training to analyze stages of cell division.
- Predict structure of biomolecules using bioinformatics tools.

Cell and Molecular Biology

7. Estimation of DNA by DPA method.
8. Determination of Logic properties (pH value of glycine by titration).
9. Study of the stages of mitotic and meiotic cell division.
10. Separation of different organelles/molecules by sucrose density gradient/differential gradient.
11. Histochemical localization of biomolecules (protein, carbohydrate or any other).

Biophysics

12. Download PDB files for protein complexes with proteins (haemoglobin, myoglobin, insulin), nucleic acid and do various exercises using:
 - Rasmol
 - SPDBV

Suggested Books:

- Saxena, J., Baunthiyal, M. & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.
- Sharma, R.K., Sangha, S.P.S. (2009). *Basic Techniques in Biochemistry & Molecular Biology*. New Delhi: I.K. International Publisher.
- Swamy, P.M. *Laboratory Manual on Biotechnology* (1st ed.). Meerut: Rastogi Publication.

Microbiology and Immunology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Explain bacterial and fungal classification and ultra structure.
- Discuss different techniques related to isolation, staining and maintenance of microbes.
- Understand fundamental concept of immunology.

Section – A

- Discovery of microorganisms and their significance.
- Bacteria: Classification, structural organization, composition of cell wall, cell membrane, capsule, nutrition, respiration, methods of recombination and asexual reproduction.
- Fungi- classification, ultra structure and characteristics, nutrition and reproduction.
- Nature, organization, classification and replication of Plant and animal viruses and bacteriophages.

Section – B

- Sterilization techniques: Physical and Chemical methods.
- Techniques in Microbiology: Media preparation, isolation and pure culture techniques, staining techniques, preservation and maintenance of culture.
- Industrial applications of microorganisms in food and medicines.
- Introduction to Immunology: Innate and acquired immunity, active and passive immunity, organs and cells of immune system.
- Antigen and antigenicity: Concept of immunogens, antigens, haptens, characteristic properties of antigens.

Section-C

- Immunoglobulins: Molecular structure, properties, classification and significance of immunoglobulin. Immunoglobulin as antigens– isotypes, allotypes and idiotypes.
- Cell mediated and humoral immune response.
- General idea of Major Histocompatibility Complex, complement system.
- Hypersensitive reactions: (Type I, II, III and delayed type IV).
- Monoclonal antibody (production and their applications).

Suggested Books:

- Goldsby, R. A., Kindt, T.J., & Osborne, B. A. (2006). *Kuby Immunology* (6th ed.). New York: W.H. Freeman & Co. Ltd.
- Madigan, M., Martinko, J., Stahl, D., & Clark, D. (2010). *Brock Biology of Microorganisms* (13th ed.). Pearson
- Paul, W.E. (1999). *Fundamental Immunology* (14th ed.). Lippincott-Raven.
- Pelczar, M.J., Sun, C.E., & Krieg, N.R. (2002). *Microbiology* (5th ed.). New Delhi: Tata Mc Graw Hill.
- Willey, J. M., Sherwood, L.M. & Woolverton, C.J. (2014). *Prescott's Microbiology* (9th ed.). McGraw-Hill Education.

Metabolic Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Provide basic concept about cellular metabolism, pathway design and bioenergetics.
- Understand regulatory mechanisms and metabolic modeling.
- Develop analytical skills to address metabolic engineering problems.

Section – A

- Basic concepts of metabolic engineering, overview of cellular metabolism. Introduction to various pathways.
- Primary and secondary metabolites.
- Medical and agricultural importance of secondary metabolites.
- Different models for cellular reactions, flexible and rigid metabolic pathways.
- Metabolic regulation at enzyme level and whole cell level, examples of metabolic pathway manipulations.

Section – B

- Metabolic pathway synthesis algorithms.
- Metabolic flux analysis and its applications.
- Mathematical calculation for the flow of carbon and nitrogen fluxes.
- Methods for experimental determination of metabolic fluxes by isotope labeling.
- Stereochemistry of regulatory molecules.
- Concepts of regulatory analogs.

Section – C

- Genetic regulation of metabolic fluxes.
- Gene expression in response to environmental stimuli.
- Regulation of gene expression.
- Analysis of metabolic control and the structure of metabolic networks.
- Thermodynamics of cellular processes – New concepts for quantitative bioprocess research and development.

Suggested Books:

- Bailey, J.E., & Ollis, D.F. (1986). *Biochemical Engineering fundamentals* (2nd ed). McGraw-Hill.
- Bower, J.M., & Bolouri, H., (2001). *Computational Modeling of Genetic and Biochemical Networks* (1st ed.). MIT Press.
- Stephanopoulos, G.N., Aristidou, A.A., & Nilsen, J., (1998). *Metabolic Engineering-Principles and Methodologies*. Academic Press.

Suggested e-Resources:

- **Metabolites**
<http://lifeofplant.blogspot.in/2011/03/metabolites-primary-vs-secondary.html>
http://www.bio21.bas.bg/ipp/gapbfiles/v-34_pisa-08/08_pisa_1-2_67-78.pdf
- **Metabolic engineering file**

Genetics and Genetic Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Explain the theoretical and experimental foundation of classical and molecular genetics.
- Develop comprehensive concept of genetic engineering including vectors and techniques.
- Identify various applications of genetics and genetic engineering.

Section-A

- Mendel's laws of inheritance.
- Gene-Gene interaction, multiple alleles, lethal alleles.
- Linkage and crossing over, linkage maps, three point testcross, Interference, calculating recombinant frequencies.
- Sex-determination: Chromosomes theory, Genic balance theory and hormone theory, other factors affecting sex determination, Lyon's hypothesis, dosage compensation, sex-linked inheritance.
- Chromosomal aberrations: Structural and numerical mutation, spontaneous and induced mutation, chemical and physical mutagens, induced mutations in plants, animals and microbes for economic benefit of man.

Section-B

- Vector systems: *E. coli*-the host cell plasmids structural and functional organization, replication, classification, incompatibility groups, construction of an ideal plasmid vector pBR322.
- Phage biology, construction of vector, other phages and cosmids.
- Direct gene delivery methods- Biolistics, electroporation, liposome mediated, microinjection.
- Construction, cloning and selection of inserts ligation, infection, transfection and cloning.
- Synthesis and cloning of cDNA, cDNA library.
- Enzymes used in molecular cloning: Nucleases, restriction Endonucleases, phosphodiesterase, polynucleotide kinase, DNA ligase, DNA polymerase, reverse transcriptase, terminal deoxynucleotidyl transferase.
- Isolation of DNA, RNA: bacteriophage, prokaryotic and eukaryotic.

Section-C

- Inborn errors of metabolism, autosomal and sex linked diseases.
- One gene-one enzyme, one gene-one protein, one gene-one polypeptide hypothesis.
- Heredity and environment with special reference to the study of twins.
- Human Genome Project: Genetic diseases in humans, genetics and society.
- Current techniques of genetic analysis.
- Important discoveries of genetic engineering.
- Identification and analysis of recombinant clones.

Suggested Books:

- Brown, T. A. (1990). *Genetics: A molecular approach* (3rd ed.). UK: Chapman and Hall.
- Gupta, P. K. (2005). *Biotechnology and Genomics*. India: Rastogi Publications.
- Primrose, S. B., Twyman, R., & Old, B. (2001). *Principles of Gene Manipulation* (6th ed.). USA: Wiley-Blackwell.
- Russel, P. J. (1996). *Genetics*. USA: Addison-Wesley.
- Sambrook, J. F., & Russell, D. W. (2001). *Molecular Cloning: A Laboratory Manual* (3rd ed.). USA: Cold Spring Harbor Laboratory Press.
- Singh, B. D. (2015). *Biotechnology*. Kolkata, India: Kalyani Publishers.

Suggested e-Resources:

- **Bacteria structure** <http://www.biologydiscussion.com/bacteria/cell-structure-of-bacteria-with-diagram/47058>
- **Bacterial growth & nutrition**
<http://www.biologydiscussion.com/bacteria/nutrition-and-growth-in-bacteria/47001>
- **Basic Immunology**
<http://pdffavor.info/the-tao-of-immunology-a-revolutionary-new-understanding-of-our-body-s-defenses-openlibra-free-books-marc-lapp.pdf>

Metabolic Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Provide basic concept about cellular metabolism, pathway design and bioenergetics.
- Understand regulatory mechanisms and metabolic modeling.
- Develop analytical skills to address metabolic engineering problems.

Section – A

- Basic concepts of metabolic engineering, overview of cellular metabolism. Introduction to various pathways.
- Primary and secondary metabolites.
- Medical and agricultural importance of secondary metabolites.
- Different models for cellular reactions, flexible and rigid metabolic pathways.
- Metabolic regulation at enzyme level and whole cell level, examples of metabolic pathway manipulations.

Section – B

- Metabolic pathway synthesis algorithms.
- Metabolic flux analysis and its applications.
- Mathematical calculation for the flow of carbon and nitrogen fluxes.
- Methods for experimental determination of metabolic fluxes by isotope labeling.
- Stereochemistry of regulatory molecules.
- Concepts of regulatory analogs.

Section – C

- Genetic regulation of metabolic fluxes.
- Gene expression in response to environmental stimuli.
- Regulation of gene expression.
- Analysis of metabolic control and the structure of metabolic networks.
- Thermodynamics of cellular processes – New concepts for quantitative bioprocess research and development.

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- Bower, J.M., & Bolouri, H., (2001). *Computational Modeling of Genetic and Biochemical Networks* (1st ed.). MIT Press.
- Stephanopoulos, G.N., Aristidou, A.A., & Nilsen, J., (1998). *Metabolic Engineering-Principles and Methodologies*. Academic Press.

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- **Metabolites**
<http://lifeofplant.blogspot.in/2011/03/metabolites-primary-vs-secondary.html>
http://www.bio21.bas.bg/ipp/gapbfiles/v-34_pisa-08/08_pisa_1-2_67-78.pdf
- **Metabolic engineering file**

Genetics and Genetic Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Explain the theoretical and experimental foundation of classical and molecular genetics.
- Develop comprehensive concept of genetic engineering including vectors and techniques.
- Identify various applications of genetics and genetic engineering.

Section-A

- Mendel's laws of inheritance.
- Gene-Gene interaction, multiple alleles, lethal alleles.
- Linkage and crossing over, linkage maps, three point testcross, Interference, calculating recombinant frequencies.
- Sex-determination: Chromosomes theory, Genic balance theory and hormone theory, other factors affecting sex determination, Lyon's hypothesis, dosage compensation, sex-linked inheritance.
- Chromosomal aberrations: Structural and numerical mutation, spontaneous and induced mutation, chemical and physical mutagens, induced mutations in plants, animals and microbes for economic benefit of man.

Section-B

- Vector systems: *E. coli*-the host cell plasmids structural and functional organization, replication, classification, incompatibility groups, construction of an ideal plasmid vector pBR322.
- Phage biology, construction of vector, other phages and cosmids.
- Direct gene delivery methods- Biolistics, electroporation, liposome mediated, microinjection.
- Construction, cloning and selection of inserts ligation, infection, transfection and cloning.
- Synthesis and cloning of cDNA, cDNA library.
- Enzymes used in molecular cloning: Nucleases, restriction Endonucleases, phosphodiesterase, polynucleotide kinase, DNA ligase, DNA polymerase, reverse transcriptase, terminal deoxynucleotidyl transferase.
- Isolation of DNA, RNA: bacteriophage, prokaryotic and eukaryotic.

Section-C

- Inborn errors of metabolism, autosomal and sex linked diseases.
- One gene-one enzyme, one gene-one protein, one gene-one polypeptide hypothesis.
- Heredity and environment with special reference to the study of twins.
- Human Genome Project: Genetic diseases in humans, genetics and society.
- Current techniques of genetic analysis.
- Important discoveries of genetic engineering.
- Identification and analysis of recombinant clones.

Suggested Books:

- Brown, T. A. (1990). *Genetics: A molecular approach* (3rd ed.). UK: Chapman and Hall.

- Gupta, P. K. (2005). *Biotechnology and Genomics*. India: Rastogi Publications.
- Primrose, S. B., Twyman, R., & Old, B. (2001). *Principles of Gene Manipulation* (6th ed.). USA: Wiley-Blackwell.
- Russel, P. J. (1996). *Genetics*. USA: Addison-Wesley.
- Sambrook, J. F., & Russell, D. W. (2001). *Molecular Cloning: A Laboratory Manual* (3rd ed.). USA: Cold Spring Harbor Laboratory Press.
- Singh, B. D. (2015). *Biotechnology*. Kolkata, India: Kalyani Publishers.
- Snustad, D. P., & Simmons, M. J. (2008). *Principles of Genetics* (5th ed.). USA: John Wiley & Sons.

Suggested e-Resources:

- **Linkage and crossing over**
<http://classpages.warnerpacific.edu/bdupriest/BIO%20250/Lecture%207%20Linkage%20&%20Mapping.pdf>
- **Sex determination theory**
<http://www.biologydiscussion.com/genetics/modern-theories-of-sex-determination-with-diagrams/5257>
- **Plasmid vector**
<https://nptel.ac.in/courses/102103045/module3/lec17/3.html>
- **Direct gene delivery methods**
<https://www.slideshare.net/saugatbhatt/methods-27443684>
- **cDNA library**
<https://nptel.ac.in/courses/102103013/19>
- **Enzymes used in molecular cloning**
<http://www.biologydiscussion.com/enzymes/types-of-enzymes-involved-in-dna-synthesis-and-cloning-7-types/12075>
- **One gene one enzyme hypothesis**
<http://www.biologydiscussion.com/genetics/one-gene-one-enzyme-hypothesis-genetics/59768>
- **Techniques of genetic analysis**
http://psych.colorado.edu/~carey/hgss/hgsschapters/HGSS_Chapter07.pdf
- **Important discoveries of genetic engineering**
<https://www.genome.gov/pages/education/genetictimeline.pdf>

Enzyme Engineering and Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Describe structure, functions and the mechanisms of action of enzymes.
- Develop concept of regulation of enzyme activity.
- Identify industrially relevant enzymes and describe their application.

Section – A

- Brief history of enzymes, nomenclature and classification of enzymes.
- Specificity of enzymes: Types of specificity, the Koshland “induced fit” hypothesis.
- Strain or transition – state stabilization hypothesis.
- Mechanism of enzyme action: Chymotrypsin and carboxypeptidase A.
- Enzyme catalysis and kinetics: Factors affecting the rate of chemical reactions, kinetics of enzyme-catalyzed reaction, Michaelis-Menten laws, importance and determination of $V_{\max}$ and K_m values, Hofstee's plot, L & B plots, Methods for investigating the kinetics of enzyme-catalyzed reactions (single and bisubstrate), nature of enzyme catalysis.
- Enzyme inhibition: types and their kinetics.

Section – B

- Extraction of soluble and membrane bound enzymes.
- Purification of enzymes: salt precipitation, gel filtration, ion exchange and affinity chromatography.
- Regulation of enzyme activity, various controls (metabolic compartmentation, covalent modifications and others), feedback regulation, allosteric enzymes.
- The investigation of active site structure and chemical nature of enzyme catalysis: The identification of binding sites and catalytic site, three dimensional structure of active site, mechanism of catalysis, mechanism of reaction catalyzed by enzyme without cofactors, metal-activated enzyme and metalloenzyme, coenzymes in enzyme catalyzed reactions.
- The impact of genetic engineering on enzyme production, modification of structural and catalytic properties by chemical methods and genetic engineering, enzymes from extremophiles, enzymes in organic solvent.

Section – C

- Immobilization of enzymes: Concept, methods of immobilization, kinetics of immobilized enzymes, effect of solute partition and diffusion on kinetics of immobilized enzymes, bioreactors using immobilized enzyme.
- Industrial enzymes: traditional (non-recombinant) sources of industrial enzymes,
- Proteases and carbohydrases: Proteolytic enzymes, carbohydrases, lignocellulose degrading enzymes, pectin and pectic enzymes.
- Additional industrial enzymes: Lipases, penicillin acylase, amino acylase and amino acid production, cyclodextrins and cyclodextrin glycosyl transferase, enzymes in animal nutrition, oxidoreductases.
- Enzymes in molecular biology and clinical diagnostics.

Suggested Books:

- Bhaskar, A., Vidhya, V. G. (2014). *Enzyme Technology*. India: Mjp Publishers.

- Copeland, R. A. (2000). *Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis*. USA: John Wiley & Sons.
- Devasena, T. (2010). *Enzymology* (3rd ed.). UK: Oxford University Press.
- Meena, M., & Chauhan, D. (2009). *Fundamentals of Enzymology*. Jaipur, India: Aavishkar publishers.
- Palmer, T., & Bonner, P. (2008). *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry* (2nd ed.). India: East West Publications.
- Scopes, R. K. (2013). *Protein Purification: Principles and Practice* (3rd ed.). USA: Springer.
- Segel, I. H. (2010). *Biochemical Calculations* (Second Edition). India: Wiley India Pvt. Ltd.

Suggested e-Resources:

- **Mechanism of chymotrypsin**
<https://slideplayer.com/slide/5116894/>
- **Factors affecting rate of chemical reaction**
<https://www.adichemistry.com/physical/kinetics/factors/factors-affecting-rate-reaction.html>
- **Extraction and purification of enzyme**
<http://chemsites.chem.rutgers.edu/~kyc/Teaching/Files/543-05/09%20544-10%20ppt.pdf>

Biotechnology Lab-III

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Demonstrate microbial and immunological techniques.
- Understand chromosome structure and solve genetic problems.
- Learn various techniques of genetic engineering.
- Gain hands on training for experiments related to properties of enzyme.

Microbiology

1. Preparation of media for fungal and bacterial culture and their sterilization, slant preparation.
2. Streaking technique, spread plate technique.
3. Isolation and enumeration of microbes from air/soil by serial dilution/agar plating method.
4. Antibiotic sensitivity test.

Immunology

5. Blood film preparation and identification of leucocytes.
6. Ouchterlony double diffusion and immuno-electrophoresis.
7. ELISA: Determination of antibody titre.

Genetics

8. Microscopic examination of Giant chromosomes.
9. Genetic problems and Genetic traits.

Genetic Engineering

10. Isolation of genomic DNA and its electrophoretic separation.
11. Extraction of RNA and its estimation by orcinol method.
12. Amplification of a gene fragment using PCR.

Enzymology

13. To obtain standard curve of p-nitrophenol solution.
14. To determine activity of acid phosphatase from mung bean seeds.
15. Purification of an enzymatic protein by salt precipitation.
16. Determination of kinetic properties (K_m and V_{max} values) of an enzyme.
17. To check time and protein linearity of an enzymatic reaction.
18. Immobilization of an enzyme.

Suggested Books:

- Cappuccino, J. G., & Welsh, C. (2016). *Microbiology: a Laboratory Manual*. Benjamin-Cummings Publishing Company.
- Kumar, V. (2011). *Laboratory Manual of Microbiology*. New Delhi: Scientific Publishers.

- Mahajan, R., Sharma, J., & Mahajan, R.K. (2010). *Practical Manual of Biotechnology* (1st ed.). New Delhi: Vayu Education of India.
- Saxena, J., Baunthiyal., & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.
- Vats, S. (2015). *A laboratory Text book of Biochemistry, Molecular Biology and Microbiology*. Germany: GRIN Verlag.

Basic Bioinformatics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Demonstrate basic skills in information retrieval, programming languages and operating systems.
- Identify various biological databases and develop data mining methods.
- Predict 3D structure of proteins and their regular structural elements for the integrity of the structure.

Section-A

- Bioinformatics: Introduction and historical background.
- Information retrieval: LAN, WAN, introduction to internet, WWW, NICNET, ERNET, VSNL, ISDN, introduction to FTP, login and other network services, publication on worldwide web, on-line publishing ventures e.g. biomed, online international database access.
- Conceptual understanding of assemblers, operating systems (DOS, Windows, UNIX, LINUX).

Section-B

- Concept of CD-ROM, e-mail, websites, internet, networking, databases.
- Biological databases: Primary sequence databases (Protein and DNA databases), secondary databases, composite databases.
- Sequence format i.e. genbank and FASTA format.
- Sequence alignment and databases searching: Evolutionary basis of sequence alignment, optimal alignment methods, substitution scores and gap penalties.

Section-C

- Statistical significance of alignment, similarity searching tools: FASTA, BLAST.
- Pair wise database searching: EMBOSS, multiple Sequence alignment: CLUSTAL W.
- Protein structure prediction method- Homology modeling, ab-initio method and threading method.
- Scope of bioinformatics, BTIS Network in India, centers for bioinformatics (DICs and sub DICs) in India.

Suggested Books:

- Baxevanis, A.D. & Ouellette, B.F.F. (2004). *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins* (3rd ed.). Wiley.
- Bosu, O. & Thukral, S.K. (2007). *Bioinformatics: database, tools and algorithms* (1st ed.). Oxford University Press.
- Sharma, V., Munjal, A., & Shanker, A. (2017). *A Text Book of Bioinformatics* (2nd ed.). Meerut: Rastogi Publications.
- Sinha, P.K & Sinha, P. (2016). *Computer Fundamentals* (6th ed.). New Delhi: BPB publication.

Suggested e-Resources:

- **Chou-Fasman Method for protein secondary structure prediction**
<https://pdfs.semanticscholar.org/fd8c/c95aec2d7af19ed28eea3688b3c231d0e745.pdf>
- **Homology modeling**
<https://proteinstrutures.com/Modeling/homology-modeling.html>
- **ExPASy**
<https://www.expasy.org/>

Bioprocess Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Develop comprehensive concepts on various processes in bioreactors mediated microbial process.
- Apply engineering principles to address issues in bioprocesses and delineate problems associated with production of biomolecules in bioreactor.
- Plan a career in research field in the biotechnology industry.

Section – A

- Growth kinetics and death kinetics.
- Microbial growth: structured and unstructured.
- Kinetics of batch, fed-batch and continuous processes.
- Mass balance, energy balance.
- Maintenance coefficient and yield concept.
- Mass transfer, volumetric mass transfer coefficient, aeration and agitation.
- Media sterilization and medium rheology.

Section – B

- Bioreactors: components and control of process parameters.
- Types of bioreactors: CSTR, airlift, fluidized bed, plug flow reactor, photobioreactor, bubble column, advances in bioreactor designing.
- Down stream processing: recovery and purification of fermentation products.
- Upscaling of bioprocess.

Section – C

Fermentative production of:

- Organic solvents: acetone, ethanol, butanol.
- Organic acids: lactic acid, citric acid and acetic acid.
- Enzymes: Proteases, lipases and alpha-amylase.
- Antibiotics: Penicillin, streptomycin and tetracycline.
- Amino acids: L-glutamic acid, phenylalanine and L-lysine.

Suggested Books:

- Bailey, J.E., & Ollis, D.F. (1986). *Biochemical Engineering fundamentals* (2nd ed). McGraw-Hill College.
- Clark, D.S., & Blanch, H.W. (1997). *Biochemical Engineering*. CRC Press.
- Crueger, W., & Crueger, A. (1990). *Biotechnology, A Text Book of Industrial Microbiology* (2nd ed.). USA: Sinauer Associates Inc.,
- Shuler, M.L., & Kargi, F. (2002). *Bioprocess Engineering Basic Concepts* (2nd ed.). USA: Prentice Hall PTR Upper Saddle River.
- Stanbury, P.F., Whitaker, A., & Hall S.J. (1995). *Principles of Fermentation Technology* (2nd & 3rd ed.). Elsevier Science Ltd.

Suggested e-Resources:

➤ **Application of microbial enzymes**

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5387804/pdf/BMRI2017-2195808.pdf>

➤ **Acetone-Butanol-Ethanol fermentation**

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4894279/pdf/fnw134.pdf>

➤ **Microbial culture fermentation**

<https://pdfs.semanticscholar.org/b4d3/7ed66ef2e37ce22ff7a3be09e3df7568fe49.pdf>

Cell and Tissue Culture Technology

L T P C

3 1 0 4

Max. Marks : 60
(CA: 20 + ESA: 40)

Section – A

- Historical background and terminology used in cell and tissue culture.
- Basic techniques, surface sterilization, aseptic tissue transfer, concept of totipotency.
- Nutritional requirement of cells in vitro, various types of nutrient media.
- Somatic embryogenesis and organogenesis in plants.
- Variability in tissue cultures, somaclonal and other variations.
- Isolation of cells, single cell cultures and cloning.

Section – B

- Production of disease free plants by tissue culture methods.
- Protoplast isolation and culture, viability test, techniques of protoplast fusion.
- Somatic hybrids, selection methods, gene expression in somatic hybrids.
- Haploid Production: Introduction, Techniques, plant regeneration from pollen embryo.
- Plant cell culture products: Secondary Metabolites.

Section- C

- Maintenance and propagation of animal cell and tissue culture: Disaggregation techniques and primary culture.
- Preservation of cell lines: cryopreservation, cell banks, transporting cells.
- Somatic Hybridization: Fusogens, basis of somatic hybridization technology, storage of hybridoma cells, Productions of monoclonal antibodies.
- Animal cell culture products.

Recommended Books:

1. Plant Tissue Culture: S.S. Bhojwani and M.K. Razdan, Elsevier Science, The Netherlands.
2. An Introduction to Plant Tissue Culture: M.K. Razdan.
3. Biotechnology in Agriculture and Forestry: Y.P.S. Bajaj, Narosa.
4. Plant Cell and Tissue Culture: Butenko.
5. Plant Tissue Culture Methods and Application in Agriculture: T.A. Thorpe, Academic Press Inc.
6. Cell and Tissue Culture: Lab Procedures in Biotechnology, Alan Doyal (ed) J.Bryan Griffth (ed.)
7. Micropropagation Tech. and Applications: P.C. Dobergh & R.H. Zimmerman, Kluwer Academic Pub. Dordrecht.
8. Introduction to Cell and Tissue Culture: Jennie P. Methew and Penelope E. Rohes.
9. Animal Cell Culture: John R.W. Masters.
10. Cell and Tissue Culture: Lab procedure in biotechnology Alan Doxal (ed) J. Bryan 6th ed.
11. Animal Cell Culture- a Practical Approach: R.I. Freshney, Wiley-Liss.

Recombinant DNA Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand the concept of DNA synthesis, amplification and sequencing.
- Apply strategies of cloning in both prokaryotes and eukaryotes.
- Explain use of molecular probes and DNA finger printing for relevant applications.

Section A

- Chemical synthesis of DNA: Phosphodiester, triester approaches, phosphoramidite method, solid phase automated synthesis of DNA.
- Sequencing of DNA: Chemical and dideoxy method, random and directed approaches, automated DNA sequencing, improved gel based sequencers, mass spectrometry based sequencing, pyrosequencing.
- Polymerase chain reaction (PCR)- Basic principle, modifications: multiplex, nested, hot start, reverse transcriptase, real time, inverse, anchored, touch down and applications.
- Site directed mutagenesis: Oligonucleotide directed mutagenesis using M13 DNA, oligonucleotide directed mutagenesis using plasmid DNA, PCR based oligonucleotide directed mutagenesis, deletion mutagenesis.

Section – B

- Gene expression analysis: Northern blot, primer extension, SI mapping, RNase protection assays, reporter assays.
- Cloning in *Bacillus subtilis*.
- Cloning in yeast: YEPs, YIPs, YRP, YAC.
- Cloning in plants-*Agrobacterium tumefaciens* mediated gene transfer: Binary vector, cointegrate vector; viral vector mediated gene transfer, direct gene transfer methods.
- Cloning in mammalian cell using SV-40 vector- Early replacement and late replacement vector.

Section – C

- Molecular probes- DNA, RNA probes, application, radioactive and non-radioactive labeling of probes.
- Eukaryotic selectable markers.
- Various molecular markers: RAPD, AFLP, SNPs, SSR, ARDRA.
- DNA fingerprinting- Principle of technique, Basic DNA fingerprinting procedure.
- Antisense RNA technology, RNAi, siRNA.
- Gene therapy.
- Methods of detection of genetic disorders: Cytogenetic testing, biochemical testing, molecular testing.

Suggested Books:

- Glick, B.R., Pasternak, J.J. & Patten, C.L. (2010). *Molecular Biotechnology: Principles and Applications of Recombinant DNA* (4th ed.). American Society for Microbiology.
- Kumar, H.D. (1990). *Nucleic acid and biotechnology*. Vikas Publication.
- Primrose, S. B., & Old, R.W. (2001). *Principles of Gene Manipulation* (6th ed.). Wiley-Blackwell.
- Sambrook, J.F. & Russell, D.W. (2001). *Molecular Cloning: A Laboratory Manual* (3rd ed.) Vol. 1, 2 and 3. Cold Spring Harbor laboratory.

- Winnacker, E.L. (1987). *From genes to clones: Introduction to gene technology*. Wiley VCH.

Suggested e-Resources:

- **Solid phase oligonucleotide synthesis**

<https://www.atdbio.com/content/17/Solid-phase-oligonucleotide-synthesis>

- **Antisense Technology**

<https://www.ukessays.com/essays/sciences/antisense-technology-applications-7151.php>

- **SV40 vector**

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC322153/pdf/nar00317-0279.pdf>

Biotechnology Lab-IV

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Demonstrate an understanding of production and estimation of commercially important molecules.
- Hands on training related to genetic manipulation techniques.
- Learn sequence alignment of biomolecules using bioinformatic tools.

Bioprocess Engineering

1. Determination of growth kinetics of *E. coli*
2. Demonstration of Bioreactor.
3. Estimation of growth and product yield in a Bioconversion process.
4. Comparison between aerobic and anaerobic process.
5. Lactic acid production and estimation by titration.

Recombinant DNA Technology

6. Isolation of plasmid DNA from *E. coli*.
7. Restriction digestion of plasmid DNA and its electrophoretic separation.
8. To transfer plasmid pJB3JI from J53 strain of *E. coli* to HB101 strain of *E. coli*.

Bioinformatics

9. To check similarity between DNA and Protein sequence using DOT PLOT method.
10. To check sequence alignment of DNA and Protein sequence using dynamic programming.
11. Various exercises of *in silico* functional and comparative genomics in downloaded DNA and Protein sequences using:
 - a. BLAST
 - b. FASTA
 - c. ClustalX

Suggested Books:

- Green, M. R., & Sambrook, J. (2012). *Molecular Cloning: a Laboratory Manual*. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
- Mahajan, R., Sharma, J., & Mahajan, R.K. (2010). *Practical Manual of Biotechnology* (I Ed.). New Delhi: Vayu Education of India.
- Swamy, P.M. *Laboratory Manual on Biotechnology* (I Ed.). Meerut: Rastogi Publication.
- Vats, S. (2015). *A Laboratory Text book of Biochemistry, Molecular Biology and Microbiology*. Germany: GRIN Verlag.

Plant Genetic Engineering

Max. Marks : 30

(CA : 10 + ESA : 20)

Section – A

- Direct gene delivery systems – Biolistics, electroporation, microinjection and liposome mediated gene transfer.
- Vectors used for gene transfer in plants: Ti and Ri plasmid based vectors.
- Gemini virus, cauliflower mosaic virus.
- Cloning vectors for plant genes: pUC vectors.
- Other possible vectors – maize mitochondrial elements, nuclear genomic components, RNA viruses.

Section – B

- Gene cloning strategies in plants – cloning plastid and mitochondrial genes.
- Molecular markers for plants.
- Plant gene expression signals and genetic markers.
- Study of structure and function of representative plant genomes viz. Chloroplast, mitochondrial and nuclear.

Section – C

- Antisense RNA technology, use of RNAi.
- Arabidopsis as a model plant for genetic engineering.
- Gene tagging.
- Improvement of seed storage proteins.
- Transgenic plants with resistance against herbicide, pesticide and disease resistance, stress tolerance.
- Manipulation of photosynthetic carbon metabolism (Rubisco) in transgenic plants.

Recommended Books:

1. Transgenic plants: Promise or danger by B.L. Kakralya and Ishita Ahuja (Agrobios, India).
2. Plant Biotechnology by Ignacimuthu, S.J. (Oxford and IBH publishing Co. PVT. Ltd.).
3. Applied Plant Biotechnology by S. Ignacimuthu S.J. (Tata Mc Graw Hill Publishing Co. Ltd. New Delhi).

Animal Biotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Develop comprehensive concepts of cell and tissue culture techniques and methodology.
- Gain fundamental concepts of in vitro fertilization and animal cloning.
- Explain applications of cell and tissue culture in pharmaceutical industry.

Section - A

- Animal cell culture: brief history of animal cell culture, cell culture media and reagents, animal cell growth characteristics.
- Disaggregation techniques, primary cell cultures, secondary culture, continuous cell lines, suspension cultures, establishment and maintenance of cell cultures.
- Cell viability assays, cytotoxicity assays, survival assay and transformation assay.

Section - B

- Animal reproductive biotechnology: structure of sperms and ovum; cryopreservation of sperms and ova of livestock; artificial insemination; super ovulation, embryo recovery and *in vitro* fertilization.
- Culture of embryos; cryopreservation of embryos; embryo transfer technology; transgenic manipulation of animal embryos.
- Animal cloning: Basic concept; cloning for conservation of endangered species.

Section - C

- Vaccinology: History of development of vaccines, introduction to the concept of vaccines, conventional methods of animal vaccine production, recombinant approaches to vaccine production, modern vaccines.
- Somatic hybridization: Fusogens, basis of somatic hybridization technology, storage of hybridoma cells, productions of monoclonal antibodies.
- General overview of applications of transgenic animal technology and animal cell culture products.

Suggested Books:

- Bernard, R., Glick, Jack, J., Pasternak, Cheryl, L, &. Patten. (2009). *Molecular Biotechnology Principles and Applications of Recombinant DNA* (4th ed.). ASM press.
- Butler, M. (2004). *Animal Cell Culture & Technology* (2nd ed.). UK: Taylor & Francis.
- Davis, J. M. (2011). *Animal Cell Culture: Essential Methods*. USA: John Wiley & Sons Ltd.
- Freshney, R. I. (2011). *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications* (6th ed.). USA: Wiley-Blackwell.
- Gordon, I. (2005). *Reproductive Techniques in Farm Animals*. Oxford: CAB International.
- John, R. W. (2000). *Animal Cell Culture: a Practical Approach* (3rd ed.). UK: Oxford University Press.
- Levine, M. M. (2004). *New Generation Vaccines*. New York: M. Dekker.
- Pörtner, R. (2007). *Animal Cell Biotechnology: Methods and Protocols*. Totowa, NJ: Humana Press.

Suggested e-Resources:

➤ **Animal cell culture products**

<http://www.biologydiscussion.com/biotechnology/animal-biotechnology/applications-of-animal-cell-cultures/10457>

➤ **Artificial Insemination**

<https://fertilityfirst.com.au/wp-content/uploads/2017/02/intrauterine-insemination-iui.pdf>

➤ **Intracytoplasmic Sperm Injection (ICSI)**

<https://www.intechopen.com/books/advances-in-embryo-transfer/new-advances-in-intracytoplasmic-sperm-injection-icsi->

Bioethics and Biosafety

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Explain role of biotechnology in sustainable research and various ethical implications.
- Understand biosafety—objective, implementation, necessity and legislations.
- Develop preliminary understanding of Intellectual Property with emphasis on patents.

Section – A

- Introduction to science, technology and society, socio-economic impacts of biotechnology. Global biotech issues; major categories and impact.
- Biodiversity: concept and importance, main features of Indian Biodiversity Act. Traditional knowledge. Access and benefit sharing (ABS): concept, convention on biological diversity and its impact on ABS, regulation of ABS and impact on developed and developing countries.
- Environmental sustainability: concept of sustainable development types and factors, significance for developed and developing countries. Globalization: concept, impact in biotechnology. Development divide.
- Concept of legality, morality and ethics. Concept and Principles of bioethics: expanding scope of ethics from biomedical practice to biotechnology. Ethical conflicts in biotechnology: interference with nature, fear of the unknown, unequal distribution of risks and benefits of biotechnology; bioethics vs. business ethics. Case studies of relevance - ethical aspects of human genome project prenatal diagnosis and xenotransplantation.

Section – B

- Biosafety: concept definition of risks, hazards and various terminologies associated with hazard assessment and management. Public acceptance in biotechnology (based on rational vs subjective perception of risk and benefits).
- Biotechnology and biosafety concerns at the level of individuals, institutions and country. Cartagena Protocol: history conception and implementation of the protocol, impact on nations, main areas covered.
- Levels of Biosafety: concept, levels and their description (plants, animals and microbes). General, concepts: Good Lab Practices, Good Manufacturing Practices, Good Clinical Practices, Good Large Scale Practices. Chemical and biological hazards: disposal and safeguards.
- Biosafety regulations in the handling of recombinant DNA processes and products in institutions and industries- India America, European Union, China and Japan. Biosafety assessment: A general perspective.

Section - C

- Biotechnology and food safety: The GM food debate and biosafety assessment procedures for biotech foods and related products, including transgenic food crops.
- Ecological safety assessment of recombinant organisms and transgenic crops, Case studies-golden rice, Bt cotton, flavr savr tomatoes, transgenic soybean.
- International dimensions in biosafety: Bioterrorism and convention on biological weapons. Biosafety assessment of biotech pharmaceutical products such as drugs/ vaccines.
- Intellectual Property rights: definition, origin, types, Role of GATT, WTO, WIPO and TRIPS in IPR, ethical impacts of IPR, technology transfer (concept and significance) ownership and monopoly Patents: brief description, types, basic idea of patent application and procedure, farmers rights Plant breeder's rights, international union for the protection of new varieties of plants (UPOV).

Suggested Books:

- Fleming D. O. & Hunt D. L (Eds.). (2006). *Biological Safety: Principles & Practices* (4th ed.). ASM Press
- Goel D. & Parashar S. (2013). *IPR, Biosafety and Bioethics* (1st ed.) Pearson Education India.
- Ignacimuthu, S. (2008). *Bioethics*. Alpha Science International Ltd.
- Pandey, N. & Dharni, K. (2014). *Intellectual Property Rights*. PHI Learning.
- Ramakrishna, B. & Kumar, A. (2017). *Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers* (1st ed.). Notion Press.

Environmental Biotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand the biological process for sewage and wastewater management.
- Discuss role of biology in sustainable technology development.
- Explain the role of microbes in environmental remediation.

Section – A

- Biological processing of sewage and wastewater treatment: Anaerobic and aerobic, conventional, advanced and new emerging technology, methanogenesis, methanogenic, acetogenic and fermentative bacteria – technical process and conditions.
- Solid waste management: Waste monitoring, treatment and disposal of non-hazardous solid waste, general remedial measures for medical waste management and hazardous waste.

Section – B

- Bioenergy and biofuel: Advantages of biofuels, plant derived fuels, energy crops, biogas, bioethanol and biohydrogen.
- Biopolymers and bioplastics: Types of Bio-polymers, preparation of Bio polymers and bioplastics, properties and practical applications of PHB, advantages and disadvantages of bioplastics.
- Biosensors: Principle and application, BOD, ammonium, nitrate and sulphate.

Section – C

- Biodegradation of xenobiotics: Organisms involved in degradation of chlorinated hydrocarbons, polyaromatic hydrocarbons, pesticides.
- Surfactants and microbial treatment of oil pollution.
- Biofertilizers and biopesticides.
- Bioremediation and biore Restoration: General approaches, reforestation through micropropagation, use of microbes for improving soil fertility, germplasm conservation (gene banks), conservation of Biodiversity (*in situ* and *ex situ*).

Suggested Books:

- Jogdand, S. N. (2010). *Environmental Biotechnology (Industrial pollution management)* (3rd ed.). Mumbai, India: Himalaya Publishing House.
- Milton, W. (Ed.). (1999). *An Introduction to Environmental Biotechnology*. USA: Springer.
- Modi, P.N. (2015). *Sewage treatment & disposal and waste water engineering*. New Delhi, India: Rajsons Publications Pvt. Ltd.
- Srinivasan, D. (2009). *Environmental Engineering*. New Delhi, India: PHI Learning Pvt. Ltd.

- Thakur, I.S. (2012). *Environmental Biotechnology: Basic concepts and Application* (2nd ed.). New Delhi: I K International Publishing House.
- Tripathi, B.N., Shekhawat, G.S., & Sharma, V. (Ed.). (2009). *Applications of Biotechnology*. Jaipur, India: Aavishkar Publishers.

Suggested e-Resources:

- **Biological treatment of wastewater**
<http://www.neoakruthi.com/blog/biological-treatment-of-wastewater.html>
- **Biogas**
<http://www.biologydiscussion.com/biomass/production-of-biogas-from-biomass/10436>
- **Biofuel**
<http://uru.ac.in/uruonlinelibrary/BioFuels/Biomass%20and%20biofuels.pdf>
- **Biosensor**
<https://www.edgefx.in/biosensors-types-its-working-and-applications/>
- **Xenobiotic compound biodegradation**
<http://www.biologydiscussion.com/microbiology-2/bioremediation/xenobiotic-compounds-meaning-hazards-and-biodegradation/55625>

Plant Biotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	1	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Develop comprehensive concepts of cell and tissue culture techniques and methodology.
- Understand the basic concepts of transgenic plants and molecular pharming.
- Comprehend the basic knowledge of chloroplast engineering and edible vaccines.

Section – A

- Plant tissue culture: historical perspective, totipotency, media preparation – nutrients and plant hormones.
- Sterilization techniques, establishment of cultures – callus culture, cell suspension culture, organogenesis, somatic embryogenesis, artificial seeds.
- Micropropagation, somaclonal variation, somatic hybridization, cybrids.
- Protoplast isolation and culture, viability test, techniques of protoplast fusion, haploid production and applications.

Section – B

- Transgenic plants - basic concept and use of suitable promoters.
- Development of plants resistant to environmental stress and herbicides.
- Development of pathogen resistant plants (Virus and insect resistance).
- Overview of plant secondary metabolites, metabolic engineering, strategies for enhancement of their production in cell and tissue culture.
- Concept of plants as biofactories, molecular pharming.

Section – C

- Chloroplast engineering: techniques, advantages and application of chloroplast transgenics in production of biopharmaceuticals and introduction of agronomic traits.
- Edible Vaccines.
- Plant gene banks, germplasm collection, cryobanks.
- Biotechnology of biological nitrogen fixation: *nif* genes.

Suggested Books:

- Bhojwani, S.S., & Razdan, M K. (1996). *Plant Tissue Culture: Theory and Practice*. Nederland: Elsevier Science.
- Chawla, H.S. (2000). *Introduction to Plant Biotechnology*. USA: Science Publishers.
- Gupta, P.K. (2005). *Elements of Biotechnology*. India: Rastogi Publications.
- Singh, B.D. (2015). *Biotechnology*. Kolkata, India: Kalyani Publishers.

- Slater, A., Scott, N., & Fowler, M. (2008). *Plant Biotechnology: The Genetic Manipulation of Plants* (2nd ed.). UK: Oxford University Press.

Suggested e-Resources:

- **Background of Tissue Culture Technology**

<http://www.biologydiscussion.com/botany/tissue-culture/tissue-culture-definition-history-and-importance/42944>

- **Embryogenesis and organogenesis**

<https://nptel.ac.in/courses/102103016/module1/lec8/3.html>

- **Single Cell Cultures and Cloning:**

<http://www.biologydiscussion.com/botany/tissue-culture/methods-for-obtaining-single-cell-clones-from-callus-culture-plant-tissue-culture/43004>

- **Protoplasm isolation and regeneration**

<https://nptel.ac.in/courses/102103016/12>

Haploid plant production

<http://www.biologydiscussion.com/plants/haploid-plants/production-of-haploid-plants-with-diagram/10700>

- **Preservation of cell lines**

<https://www.ukessays.com/essays/biology/techniques-for-cell-preservation-biology-essay.php>

- **Somatic hybridization**

<http://www.biologydiscussion.com/somatic-hybridization/somatic-hybridization-aspects-applications-and-limitations/10686>

Food and Dairy Biotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Identify parameters affecting microbial growth and its effect on food.
- Demonstrate an understanding of various food processing and preservation methods.
- Describe contemporary food related policies and their implications.

Section – A

- Introduction and history of microorganisms in food.
- Intrinsic and extrinsic parameters that affect microbial growth.
- Microbiological examination of food. Enumeration and detection of food borne microorganisms (conventional, immunological, molecular, biosensor).
- Bioassay and related methods.
- Food preservation by controlling growth of microorganisms (asepsis, low temperature, high temperature, non-thermal processes, hurdle concept).

Section – B

- Alcoholic beverages: Beer, wine and distilled spirits.
- Fermented meat products: sausages, salami.
- Fermented vegetables products: Sauerkraut, miso, tempeh, kimchi, gundruk, khalpi.
- Protein foods: Single cell proteins (SCP), mushroom, algal proteins.
- Overview of the International and National guidelines for safety assessment of genetically modified (GM) foods.

Section – C

- Emerging processing and preservation technologies for milk and dairy products.
- Fermented dairy products: Cheese, yogurt, kefir, butter.
- Lactose metabolism and production of aroma compounds.
- Food safety acts (Indian act-Food Safety and Standards Act, 2006, Various food acts-PFA, FPO, AGMARK, MMPO, MFPO, edible oil acts, standard weight acts) and regulatory agencies monitoring safety of foods .

Suggested Books:

- Adams, M.R., & Moss, M.O. (2007). *Food Microbiology*. Royal Society of Chemistry.
- Banwart, G.J. (1989). *Basic Food Microbiology*. CBS Publishers and Distributors, Delhi
- Frazier, W.C., & Westhoff, D.C. (2003). *Food Microbiology*. Tata McGraw Hill, Inc., New York.
- Joshi, V.K., & Pandey, A. (1999). *Biotechnology: Food Fermentation*. Asiatech Publishers Inc.
- Robinson, R.K. (1990). *Dairy Microbiology*. Elsevier Applied Sciences, London.
- Stanbury, P.F., Hall, S.J., & Whitaker, A. (1999). *Principles of Fermentation Technology*. Butterworth-Heinemann, Elsevier Science Ltd.

Suggested e-Resources:

- **History of microorganisms in food**

[https://faculty.weber.edu/coberg/class/3853/3853%20HistoryofFood. htm](https://faculty.weber.edu/coberg/class/3853/3853%20HistoryofFood.htm)

➤ **Quality control of food detection system**

<https://www.engineersgarage.com/Contribution/Arduino-based-Smart-IoT-Food-Quality-Monitoring-System>

➤ **Food Preservation**

<https://sciencesamhita.com/methods-of-food-preservation/>

➤ **Genetically modified food**

<http://anrcatalog.ucdavis.edu/pdf/8180.pdf>

Genomics and Proteomics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand the scope of genomics with special emphasis on functional and structural genomics.
- Describe role of proteomics and various techniques associated.
- Demonstrate practical insight of techniques and tools applied in Proteomic and genomic research.

Section – A

- Introduction to genomics and proteomics.
- Gene prediction and counting.
- Genome similarity: SNPs and comparative genomics.
- Functional genomics: Microarray technique, fluorescence *in situ* hybridization, comparative genomic hybridization, microarray
- Mapping genome modifications for crop improvement, gene mining by transposons.

Section – B

- Proteomics and proteome: Proteomics and the new biology, the proteome method for measurement of gene (mRNA) expression.
- Analytical protein and peptide separations: Two-dimensional gel electrophoresis for proteome analysis, Image analysis of two dimensional gels, detection of proteins in polyacrylamide gels and on electroblot membranes.
- Mass-spectrometry based method for protein identification and phosphorylation site analysis.

Section – C

- Application of proteomics: Drug development and toxicology, mixing proteome, protein expression profile, identifying protein-protein interaction and protein complexes, mapping protein modifications as tool for plant genetics and breeding.
- Novel approaches to protein expression analysis.
- Protein arrays: Generation of cDNA expression Libraries, use of automated technologies to generate protein arrays and chips, application of protein arrays in proteomics.
- Characterization of protein complement of a specific cell type or tissue or a certain time by high-resolution 2DE.
- Bridging the current proteomics and genomic approaches by mass spectrometry, Future perspective and developments.

Suggested Books:

- Brown, S.M. (2015). *Next-generation DNA sequencing Informatics* (2nd ed.). Cold Spring Harbor Press.
- Lesk, A.M. (2015). *Introduction to Genomics* (2nd ed.). Oxford University Press.
- Liebler, D.C. (2001). *Introduction to proteomics tools for the new biology*. Humana Press.
- Pennington, S.R., Dunn, M.J., & Ebrary, Inc. (2001). *Proteomics: From protein sequence to function*. Oxford: BIOS.
- Pevsner, J. (2017). *Bioinformatics and Functional Genomics* (3rd ed.). John Wiley.

- Thangadurai, D. & Sangeetha, J. (2015). *Genomics and Proteomics: Principles, Technologies, and Applications*. CRC Press.
- Twyman, R.M. (2004). *Principles of Proteomics*. CBS Publishers.

Suggested e-Resources:

- **Protein array**
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3680110/pdf/nihms465562.pdf>
- **Gene mining by transposon**
<http://transposonpsi.sourceforge.net/>
- **Applications of proteomics in drug development**
<https://onlinelibrary.wiley.com/doi/full/10.1002/jcb.10576>

Immunotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Explain structure and function of the immune system at cellular and molecular level.
- Describe immunization/vaccination, immunological disease and immunotherapy.
- Develop approaches for the immune intervention of diseases.

Section – A

- General organization, expression and regulation of major histocompatibility complex. Structural organization and expression of immunoglobulin genes and generation of antibody diversity.
- Genomic organization, structure and isolation of TCR.
- Immune regulation, positive and negative selection in thymus, apoptosis.

Section – B

- Autoimmune diseases (organ specific and systemic autoimmune disease).
- Immune response to infectious diseases (viral, bacterial, protozoan and parasitic infections).
- Immunodeficiency diseases (phagocytic, humoral, cell mediated, combined cell mediated humoral deficiencies and complement deficiencies).
- Immune system in AIDS.

Section – C

- Tumor Biology.
- Transplantation immunology.
- Synthetic vaccines.
- Cloning techniques and engineered antibody production and application, T cell cloning.

Suggested Books:

- Abbas, A.K., Lichtman, A.H. & Pillai, S. (2017). *Cellular and Molecular Immunology* (9th ed.). Elsevier.
- Delves, P. J., Martin, S. J., Burton, D. R., & Roitt, I. M. (2006). *Roitt's Essential Immunology* (11th ed.). Wiley-Blackwell.
- Punt, J., Stranford, S., Jones, P., & Owen, J. (2018). *Kuby Immunology* (8th ed.). W. H. Freeman and Company.
- Tizard, I. R. (1995). *Immunology: Introduction* (4th ed.). Philadelphia: Saunders College Publishing.

Suggested e-Resources:

- **Cellular and Molecular Immunology**
<https://ocw.mit.edu/courses/health-sciences-and-technology/hst-176-cellular-and-molecular-immunology-fall-2005/lecture-notes/>
- **Immunology**
<https://study.com/academy/topic/immunology.html>

Nanotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand the basic concepts of nanobiotechnology.
- Apply engineering concepts to the nano-scale domain and design processing conditions.
- Comprehend the legal issues in nanotechnology and environmental risk assessment.

Section – A

- Introduction to nanotechnology.
- Current and future market applications: Semiconductor manufacturing, advanced composites, advanced ceramics, catalytic and photocatalytic applications, gas sensors and other analytical devices, consumer products, drug delivery mechanisms and medical therapeutics, micro electronic applications.
- Legal considerations for nanotechnology.
- Environmental risk assessment, health risk assessment, hazards risk assessment.

Section – B

- Prime Materials: Metals, iron, aluminum, nickel, silver, gold, copper and their oxides, silica products.
- Nonmaterial Types: Nanowires, nanotubes and their synthesis, properties, applications.
- Fullerenes, quantum dots, dendrimers, Properties.
- Method of preparation: Top down, bottom up, plasma orcing, chemical vapour deposition, sol – gel methods.

Section – C

- Self assembled monolayers, bio molecular motors and their functions.
- Proteins and applications.
- Drug delivery systems - Nanofluidic, fluids at micro and nanometer scale, fabrication of nanoporous and nanofluidic devices, applications.

Suggested Books:

- Bhattacharya, S. (2013). *Introduction to Nanotechnology*. New Delhi: Wisdom Press.
- Bhushan, B. (2017). *Springer Handbook of Nanotechnology*. Berlin, Heidelberg: Springer Berlin Heidelberg.
- Di, V. M. (2008). *Introduction to Nanoscale Science and technology*. New York, NY: Springer.
- Wilson, M. (2004). *Nanotechnology: Basic Science and Emerging Technologies*. Boca Raton: Chapman & Hall/CRC.

Suggested e-Resources:

- **Nanofluidic devices**
<https://aip.scitation.org/doi/pdf/10.1063/1.4794973?class=pdf>
- **Preparation of Nanomaterial**
<https://nptel.ac.in/courses/103103033/module9/lecture2.pdf>

Plant Secondary Metabolites

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand isolation techniques for plant secondary metabolites and their biosynthetic pathway.
- Demonstrate production of various secondary metabolites and factors affecting it.
- Explain large scale production of various secondary metabolites.

Section – A

- Introduction to secondary metabolites.
- Plant products in nature.
- Occurrence, types and uses of plant products.
- Basic tools and techniques used in isolation & separations of plant secondary metabolites.
- Biosynthesis of secondary metabolites- Shikimate, Acetate-malonate and acetate-mevalonate pathways.

Section – B

- Secondary metabolite selection, effect of metabolism on secondary metabolite production.
- Production of secondary metabolites under stress factors.
- Production of alkaloids, steroids & saponins.
- Mechanism & control by different factors.
- Detoxification of secondary metabolites.

Section – C

- Production of secondary metabolites by bioconversion.
- Genetic transformation for production of secondary metabolites.
- Large scale production in bioreactors.
- Sources & types of antitumour compounds.
- Food additives and insecticides.

Suggested Books:

- Buchanan, B.B., Gruissem, W., & Jones, R.L. (2000). *Biochemistry & molecular biology of plants*. Rockville, Md.: American Society of Plant Physiologists.
- Noggle, G.R. and Fritz, C.J. (1986). *Introductory Plant Physiology*. (2nd ed.). New Delhi: Prentice Hall of India Pvt. Ltd.,
- Pandey, S.N. and Sinha, B.K. (1996). *Plant Physiology* (3rd revised ed.). New Delhi: Vikas Publishing House Pvt. Ltd.
- Ramavat, K.C. (2000). *Secondary Metabolites*. Oxford Press.
- Ross, C.W. (1974). *Plant Physiology Laboratory Manual*. California: Wadsworth Publishing Company.
- Salisbury, F.B. & Ross, C.W. (1991). *Plant Physiology* (4th ed.) Wadsworth Publishing Company.

- Taiz, L., & Zeiger, E. (2010). *Plant Physiology* (5th ed.). USA: Sinauer Associates Inc.,
- Witham, F.H., Devlin, R.M., & Blaydes, D.F. (1971). *Experiments in Plant Physiology*. New York: Van Nostrand Reinhold Co.

Suggested e-Resources:

- **Secondary metabolites**
<https://nptel.ac.in/courses/102103016/module4/lec32/3.html>
- **Tools for production of secondary metabolites**
<https://nptel.ac.in/courses/102103016/38>
- **Industrial application**
<http://www.biologydiscussion.com/biotechnology/plant-biotechnology/secondary-metabolites-in-plant-cultures-applications-and-production/10646>

Biotechnology Lab – V

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes:

After successful completion of the course, students should be able to:

- Understand various techniques of plant and animal biotechnology.
- Learn analytical techniques to estimate toxicity of hazardous component.
- Demonstrate an understanding to assess water pollution.
- Demonstrate animal cell culture techniques.

Plant Biotechnology

1. Preparation of MS medium.
2. Sterilization techniques.
3. Embryo culture.
4. Shoot tip culture.
5. Encapsulation of embryo using sodium alginate.
6. Isolation of protoplasts.
7. Estimation of total phenolic content from plant leaves.

Environmental Biotechnology

8. Degradation of pesticide in soil and estimation of its residue.
9. Determination of fluoride in water/soil/biosamples.
10. Determination of LD₅₀ of common pesticides/weedicides.
11. Bacteriological Analysis of wastewater.
12. Estimation of BOD from water samples.

Animal Biotechnology

13. Cell counting and determination of cell viability.
14. Preparation of metaphase chromosomes.

Suggested Books:

- Kumar, V. (2011). *Laboratory Manual of Microbiology*. New Delhi: Scientific Publishers.
- Mahajan, R., Sharma, J., & Mahajan, R.K. (2010). *Practical Manual of Biotechnology* (1st ed.). New Delhi: Vayu Education of India.
- Saxena, J., Baunthiyal., & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.
- Sharma, R.K., Sangha, S.P.S. (2009). *Basic Techniques in Biochemistry & Molecular Biology*. New Delhi: I.K. International Publisher.
- Swamy, P.M. *Laboratory Manual on Biotechnology* (1st ed.). Meerut: Rastogi Publication.
- Trivedi, R. (2016). *Practical Manual in Microbial Physiology and Industrial Microbiology* (1st ed.). New Delhi: S. K. Book Agency.

Advanced Cell Biology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Basic overview of cell organelles, cell cycle, cell membrane, cytoskeleton, cell motility and shape. Mitochondria: membrane organization, transport of proteins into mitochondria and chloroplasts. Semiautonomous organelles concept, cell-cell signaling. DNA replication, Transcription and Translation.

Section B

Lysosomes: intracellular digestion, sorting of lysosomal enzymes in Golgi, lysosomal storage diseases. Signal hypothesis: Concept of signal peptide, SRP, SRP Receptor, transport of soluble and membrane bound proteins in Endoplasmic Reticulum, ER Resident proteins, ER chaperone proteins and their functions, protein glycosylation.

Section C

DNA -protein interaction: Mobility shift DNA binding assay, Methylation and Uracil interference assay, DNase I foot printing, UV cross linking of protein to nucleic acid. Yeast one and two hybrid system for DNA –protein/ protein-protein interaction .Expression of proteins in E.coli, insect cell and Mammalian cell, GST- fusion protein purification, Far western analysis, FISH & GISH techniques.

Recommended Books:

1. Cell and Molecular Biology : De Robertis & De Robertis, B.I. Waverly Pvt. Ltd., New Delhi.
2. The world of the cell : W.M. Becker, Pearson Education.
3. Cell and Molecular Biology : G. Karp, John Wiley & Sons.
4. The Cell - A Molecular Approach : Cooper, Sinauer.
5. Cell and Molecular Biology : P.K. Gupta, Rastogi Publications.
6. Molecular Cell Biology : Lodish, Baltimore, W. H. Freeman & Co.
7. Molecular Biology of the Cell : Bruce Albert, Garland Publication, NY.
8. Essentials of Cytology : C.B. Powar, Himalaya Publications.
9. Principles of Genetics : Gardner, Simmons, Snustad, John Wiley & Sons.
10. Gene VIII : Lewin, Pearson Education.

Bioprocess Engineering-I

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction to bioprocess, Steps in bioprocess development: A typical new product from recombinant DNA- An overview, growth factors and precursors for microorganisms. Isolation, selection and improvement of cultures – screening methods, culture preservation, strain improvement. Kinetics of microbial growth, thermal death kinetics of micro organisms, growth stoichiometry and elemental balances, kinetics of Batch, Fed-batch and Continuous operation of bioreactors, design of sterilization systems for liquids and gases. Yields in cell culture.

Section B

Heat transfer: General equipment for heat transfer, mechanisms of heat transfer, calculation of heat-transfer coefficients. Transport phenomena in bioprocess systems: Gas –liquid mass transfer in cellular systems, role of diffusion in bioprocessing, liquid- solid mass transfer, liquid –liquid mass transfer, gas-liquid mass transfer, measurement of $k_L a$. Classification of fluids, fluids in motion, momentum transfer in fluids, viscosity measurement, effect of rheological properties on mixing.

Section C

Mechanical design and analysis of biological reactors: Ideal bioreactors, bioreactor configurations of: plug-flow, packed bed, fluidized bed, trickle bed, photobioreactor, solid-state fermentation, on-line sensors for cell properties, off-line analytical methods, Immobilized biocatalysts: Formulation and characterization of immobilized cell biocatalysis, applications of immobilized cell biocatalysts. Animal and plant cell reactor technology: Environmental requirements for animal cell cultivation, reactors for large-scale production using animal cells, plant cell cultivation using bioreactors.

Recommended Books:

1. Shuler, M.L. and Kargi, F. Bioprocess Engineering : Basic concepts, 2 nd ed., Prentice- Hall, 2002.
2. Doran Pauline M, Bioprocess Engineering Principles, Academic Press, 1995
3. Nielsen, J. and Villadsen, J. “Bioreaction Engineering Principles”. Springer, 2007.
4. Blanch, H.W and Clark D.S., “Biochemical Engineering”, Marcel Dekker,1997
5. Bailey,J.E. and Ollis, D.F. Biochemical Engineering Fundamentals”, 2nd ed.,McGraw Hill 1986.
6. Stanbury, P.F., Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.
7. Thakore, S.B. and Bhatt, B.I. Introduction to process engineering and design, McGraw Hill 2009.
8. Colin Ratledge, Bjorn Kristiansen, Basic Biotechnology, 2nd Edition, Cambridge University Press, 2001.
9. Roger Harrison et al., Bioseparations Science and Engineering, Oxford University Press, 2003.
10. W. Crueger and A.Crueger, Biotechnology- A Text Book of Industrial Microbiology.

Biological Databases and Computational Biology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Biological Databases: Primary Secondary, Composite Databases & their file formats. Nucleic Acids (GenBank, DDBJ, EMBL), Proteins (SWISS-PROT, PIR), Structures (PDB, HSSP, SCOP, FSSP, CATH), Specialized (KEGG, Transfac, ReBase), Submission & Retrieval of data from public databases.

Section B

Sequence alignment: Local and Global alignment concepts, Scoring matrices - PAM and BLOSUM, Gap penalties, Dot Plot, Dynamic programming methodology- Needleman- Wunsch algorithm, Smith-Waterman algorithm, Databases similarity searching: Algorithms of FASTA, BLAST and their variants, Multiple sequence alignment, Progressive alignment.

Section C

Detecting ORF's, Gene finding methods: content and signal methods, Genome comparison, Markov chain, Random Walk, Hidden Markov models, Docking and modeling substrate receptor interactions. Methods for Phylogenetic analysis: Distance and Character based methods.

Suggested Readings:

1. Bioinformatics –Sequence and Genome analysis-David W. mount.
2. Bioinformatics-from Genomes to drugs- Thomas lengauer.
3. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids, Richard Durbin, S. Eddy, A. Krogh, G. Mitchison.
4. David Mount (2001) Bioinformatics – Sequence and Genome analysis, CSHL Press.
5. Introduction to Bioinformatics-Terasa K. Attwood.
6. Bioinformatics –A practical guide to the analysis of genes and proteins-Baxevanis and Ouellette

Enzyme Technology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction to enzymes, Classification, Sources, Mechanism of enzyme action. Strategies of purification of enzymes, criteria of purity, molecular weight determination and characterization of enzymes. Methods for investigating the kinetics of Enzyme catalysed reactions – Initial velocity Studies, Estimation of Michaelis Menten parameters, Effect of pH and temperature on enzyme activity, Modeling of rate equations for single and multiple substrate reactions.

Section B

Kinetics of inhibition- Reversible Inhibitors, Tight Binding Inhibitors, Time-Dependent Inhibition. Techniques of enzyme immobilization; kinetics of immobilized enzymes, effect of solute, Partition & diffusion on the kinetics of immobilized enzymes, design and configuration of immobilized enzyme reactors, applications of immobilized enzyme technology, Economic argument for immobilization. Functional group interconversion using enzymes (hydrolysis reaction, oxidation/reduction reactions, C-C bond formations). Cooperativity in Enzyme Catalysis

Section C

Reaction engineering for enzyme-catalyzed biotransformations. Catalytic antibodies. Biocatalysts from extreme Thermophilic and Hyperthermophilic microorganisms (extremozymes). The design and construction of novel enzymes, artificial enzymes, Biotransformation of drugs (hydroxylation of Steroids), Host Guest Complexation chemistry, enzyme design using steroid templates, enzymes for production of drugs, fine chemicals and chiral intermediates. Enzymes of biological importance- Acetylcholinesterase, angiotensin converting enzyme (ACE), ACE Inhibitors, HMG Co A reductase inhibitors, pseudocholinesterase, 5-nucleotidase(5NT) and glucose-6-phosphate dehydrogenase(GPD).

Recommended Books:

1. Blanch, H.W., Clark, D.S. "Biochemical Engineering." Marcel Dekker, 1997.
2. Lee, James M. "Biochemical Engineering." PHI, 1982.
3. Bailey J.E. & Ollis, D.F. "Biochemical Engineering Fundamentals." 2nd Edition. McGraw Hill, 1986.
4. Faber, Kurt "Biotransformations in Organic Chemistry : A Textbook." 5th Edition. Springer, 2008.
5. Palmer, Trevor. "Enzymes : Biochemistry, Biotechnology, Clinical Chemistry." 2nd Edition, East West Press, 2008.
6. Robert A. Copeland. "A Practical Introduction to Structure, Mechanism, and Data Analysis." Second Edition, John Wiley & Sons Inc. Publication, 2000.

Bioprocess Engineering-II

L	T	P	C
4	0	0	4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Importance of process flow sheeting in bioprocess engineering, development and utility of process flow diagrams, symbols for equipments, piping, instrumentation and controls, materials of construction for bioprocess plants. Scale up and Scale down, process economics, bioproduct regulation, general fermentation process economics. cGMP guidelines, medical applications of bioprocess engineering. Biological waste treatment: An example of the industrial utilization of mixed cultures.

Section B

Recovery and purification of products: strategies to recover and purify products, cell disruption, filtration, centrifugation, sedimentation, coagulation and flocculation, solid-liquid/liquid-liquid extraction, precipitation, adsorption, membrane separation- reverse osmosis, ultrafiltration, chromatography-FPLC, HPLC and HPTLC, affinity chromatography, electrophoresis, electrodialysis, crystallization, drying.

Section C

Analysis of few industrially important bioprocesses/products (taking into consideration, the raw material, media, organism metabolic pathway, production methodology, product separation and uses) such as: Baker's yeast, single cell protein, high-fructose corn syrup, humulin, erythropoietin, vitamin B₁₂, vitamin C, riboflavin, α -carotene, glucoamylases, L-asparaginases, glucose isomerases, rennin, pectinases, propionic acid, gluconic acid, glycerol, dextran, xanthan gum, gibberellic acid, rifamycin, chlortetracycline, algal biofuels.

Recommended Books:

1. Shuler, M.L. and Kargi, F. Bioprocess Engineering : Basic concepts, 2 nd ed., Prentice- Hall, 2002.
2. Doran Pauline M, Bioprocess Engineering Principles, Academic Press, 1995
3. Nielsen, J. and Villadsen, J. "Bioreaction Engineering Principles". Springer, 2007.
4. Blanch, H.W and Clark D.S., "Biochemical Engineering", Marcel Dekker, 1997
5. Bailey, J.E. and Ollis, D.F. Biochemical Engineering Fundamentals", 2nd ed., McGraw Hill 1986.
6. Stanbury, P.F., Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.
7. Thakore, S.B. and Bhatt, B.I. Introduction to process engineering and design, McGraw Hill 2009.
8. Colin Ratledge, Bjorn Kristiansen, Basic Biotechnology, 2nd Edition, Cambridge University Press, 2001.
9. Roger Harrison et al., Bioseparations Science and Engineering, Oxford University Press, 2003.
10. W. Crueger and A. Crueger, Biotechnology- A Text Book of Industrial Microbiology.

Genetic Manipulation Technology

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Genetic engineering tools: Introduction, Historical perspective of Genetic Manipulation, Enzymes used in genetic engineering, Vectors used in genetic engineering pBR322 and pUC series, Lambda and M13 based vectors, Expression vectors, T-vectors, Animal and plant virus based cloning vectors, Gene cloning and expression in *E.coli* and yeast (*Saccharomyces cerevisia*). Construction of gene libraries, cDNA, PCR based cDNA, subtractive cDNA, normalized cDNA, Genomic DNA, BAC and YAC library.

Section B

Screening and identification of libraries. Automated DNA sequencing, Illumina and Pyrosequencing based Next Generation Sequencing. Primer design, PCR: Nested PCR, 5' and 3' RACE-PCR, inverse PCR, hybrid PCR, TAIL PCR, Real Time PCR, Cloning of PCR product. Promoters, Analysis of Gene Expression at transcription and translation level, Hybridization techniques, Transformation and transfection assays, In vitro mutagenesis, Antisense technology.

Section C

Genetically Modified Organisms: Introduction, Genetic transformation methods (*Agrobacterium* and virus mediated methods, Direct gene transfer by gene gun, electroporation, microinjection, Embryonic stem cells method). Chloroplast genetic engineering: Methodologies, foreign gene expression, advantages over nuclear transgenics, limitations, production of biopharmaceuticals. Applications of GMO (Agriculture, Pharmaceutical, Food, Beverages, Dairy, Poultry), Ethical, legal and social issues, IPR in transgenic technology, Biosafety guidelines.

Suggested Readings:

1. Primrose S.B., Twyman R.H. and Old R.W. Principles of Gene Manipulation, 6th ed., Blackwell Science, 2001.
2. Winnacker E.L. From Genes to clones: Introduction to Gene Technology, Panima, 2003.
3. Glick B.R. and Pasternak J.J. Molecular Biotechnology: Principles and applications of recombinant DNA, 3rd ed., ASM Press, 2003.
4. Lemonie, N.R. and Cooper, D.N. Gene therapy, BIOS Scientific, 1996.
5. Allison LA . Fundamental Molecular Biology. Blackwell publishing. 2007
6. Watson et al. Recombinant DNA, 5th Ed, Freeman; 2006
7. Brown TA. Gene Cloning and DNA Analysis ; 5th Ed ; 2006
8. Reece RJ. Analysis of Genes and Genomes, Wiley; 2004
9. Kreuzer H and Massey A. Recombinant DNA and Biotechnology ; 2nd Ed; ASM; 2006
10. Korf BR. Human Genetics and Genomics; 3rd Ed; Blackwell; 2007
11. Sambrook & Russel. Molecular Cloning; 3rd Ed; Cold Spring Harbour Laboratory press, NY; 2001

Plant and Animal Cell Culture Technology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Concept of cell culture, development of tissue culture, cellular totipotency, various terminologies associated with Plant tissue culture. Nutritional requirements and media preparation for plant and animal tissue culture. PGR's and their *in vitro* roles. Callus culture technique and applications. Suspension culture: Technique, growth measurement and applications. Organ culture techniques. Haploids and its application. Protoplast isolation, culture, Somatic hybridization: protoplast fusion, requirement and application. Micro propagation: Concept, stages, explants, Axillary bud proliferation.

Section B

Secondary metabolites production and biotransformations: Introduction, principal, optimization of yield. Somatic embryogenesis, somaclonal variation, Germplasm preservation. Basic concepts and essential steps for producing transgenic plants. Development of plants resistant to environmental stress and herbicides and pathogen resistant (Virus and insect). Introduction to animal cell cultures; animal cell growth characteristics, Disaggregation techniques, Primary cell cultures, Establishment and maintenance of primary cell cultures of adherent and non-adherent cell lines, . Secondary cell cultures, Establishment and maintenance of secondary mammalian and insect cell lines, Organ and histotypic culture in animals. Preservation of cell lines: cryopreservation, cell banks, transporting cells.

Section C

Cell fusion: aim & requirement, fusogens, Somatic cell fusion, Selection of hybrids, Transfection: gene transfer methods for adherent & non- adherent animal cell cultures, Characterization of cell lines: Karyotyping, biochemical and genetic characterization of cell lines, cytotoxicity assays, cell viability assays. Production of vaccine in animal cells: use of Hybridoma for production of monoclonal antibodies, Bioreactors in animal cells: Bioreactors for large-scale culture of animal cells, Transplantation: tissue culturing, Transplantation techniques, General overview of animal cell culture products.

Recommended books:

1. Plant Tissue Culture: Applications and Limitations. S.S. Bhojwani (1990), Elsevier, Amsterdam.
2. Plant biotechnology In Agriculture: K. Lindsey and M.G.K. Jones (1990), Prentice hall, New Jersey.
3. Dashek W.V. Methods in Plant Biochemistry and Molecular Biology, CRC Press, 1997.
4. Kirsi-Marja Oksman-Caldentey and Barz W.H. Plant Biotechnology and Transgenic Plants, Marcel Dekker Inc., 2002.
5. R.E. Spier and J.B Griffiths (1998). Animal cell Biotechnology, Academic Press.
6. Living resources for Biotechnology, Animal cells ; a.Doyle, R.Hay and B.E. Kirsop (1990), Cambridge University Press, Cambridge.
7. Freshney, R. Ian, "Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications," 6th ed., Wiley Blackwell.
8. John R.W. (2006) Masters, Animal Cell Culture: Practical Approach, 3rd Edition, Oxford.
9. M. Clynes (2006) Animal Cell Culture Techniques, 2ndt Edition, Springer.
10. Basic Cell Culture Vol. 290 Protocols by Cheryl D Helgason, Cindy L
11. Miller. Humanan Press

12. Morgan, S.J. and Darling, D. C., "Animal Cell Culture," Bios Scientific Publishers in Association with the Biochemical society.
13. In vitro Cultivation of Animal Cells: Biotechnology by Open Learning, Elsevier.
14. Basic Cell Culture 2nd Edition by JM Davis Oxford Press
15. Tissue Culture in Biological Research by G. Penso and D. Balduki.
16. Biotechnology by B. D. Singh.
17. Principle of Fermentation Technology by Whittaker.
18. Gangal, Sudha, "Principles and Practice of Animal Tissue Culture, 2nd ed., Universities Press (India) Private Limited.
19. In vitro Cultivation of Animal Cells: Biotechnology by Open Learning, Elsevier.
20. Mathew, Jennie P., Roberts, Penelope E., "Introduction to Cell and Tissue Culture: Theory & Techniques", Plenum Press, New York, 1998

Elements of Bioinformatics

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Genome comparison & analysis, Gene prediction, RNA structure prediction algorithms (Minimum free energy method, MFold, Coevolution method). Protein secondary structure prediction methods: Chou and Fasman, Garnier-Osguthorpe-Robson. Prediction of structural classes, motifs and domains.

Section B

Steps in Homology modeling, Threading; Contact potential, structural profile and segment matching method, Abinitio method, Protein structure comparison, Structure comparison algorithms (dynamic programming, distance matrix). Perl language and syntax, scalars, arithmetic and logical operators, arrays, array functions, hashes, hash functions, conditional statements (if/else, elsif), control structures (for, foreach, while).

Section C

Pattern matching, substitutions, translations, splits and joins, file handling; opening, reading and closing a file, directory handling; opening, reading and closing a directory, subroutines, references, packages, modules, classes, objects, introduction to Bioperl.

Suggested Readings:

1. Philip E. Bourne and Helge Weissig, Structural Bioinformatics-.
2. David W. Mount, Bioinformatics - Sequence and Genome analysis.
3. Tom Christian Sen, Nathan Torkington, Perl Cook book, 2nd Edition, O'REILLY
4. James D. Tisdall, Beginning Perl for Bioinformatics, 2001, O'REILLY
5. James D. Tisdall, Mastering Perl for Bioinformatics, 2003, O'REILLY
6. Larry Wall, John Orwant, Tom Christian Sen, Programming Perl, O'REILLY

Cancer Biology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section-A

Basics of cancer biology, Cancer incidence and mortality, Cancer as a cellular disease, Tumor growth kinetics. Different forms of cancers, Diet and cancer. Regulation of cell cycle, Modulation of cell cycle in cancer. Oncogenes and tumor suppressor genes. Aberrant cell signaling in cancer, anti-apoptotic mechanisms for survival of cancer cells

Section-B

Environmental carcinogens, carcinogen metabolism. Chemical carcinogenesis, Targets of chemical carcinogenesis, initiation, promotion, and progression. Radiation induced carcinogenesis. Animal models of cancer research, athymic nude mice, syngeneic mouse model, transgenic mouse model

Section-C

Molecular mechanisms of tumor angiogenesis. Cancer invasion and metastasis. Concept of stem cells in cancer. Advances in cancer detection. Different forms of therapy: chemotherapy, radiotherapy, and surgery. Chemoprevention of cancer.

Recommended books:

1. Biology of Cancer by Robert Weinberg
2. Cancer Biology, R.J.B. King
3. Cancer Biology, R.W. Ruddon
4. Molecular Biology of Human Cancers, W. A. Schulz
5. Molecular Biology of Cancer, F. Macdonald, C.H.J. Ford, and A.G. Casson
6. Chemoprevention of cancer and DNA damage by dietary factors, S. Knasmüller, D. M. DeMarini, I. Johnson, and C. Gerhauser.

Environmental Biotechnology

L T P C

4 0 0 4

Maximum Marks : 100

(CA: 40 + ESA: 60)

Section A

Definition and Scope of Environmental Biotechnology; Environmental Pollution; Types, Causes and Effects of Soil, air, water, oil and heavy metal. Pollution, control measures. Social Issues- Green House Gases, Global Warming, Acid Rain, Ozone depletion, nuclear accidents and holocaust. Purification of waste water; Aerobic and anaerobic treatments; Laboratory methods for the detection of coli form organisms in water; Water recycling methods; Management of radioactive pollutants in water, VOC, COD BOD and BOD sensors.

Section B

Molecular biology tools for Environmental management, rDNA technology in waste treatment, Genetically modified organisms in Waste management, Genetic Sensors, Metagenomics, Bioprospecting, Nanoscience in Environmental management, Phytoremediation for heavy metal pollution, Biosensors development to monitor pollution. Biomass waste as renewable source of energy, Cellulose and Hemi cellulose as source of energy Biocomposting, Vermiculture, Biofertilizers, Organic farming, Biofuels, Biomineralization, Bioethanol and Biohydrogen,

Section C

Bioelectricity through microbial fuel cell, Conversion of Solid Waste to Methane; Biogas production, Management of Sludge and Solid waste treatment- Land filling, lagooning, Ecofriendly agriculture. Definition, Types- Ex situ and In situ Bioremediation; genetically Engineered Microbes for Bioremediation; Bioremediation of Ground Water; Biodegradation of Hydrocarbons, Pesticides, Herbicides, Insecticides and Xenobiotics.

Recommended Books:

1. Indu shekhar Thakur, 2006. Environmental Biotechnology- Basic concepts and Applications.
2. Foster C.F; Johnware D.A, 1987. Environmental Biotechnology.Ellis Harwood Ltd.
3. Chakraborty K.D. Omen G.S. Biotechnology and Bio degradation, Advances in Applied Biotechnology series, Vol. 1, Gulf Publications Co. London 1989.
4. Organic farming BY Dr.Sharma

Food Biotechnology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Constituent of food – contribution to texture, flavour and organoleptic properties of food, food additives – intentional and non-intentional and their functions. Enzymes in food processing. Physical Properties of Foods- Rheological, Thermal, Aerodynamic, hydrodynamic and Electrical properties of food. Raw material characteristics, cleaning, sorting and grading of foods; physical conversion operations – mixing, emulsification, extraction, filtration, centrifugation, membrane separation, crystallization, heat processing, evaporation, dehydration. Dehydration- Dehydration principles, Preparation of fruits and vegetables for dehydration. - Equipments used for drying with their principles, Packaging of Dried slices, Dices and powder.

Section B

Emerging technologies in food processing- High pressure processing of Foods, Pulsed electric field processing of Foods, Osmotic dehydration of Foods, Ohmic and Ultrasound Processing of Foods, Hurdle technology. Principles of food preservation; UHT, LTT, canning, frozen storage, irradiation, acidulants, salts and sugar. Factors leading to rancidity and reversion. Colloidal systems in food, stability of colloidal system. Bread and baked goods, dairy products – milk processing, cheese, butter, vegetable fermentations, meat, poultry and fish products, sugar and distillation industries; Beverages – wine, beer; food aroma compounds: microbial and enzymatic techniques.

Section C

Bread and baked goods, dairy products – milk processing, cheese, butter, ice-cream, vegetable and fruit products; edible oils and fats; meat, poultry and fish products; confectionery, beverages. Colloidal systems in food, stability of colloidal system. Types of Food Starches, Soluble Fibers: Pectin, Gums & Mucilages. Popular oils and fats in foods- pulses, dairy products and vegetable oils. Factors leading to rancidity and reversion. Properties of granular food and powders.

Recommended books:

1. Coultate T.P. Food – The chemistry of its components, 2nd ed., Royal society, London, 1992.
2. Sivasankar B. Food processing and preservation, Prentice Hall of India Pvt.Ltd., New Delhi, 2002.
3. Fennema O.R. ed. Principles of food science: Part I, Food chemistry, Marcel Dekker, New York, 1976.
4. Frazier W.C. and Westhoff D.C. Food Microbiology, 4th ed. McGraw-Hill Book Co., New York, 1988.
5. Brenner, J.G., Butters, J.R., Cowell, N.D. and Lilly, A.E.V. Food engineering operations, 2nd ed., Applied Sciences Pub.ltd., London, 1979.
6. Pyke, M. Food Science and Technology , 4th ed., John Murray, London, 1981
7. Food Biotechnology. Ed. Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto and Robert E. Levin. Taylor and Francis
8. Banwart, George. J., “Basic Food Microbiology,” CBS Publishers and Distributors, New Delhi.
9. Nuri N. Mohsenin: Physical Properties of Plant and Animal Materials Gordon and Reach Science Publishers (1970)
10. Nuri N. Mohsenin: Thermal Properties of Food & Agricultutal materials Gordon and Reach Science Publishers (1970)
11. Da-wen Sun: Emerging Technologies for Food Processing, Elsevier Academic PressMarcel Dekker Inc. NY (1995)

Medical Biotechnology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Prenatal diagnosis - Invasive techniques - Amniocentesis, Fetoscopy, Chorionic Villi Sampling (CVS), Noninvasive techniques - Ultrasonography, X-ray, TIFA, maternal serum and fetal cells in maternal blood. Diagnosis using protein and enzyme markers, monoclonal antibodies. DNA/RNA based diagnosis Hepatitis, HIV - CD 4 receptor. Microarray technology- genomic and cDNA arrays, application to diseases.

Section B

Clinical management and Metabolic manipulation – PKU, Familial Hypercholesterolemia, Rickets, ADA, Congenital hypothyroidism. Gene therapy - Ex-vivo, Invivo, Insitu gene therapy, Stratagies of gene therapy: gene augmentation

Section C

Vectors used in gene therapy Biological vectors – retrovirus, adenoviruses, Herpes Synthetic vectors–liposomes, receptor mediated gene transfer. Gene therapy trials – Familial Hypercholesterolemia, Cystic Fibrosis, Solid tumors. Properties and application of embryonic stem cells and its potential, Nanomedicine.

Recommended books:

1. Diagnostic and Therapeutic Antibodies (Methods in Molecular Medicine by Andrew J.T. George (Editor), Catherine E. Urch (Editor) Publisher: Humana Press; edition (2000)
2. Molecular Diagnosis of Infectious Diseases (Methods in Molecular Medicine) by Jochen Decker, U. Reischl Amazon
3. Human Molecular Genetics by T. Strachan, Andrew Read Amazon Sales Rank:
4. Principles of Biostatistics by Marcello Pagano , Kimberlee Gauvreau
5. Essentials of Epidemiology in Public Health, Second Edition by Ann Aschengrau , George R., III Seage
6. Stem Cells: From Bench to Bedside- Ariff Bongso, Eng Hin Lee
7. Stem Cells-C S Potten

Nanobiotechnology

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Nanoscale and nanobiotechnology: Introduction to Nanoscience and Nanotechnology; Milestones in Nanotechnology; Overview of Nanobiotechnology and Nanoscale processes; Physicochemical properties of materials in Nanoscales. Fabrication and characterization of nanomaterials: Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials.

Section B

Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials. Properties and measurement of nanomaterials: Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging. Nanobiology and bioconjugation of nanomaterials: Properties of DNA and motor proteins; Lessons from nature on making nanodevices; Reactive groups on biomolecules (DNA & Proteins).

Section C

Surface modification and conjugation to nanomaterials. Fabrication and application of DNA nanowires; Nanofluidics to solve biological problems. Nano drug delivery and nanomedicine: Properties of nanocarriers; drug delivery systems used in nanomedicine; Enhanced Permeability and Retention effect; Blood-brain barrier; Active and passive targeting of diseased cells; Health and environmental impacts of nanotechnology.

Recommended books:

1. Nanobiotechnology: Concepts, Applications and Perspectives, Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor) , Wiley-VCH; 1 edition , 2004.
2. NanoBioTechnology: BioInspired Devices and Materials of the Future by Oded Shoseyov and Ilan Levy, Humana Press; 1 edition 2007.
3. NanoBiotechnology Protocols (Methods in Molecular Biology) by Sandra J Rosenthal and David W. Wright , Humana Press; 1 edition, 2005.
4. Bio-Nanotechnology_ Concepts and applications. Madhuri Sharon, Maheshwar Sharon, Sunil Pandey and Goldie Oza, Ane Books Pvt Ltd, 1 edition 2012
5. Microscopy Techniques for Material Science. A. R. Clarke and C. N. Eberhardt (Editors) CRC Press. 1st Edition, 2002.

Civilizations of the World

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** Concepts of Civilization, Difference between Civilization and Culture; Mesopotamian Civilization- Growth of Urbanization, Art; Babylonian Civilization- Code of Hammurabi, Religion and Philosophy.
- Unit 2** Egyptian Civilization- Architecture and Sculpture; Mathematics and Science; Chinese Civilization - Religion and Philosophy; Art, Architecture and Science.
- Unit 3** Persian Civilization - Economic and Social life, Religion, Art and Culture; The Greek Civilization- Literature and Philosophy; Roman Civilization- Laws and Government, Rise of Roman Imperialism.
- Unit 4** Importance of American Civilization – The Mayas, Aztecs and the Incas; Origin of African Civilization – The Kingdom of Kush, Nubia and Sudanic.
- Unit 5** Rise of Judaism and Christianity; Birth of Islam- Emergence of Crusades.

Learning Outcomes: After the completion of the course, students will be able to:

- Know about the early world civilizations
- Analyze the contribution of world civilizations in the field of science, art and architecture.
- Discuss the literary and philosophical achievements of the Greeks.
- Understand rise of Judaism, Christianity, Islam and emergence of the crusades.

Recommended Books:

1. Davies, H.A. (2007). *An Outline History of the World*. Oxford University Press.
2. Durant, Will, Simon and Schuster. (1942). *The Story of Civilization, Our Oriental Heritage*. Part-I. New York.
3. Durant, Will. (1950). *The Story of Civilization, The Age of Faith*. Part IV. New York.
4. Goyal, Shriram. (2007). *Vishwa ki Prachin Sahyatatayen*. Varanasi: Viswavidyalaya Prakashan.
5. Piotrovsky, B. & Gregory, B.L. (1988). *Ancient Civilization of East and West*. Moscow: Progress Publishers.
6. Simone & Schuster. *Outline History of the World*. Vol. I and II. Jaipur: Arihant Publishers.
7. Swain, J.E. (1970). *A History of World Civilization*. New Delhi: Eurasia Publishing House.
8. Watton, Linda & Goucher, C. (2013). *World History Journeys from Past to Present*. London: Routledge.

Suggested E-Resources:

- History of civilization. *HistoryWorld.net*.

<http://www.historyworld.net/wrldhis/PlainTextHistories.asp?historyid=ab25>

- World Civilization and World History

<https://courses.lumenlearning.com/suny-coursesupport/chapter/world-civilization-and-world-history>

- W.Winks, Robin. World Civilizations: A Brief History. <https://www.amazon.com/World-Civilization-Robin-W-Winks/dp/0939693283>

Trends in the Understanding of History

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Unit 1 Annals School; Quantitative History; Environmental History

Unit 2 Folklore and Oral History; Cinema and Society; Literature and History

Unit 3 Regional History; Diaspora Studies; sports history

Unit 4 Postmodernism; Debates on the End of history

Unit 5 Writings on Indian Nationalism: Imperialist, Nationalist and Marxist School.

Learning Outcomes: After the completion of the course, students will be able to:

- Understand key philosophical development of 20th century.
- Develop idea about the social history.
- Develop a critical thinking with regard to the oral history and quantitative techniques.
- Discuss the various eminent historians and the new historical trends

Recommended Books:

1. Brudel, F. (1972). *The Mediterranean and the Mediterranean World in the Age of Philip II*, in 2 vols.
2. Febvre, Lucien & Martin, H.J. (1976). *The Coming of the Book: The Impact of Printing 1450-1800*. London: New Left Books.
3. Foucault, Michel. (2002). *Archaeology of Knowledge*. Routledge.
4. Fukuyama, F. (1992). The End of History and the Last Man. Free Press.
5. Guha, R. (1982). *Subaltern Studies*, Vol. I. NY: Oxford University Press.
6. Kumar, Sanjeev H. M. (2013). Constructing the Nation's Enemy: Hindutva, popular culture and the Muslim 'other' in Bollywood cinema. *Third World Quarterly*, 34:3.
7. Prasad, M. (1998). *Ideology of Hindi Film: A Historical Construction*. Delhi: Oxford University Press.
8. White, Hayden. (1973). *Meta History: The Historical Imagination in Nineteenth-century Europe*: John Hopkins University.

Suggested E- Resources:

- Cliometrics or the Quantitative Projection of Social Sciences in the Past, Claude Diebolt. Retrieved from <https://www.jstor.org/stable/20762195?Search=yes&resultItemClick=true&searchText=2>
- Schinkel, Anders. History and Historiography in Process. Retrieved from <https://www.jstor.org/stable/pdf/3590742.pdf>.

History of Early India (upto Mauryan Age)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Unit 1 Sources: Archaeological and Literary. An outline of early Paleolithic, Mesolithic, Neolithic and Chalcolithic settlements.

Unit 2 Harappan urbanization; economic processes. Vedic Age: emergence of monarchy; religion and ritualism; social stratifications and economic expansion during later Vedic age.

Unit 3 Birth and Growth of Magadhan Empire; 2nd Urbanization: Emergence of historical cities; crafts and guilds. Jainism and Buddhism, teachings and contribution.

Unit 4 Conquests of Mauryan Kings; Nature and Structure of Mauryan empire; Asoka and Dhamma; South India during Sangam Age.

Unit 5 Decline of Mauryan Empire; Society and Economy; Characteristics of Mauryan Arts.

Learning Outcomes: After the completion of the course, students will be able to:

- Comprehend different types of sources of early Indian history
- Be acquainted with trends of political developments in early India
- Orient themselves to continuity of cultural evolution beginning from the Lithic Ages
- Familiarise themselves with regional and Indian stylistic development of aesthetics

Recommended Books:

1. Basham, A.L. (2004 reprint). *The Wonder that was India*. England: Picador. (Also in Hindi)
2. Chakravarti, Ranveer (2014). *Bharatiya Itihasa ka Aadikal: Prachintam Parva se 600 tak*. Delhi: Orient Blackswan. (Hindi)
3. Jha, DN, Shrimali, KM (2013) *Prarambhik Bharat ka Itihasa*, Delhi: Delhi University Hindi Medium Directorate. (Hindi)
4. Sharma, RS. (2018). *History of Early India*, Delhi: OUP (Also in Hindi)
5. Sharma, RS. (2015). *History of Early India*, Delhi: Orient Blackswan. (Also in Hindi)
6. Singh, Upinder. (2009). *A History of Ancient and Early Medieval India from the Stone Age to the 12th Century*. Delhi: Pearson.
7. Srivastava, KC (2010), *Prachin Bharat ka Itihas tatha Sanskriti*, Delhi: United Book Depot. (Hindi)
8. Thapar, R. (1990). *History of India*, Vol. I. Delhi: Oxford. (Also in Hindi)
9. Tripathi, R.S. (1992). *History of Ancient India*, Delhi: Motilal Banarasidas. (Also in Hindi)

Suggested E-Resources:

- Thapar, Romila. (1968). Interpretations of Ancient Indian History. *History and Theory*, Vol. 7, No. 3 (1968), pp. 318-335. Retrieved from

<https://www.jstor.org/stable/pdf/2504471.pdf?refreqid=search%3Abdbccade787ce27a66ca43458df52d0d>

- Childe, Vere Gordon. (1944). *The Story of Tools*. London: Cobbett Publishing. Retrieved from <https://www.marxists.org/archive/childe/1944/tools/childetools.htm>
- Romila Thapar, Kunal Chakrabarti and Geeti Sen. (2004). *Interpretations of Indian History*. *India International Centre Quarterly*. Vol. 31, No. 2/3. Retrieved from

<https://www.jstor.org/stable/pdf/23006218.pdf?refreqid=search%3Abdbccade787ce27a66ca43458df52d0d>

History of Medieval India (1000 to 1526 AD)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** An Outline of Sources of Sultanate Period; Political and social condition of Northern India on the eve of Muslim invasions; Impact of Turkish invasions; Causes of the defeat of Rajputs; Achievements of Qutubuddin Aibak.
- Unit 2** Iltutmish as real founder of Delhi Sultanate; Consolidation under Balban and his theory of kingship; Allauddin Khilji's market control policy and Deccan Policy.
- Unit 3** Projects of Mohammad Bin-Tughlaq; Administration of Feroz Tughlaq; Afghan Theory of Kingship; Disintegration of the Delhi Sultanate; Emergence of Regional Powers- Vijaynagar and Bahamani Empire.
- Unit 4** Urbanization under Delhi Sultanate; Trade and Commerce in Sultanate period; Social life in the age of Sultanate.
- Unit 5** Sultanate Architecture with special reference to Qutub Complex; Sufism – Features and Importance; Salient features of Bhakti Movement.

Learning Outcomes: After the completion of the course, students will be able to:

- Define the struggling phase of an era of transformation in medieval India.
- Understand the advent of Islam and role of the Sultanate in the development of new political system and policies in India.
- Identify how the disintegration of an empire leads to the rise of regional powers.
- Comprehend technical developments and socio-cultural relation of two different societies.

Recommended Books:

1. Bhargav, M. (2010). Exploring Medieval India, Sixteenth to Eighteenth Centuries: Culture, Gender and Regional Patterns. Delhi: Orient Black Swan.
2. Chandra, S. (1999). *Medieval India: From Sultanate to the Mughals, Part I*, Delhi Sultanate (1205-1526). New Delhi: Haranand Publishers.
3. रिजवी, एस.ए.ए.. (2005). *खलजीकालीन भारत. तुगलककालीन भारत*. नई दिल्ली: राजकमल प्रकाशन.
4. Habib, Irfan. (2008). *Technology in Medieval India*. Delhi: Tulika Publication.
5. Habib, Irfan. (2007). *Medieval India: The Study of Civilization*. Delhi: NBT.
6. Habibullah, A.B.M. *The Foundation of Muslim Rule in India*. Allahabad: Central Book Depot.
7. Mukhia, H. (2001). *Madhyakaleen Bharat: Naye Aayam*. Delhi: Neha Publishers.
8. चंद्र, सतीश. (2007). *मध्यकालीन भारत राजनीति, समाज और संस्कृति*. नई दिल्ली: ओरियेण्ट लॉगमैन.

Suggested E-resources:

- Disintegration of the Delhi Sultanate and Rise of Provincial Kingdoms. Retrieved from www.historydiscussion.net/...>Disintegration of Delhi Sultanate.<https://archive.org>
- The Qutb Complex: An Overview. Retrieved from <https://www.sahapedia.org/the-qutb-complex-overview>.
- Urban Centers and Population during the Sultanate and Mughal Period. Retrieved from www.yourarticlelibrary.com/mughals/the-urban-development-in...the-mughal.../4348

History of India (200 BC to 1000 AD)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** Rise of new powers: Shungas - Pushyamitra; Saka Kshatrapas in Western India - Rudradaman; Kushanas - achievements of Kanishka; Satavahanas in Deccan- Gautamiputra Satakarni.
- Unit 2** India during 200 BC to 300 AD: (i) Growth of Cities, Crafts and Guilds (ii) Social transformations (iii) Beginnings of Religious Architecture and Sculpture.
- Unit 3** Imperial Guptas: Rise of Guptas; Samudra Gupta's conquests; Administrative Structure; Achievements of Chandragupta; Religious Achievements of Harsha Vardhan.
- Unit 4** India during 400 AD to 600 AD: Patterns of trade and commerce; Development of Science and Technology; Artistic achievements; Patterns of Religious Developments.
- Unit 5** Origin of the Rajputs; System of Land grants and their impact; Importance of Pallava, Chalukya, Chola powers; Expansion of Indian Culture in South-East Asia.

Learning Outcomes:

After the completion of the course, students will be able to:

- Visualize rise of imperial, regional and Rajput powers in ancient India
- Assess the consolidation of foreign powers on Indian soil
- Comprehend Indian social transformations in early Christian centuries
- Understand overseas expansion of Indian culture

Recommended Books:

1. Basham, A.L. (2004 reprint). *The Wonder that was India*. England: Picador. (Also in Hindi)
2. Chakravarti, Ranveer (2014). *Bharatiya Itihasa ka Aadikal: Prachintam Parva se 600 tak*. Delhi: Orient Blackswan. (Hindi)
3. Jha, DN, Shrimali, KM (2013) *Prarambhik Bharat ka Itihasa*, Delhi: Delhi University Hindi Medium Directorate. (Hindi)
4. Sharma, RS. (2015). *History of Early India*, Delhi: Orient Blackswan. (Also in Hindi)
5. Sharma, RS. (2018). *History of Early India*, Delhi: OUP (Also in Hindi)
6. Singh, Upinder. (2009). *A History of Ancient and Early Medieval India from the Stone Age to the 12th Century*. Delhi: Pearson.
7. Srivastava, KC (2010), *Prachin Bharat ka Itihas tatha Sanskriti*, Delhi: United Book Depot. (Hindi)
8. Thapar, R. (1990). *History of India*, Vol. I. Delhi: Oxford. (Also in Hindi)
9. Tripathi, R.S. (1992). *History of Ancient India*, Delhi: Motilal Banarasidas. (Also in Hindi)

Suggested E-Resources:

- Desai, Devangana, Social Dimensions of Art in Early India, *Social Scientist*, Vol. 18, No. 3 (Mar., 1990), pp. 3-32. Retrieved from

<https://www.jstor.org/stable/pdf/3517423.pdf?refreqid=search%3A16df57599d47b575a74d74c1f53d2fb1>

- Shastri, Ajay Mitra. (2001) Formative Phase of the Western Deccan Sātavāhanas and Kshaharātas: Achronological Review. *Annals of the Bhandarkar Oriental Research Institute*, Vol. 82, No. 1/4. pp. 57-72. Retrieved from <https://www.jstor.org/stable/pdf/41694631.pdf?refreqid=search%3A7c2f3965ed1d0d94ca40bd2b1b1f1df3>

History of Medieval India (1526 to 1707 AD)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** An Outline of Sources of Mughal Period; Babar's establishment of Mughal rule in India; Humayun's struggle against the Afghans; Administration of Shershah; Akbar's relations with Rajputs; Religious Policy of Akbar.
- Unit 2** Aurangzeb and Rajput relations; Religious policy of Aurangzeb; Mughals' Deccan policy; Formation of Maratha State.
- Unit 3** Central and Provincial administration under the Mughals; Revenue system under the Mughals; Mansabdari System; Jagirdari System.
- Unit 4** Urbanization during Mughal rule; Industries in North India; Trade and Commerce during Mughal age; Social structure under the Mughals.
- Unit 5** Main features of Mughal School of Painting – Golden period of Jahangir; Development of Mughal Architecture - Fatehpursikri and Tajmahal.

Learning Outcomes: After the completion of the course, students will be able to:

- Appreciate significance of composite culture
- Understand Mughal policies, administrative system and their military establishment
- Elaborate the growth of economic institutions and social change in medieval age.
- Define the significance of Mughal rulers as they established a new empire in India, its relation with the Central Asian empires, the commercial and cultural relations between India, China and Europe.

Recommended Books:

1. Bhargav, M., (2010). *Exploring Medieval India, Sixteenth to Eighteenth Centuries: Culture, Gender and Regional Patterns*. Orient Black Swan, First edition.
2. Chandra, S., (2007). *History of Medieval India*. New Delhi: Orient Black Swan.
3. Chandra, S., (1999). *Medieval India, Part II, Mughal Period*. New Delhi: Haranand Publishers.
4. Habib, I., (2007). *Medieval India: The Study of civilization*. Delhi: NBT.
5. Richards, J.F., (2001). *The Mughal Empire*. Cambridge University Press.
6. वर्मा, हरिशचंद्र. (2008). मध्यकालीन भारत (1540–1761 ई.). दिल्ली: हिन्दी माध्यम कार्यान्वयन निदेशालय.
7. चंद्र, सतीश. (2004). मुगलों की धार्मिक नीतियाँ: राजपूत समुदाय एवं दक्षिण. नई दिल्ली: वाणी प्रकाशन.

Suggested E-resources:

- K. N. Chaudhuri. Some Reflections on the Town and Country in Mughal India. Retrieved from <https://www.jstor.org/stable/311823>
- The Mughal Period Boundless Art History. Retrieved from <http://course.lumenlearning.com>

Political History of Modern India (1757 to 1947)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** A) Decisive Battles: Battle of Plassey (1757); Third Battle of Panipat (1761); Battle of Buxar (1764).
B) Policies: Policy of Non-intervention; Subsidiary Alliance; Doctrine of Lapse.
- Unit 2** Important Acts and their features: A) Regulating Act 1773; Charter Act of 1833. B) Indian Council Act 1909; The Government of India Act 1919; The Government of India Act 1935.
- Unit 3** Landmark Events: Nature of 1857 Formation of Indian National Congress and Safety Valve theory; Foundation of Muslim League and its Objectives; Partition of Bengal; Nature of the Tribal and Peasant Resistance Role of Capitalist Class in Freedom Struggle.
- Unit 4** Movement; Gandhi's Non-Violent Movements: Non-Cooperation, Civil Disobedience and Quit India Movements.
- Unit 5** The Independence: Cabinet Mission; Mountbatten Plan; India Independence Act 1947; Partition of India

Learning Outcomes: After the completion of the course, students will be able to:

- Develop critical thinking about the political impact of British Raj
- Understand how India got independence with partition
- Evaluate the structure of British administrative system.
- Locate the nature of various peasant, tribal movement and the discourse on 1857 event.

Recommended Books:

1. Chandra, B. (1996). *India's Struggle for Independence 1857-1947*. Delhi: Penguin.
2. Desai, A.R. (1979). *Peasant Struggles in India*. Bombay: Oxford University Press.
3. Fisher, M. H. (1999). *The Politics of the British Annexation of India, 1757-1857*. Delhi: Oxford University Press.
4. Grover, B. L. & Yashpal. (2000). *Advanced Study of the History of Modern India*. Delhi.
5. Prasad, B. *Bondage and Freedom (1858-1947)* Vol. II. New Delhi: Rajesh Publications.
6. Sarkar, S. (1998). *Modern India 1885-1947*. Delhi: Macmillan.
7. रॉबर्ट्स, पी. ई., ब्रिटिश कालीन भारत का इतिहास, एस. चंद एण्ड कं. लिमिटेड, दिल्ली, 1974.
8. शुक्ल, रामलखन, आधुनिक भारत का इतिहास, दिल्ली विश्वविद्यालय, हिन्दी डाइरेक्टोरेट, दिल्ली, 1998.

Suggested E- Resources:

- *The Eighteenth Century Debate*. Retrieved from <http://egyankosh.ac.in/youtubevideo.jsp?src=gHbBoCveEgo&title=The%20Eighteenth%20Century%20Debate-1>
- Harriet, Martineau. *British Rule in India*. Retrieved from <https://archive.org/>

Social and Economic History of Modern India (1707 to 1947)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** Historical Debate on the Eighteenth Century India: Socio-Economic Situation; British understanding of Indian Society: Orientalist, Utilitarians and Evangelical; Nature of Social Reform Movements: the Acculturative and Transitional.
- Unit 2** The development of Modern Education: Orientalist - Anglicist Controversy, Charles Woods Despatch; The rise of Middle Class; Science and the Raj: the Emergence of Colonial and National Science.
- Unit 3** Agricultural Transformation under Colonial rule: Permanent Settlement, its Operation and Effects; Ryotwari and Mahalwari Land Settlement: Operation and Effects; Famine Policy and the Raj.
- Unit 4** Nationalist Critique of Colonial Economic Policy: Dadabhai Naoroji and the Drain of Wealth; Debates on Deindustrialization and the Decline of Handicrafts; The Imperial Steam: Railways and its Impact.
- Unit 5** The Development of Industries: the Cotton Textile Industry; Jute Industry; the Development of Banking System.

Learning Outcomes: After the completion of the course, students will be able to:

- Develop the critical thinking about the colonial & exploitative character of British Raj.
- Locate the history of education, profession and institutionalization of knowledge.
- Evaluate the nature of socio-religious movement in modern India and write an assignment on the same.
- Understand the recent trends of historiography on science, technology, and environment.

Recommended Books:

1. Bagchi, A. (2010). *Colonialism and Indian Economy*. Oxford University Press.
2. Bandyopadhyay, S. (2004). *From Plassey to Partition: A History of Modern India*. New Delhi: Orient Blackswan.
3. Bhatia, B. M. (1991). *Famines in India: A study in some aspects of the Economic History of India with special reference to Food Problem, 1860-1990*. Konark Publishers.
4. Bhattacharya, S. (1990). *Aadhunik Bharat ka Aarthik Itihas*. Delhi: Rajkamal Prakashan.
5. Kumar, Deepak. (1995). *Science and the Raj 1857-1905*. Oxford University Press.
6. Marshall, P. J. (2005). *The Eighteenth Century in Indian History*. Oxford University Press.
7. Rao, M.S.A. (1978). *Social Movements in India*, Vol. I and Vol. II. Delhi: Manohar.
8. Roy, Tirthankar. (2000). *The Economic History of India 1857-1947*. Oxford University Press.
9. Shukla, R. L. (ed). (1998). *Aadhunik Bhart ka Itihas*. Delhi: Hindi Madhyam Karnvyan Nideshayalaya).

Suggested E- Resources:

- Ghosh, Suresh Chandra. The Genesis of Curzon's University Reform: 1899-1905. Retrieved from <https://www.jstor.org/stable/pdf/41820809.pdf?refreqid=search%3A693c83af8aa2f3bad4dcba22fb4746b8>
- Naoroji, D. Poverty and Un-British Rule in India. Retrieved from <https://archive.org/details/povertyandunbri00naorgoog/page/n6>
- Premchand. Godaan. Retrieved from <https://www.youtube.com/watch?v=3ZwcFPLHoUc>

Survey of the History of Rajasthan

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** Main Sources of the History of Rajasthan. Janapads of Rajasthan with special reference to Matsya and Malava; Chauhan Empire with special reference to Prithvi Raj III.
- Unit 2** Resistance to the Khilji's imperialism with special reference to Chittor and Ranthambhor; Rajputs Alliances with the Mughals and resistance of Maharana Pratap.; Sawai Jaisingh and Maratha intervention in Rajasthan.
- Unit 3** Treaties with the East India Company with special reference to Kota and Jaipur; Rajasthan's Role in 1857; Nature of Peasant, Tribal and Prajamandal movements; Stages of formation of the State of Rajasthan (1948-56).
- Unit 4** Religious movements in Medieval Rajasthan with special reference to Dadu and Vishnoi sects; Impact of Modern Education on Rajasthan.
- Unit 5** Characteristics of Rajput Architecture with special reference to Chittorgarh and Amer. Main features of Rajasthani painting.

Learning Outcomes: After the completion of the course, students will be able to:

- Recognise the importance of regional history in Indian History.
- Describe the political and cultural developments of Rajasthan.
- Assess the resistance and collaboration of Rajput rulers towards imperial powers.
- Analyse the emergence of socio-religious, tribal, peasant and prajamandal movements.

Recommended Books:

1. Sharma, Dasharath. (1966). *Rajasthan through the Ages*, Vol. I. Bikaner: Rajasthan State Archives.
2. Sharma, G. N. (1968). *Social History of Medieval Rajasthan (1500-1800 A.D.)*. Agra: Shivalal Agarwal.
3. Sharma, K.G. (2014). *History and Culture of Rajasthan*. Jaipur: Center For Rajasthan Studies.
4. Shukla, D.C. (1978). *Early History of Rajasthan*. Varanasi: Bhartiya Vidya Prakashan.
5. नीरज, जे. (1994). *राजस्थानी चित्रकला*, जयपुर :राजस्थान हिन्दी ग्रंथ अकादमी, 1994.
6. देवड़ा, जी.एल. (2005). *राजस्थान इतिहास के अभिज्ञान रूप*, जयपुर: राजस्थान हिन्दी ग्रंथ अकादमी, 2005.
7. गुप्ता, के. एस. एवं जमनेश, ओ. (2012). *राजस्थान के इतिहास का सर्वेक्षण*, जयपुर: लिटरेरी सर्किल, 2012.
8. शर्मा, गोपीनाथ (2014). *राजस्थान का इतिहास*, आगरा: शिवलाल अग्रवाल.

Suggested E-Resources:

- Beach, Milo Cleveland. (1975). The Context of Rajput Painting. *Ars Orientalis*. Retrieved from https://www.jstor.org/stable/4629279?seq=1#metadata_info_tab_contents
- Mathur,M.M. (2008). Glorious Mewar, *Bulletin of the Deccan College Research Institute*. Retrieved from https://www.jstor.org/stable/42931212?seq=1#metadata_info_tab_contents
- Tiwari, Arya Ramchandra G. (1960). Some Gaps in the History of Rajasthan. *Proceedings Of The Indian History Congress*. Retrieved from https://www.jstor.org/stable/44137537?seq=1#metadata_info_tab_contents

Tracing Women's History in Indian Society

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

- Unit 1** Role of women in the rise of early civilizations; Cult of Mother Goddess; Pursuits of women in Vedic economy.
- Unit 2** Expansion of activities during Mauryan times; Institutionalization and position of public women in ancient India; Position of Women as described in Buddhism and Jainism.
- Unit 3** Life in Royal Harem and Janani Deorhi in Medieval Period; Profiling cultural and commercial life of women; Women's agency and role in religious movements.
- Unit 4** Debating the women under colonial rule; Educating the women and rise of new professions; Pandita Ramabai and Sarojini Naidu.
- Unit 5** Rise of women's organizations with special reference to AIWC; Women in Nationalist and Revolutionary movements; Women's movements in Post-independent India.

Learning Outcomes: After the completion of the course, students will be able to:

- Locate the progress of civilization and subsequent changes in position of women
- Interpret Women's status through Buddhist and Jaina texts
- Assess women's contribution towards making of medieval Indian culture
- Analyze Women's participation in national movement

Recommended Books:

1. Chaturvedi, Heramb. (2014). *Dastan Mughal Mahilao Hasiye se Savarta Samanantar Itihas*. Delhi: Lok Bharti Prakashan.
2. Forbes, Geraldine. (2004). *Women in Modern India*. Delhi: Cambridge University Press.
3. Kumar, Radha. (1993). *The History of Doing: An Illustration Account of Movement for Women's Rights and Feminism in India, 1800-1900*. Delhi: Zubaan (Kali for Women).
4. Lal, Ruby. (2005). *Domesticity and Power in early Mughal's World*. Cambridge.
5. Mishra, Rekha. (1967). *Women in Mughal India (1526-1748)*. Delhi: Munshiram Manoharlal.
6. Mukherjee, Soma. (2001). *Royal Mughal Ladies and their Contributions*. Delhi: Gyan Publication.
7. Mullatti, Leela. (1989). *The Bhakti Movement and the Status of Women: A case study of Virsaivism*. Delhi: Abhinav Publication.
8. Roy, Kumkum. (2001). *Women in Early Indian Societies*. New Delhi: Manohar.

Suggested E-Resources:

- Marie, McKeown. Women through History: Women's Experience Through the Ages. Retrieved from <https://owlcation.com/humanities/Greatest-Indian-Women-From-History>
- <https://www.naaree.com/five-great-women-history-ancient-india>

Introduction to Historiography

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Unit 1 (i) Meaning and concept of History.

(ii) History – an art or a science.

Unit2 (i) Reconstruction of Past: Primary and Secondary Sources.

(ii) History and its Relationship with other Social Sciences.

(iii) Use and Understanding of History.

Unit 3 A Brief Outline of - (i) Subaltern History; (ii) New History; (iii) Gender History

Unit 4 Theories of History - (i) Linear History; (ii) Cyclical Theory; (iii) Great – Man Theory

Unit 5 (i) Chronology in History; (ii) Archaeological Techniques- Exploration and Excavation; (iii) Dating Methods in History.

Learning Outcomes: After the completion of the course, students will be able to:

- Develop a critical thinking with regard to the genesis and nature of the discipline.
- Understand the recent developments in gender history, new history and archaeological techniques.
- Locate the philosophy of history in terms of cyclical, linear and great men theory.
- Read and write a paper related to the fundamental question- what is history

Recommended Books:

1. Ali, B. Sheik. (1978). *History: its Theory and Method*. Madras, NY: Macmillan.
2. Bajaj, S.K. (1987). *History: Its Philosophy, Theory and Methodology*. Patiala.
3. Carr, E.H. (1967). *What is History*. NY: Penguin Books.
4. Collingwood, R.G. (1951). *The Idea of History*. Oxford.
5. Sreedharan, E. (2009). *A Textbook of Historiography 500 BC to AD 2000*. Delhi, NY: Orient BlackSwan.
6. Stern, F. (ed.). (1956). *The Varieties of History*. New York.

Suggested E-Resources:

- Anders, Schinkel. History and Historiography in Process. Retrieved from <https://www.jstor.org/stable/pdf/3590742>.
- Herodotus. The Battle of Thermopylae (from *histories*). Retrieved from https://www.youtube.com/watch?v=y_Q1T1ExaMQ
- Ranajit Guha. *The Small Voice of History*. Retrieved from <https://archive.org/details/in.ernet.dli.2015.149176>

Introduction to Traditions of Historical Writings

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

- Section I** **Ancient Tradition of Historiography:** Greco-Roman Historiography with special reference to Herodotus, Thucydides; Features of Chinese Historiography; Ancient Indian tradition of History writing (an outline).
- Section II** **Medieval Tradition:** Features of Islamic Historiography; Ibn Khaldun; St. Augustine; Medieval Indian Historiography with reference to Barani, Abul Fazl.
- Section III** **Modern Historiography:** Scientific History: Ranke. Philosophies of History: Hegel's Idealistic theory, Historical Materialism of Marx, Spengler and Cyclical Theory. Totality in History: The Annals Approach- Marc Bloch. Literary Turn and Challenges to scientific History,. Foucault and Post-Modernism.

Learning Outcomes:

After completion of the course, the student will be able to:

- Understand key philosophical development since the Greco Roman times to the postmodern times.
- Develop comparative dimension of development of historiography in Europe, China, India and Arabia.
- Develop a critical thinking with regard to the genesis and nature of the discipline.

Recommended Books:

1. Bajaj, Satish K. (1998). *Recent Trends in India Historiography*. Delhi: Anmol Publications.
2. Bloch, Marc. (1992). *Historian's Craft*. U.K. Manchester University Press.
3. Gardner, Charles S. (1961). *Chinese Traditional Historiography*. U.S.A. : Harvard : University Press.
4. Guha, Ranjit. (1983). *Subaltern Studies*. Vols. I to X (Writings on South Asian History and Society). Delhi: Oxford.
5. Habib, Irfan. (1995). *Essays in Indian Historiography: Towards Marxist Perception*. Delhi: Anthem Press.
6. Pandey, Govindachandra. (Ed.). (1991). *Itihas: Swaroop Evam Sidhanth*. Jaipur: Rajasthan Hindi Granth Academy.
7. Thompson, E. J. (1992). *History of Historical Thinking*. New York :

Suggested E-Resources:

- History, Ideology and Society. Retrieved from <http://egyankosh.ac.in/bitstream/123456789/44437/1/Unit-4.pdf>
- Thucydides. The history of the Peloponnesian war. <https://archive.org/details/his00toryofpeloponthucrich/page/n7>
- Schinkel, Anders. History and Historiography in Process. Retrieved from <https://www.jstor.org/stable/pdf/3590742.pdf>

Political and Cultural Trends in Ancient Indian History (Earliest Times to 1000 AD)

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

- Section I** Survey of Sources – Lithic Cultures (Salient Features) – Urban Nature of Harappan Civilization – Iron Age Cultures (Outline of PGW, NBPW, Megaliths)
- Section II** Development of Polity (Nature of State and administrative Structure): Tribal Vedic – Democratic Elements in form of Republican States and local self governance – Imperial Mauryan and Guptas - Rajput Polity
- Section III** Artistic Growth: Harappan - Mauryan - Kushana - Satvahana - Classical Gupta ideal – Rajput – Pallava, Chalukya Traditions; Religious Leanings: Vedic - 6th Century BC - Ashoka's Dhamma - Patronage to Buddhism - Pauranic Revivalism under Guptas - Sangam Literature

Learning Outcomes:

After completion of the course, the student will be able to:

- Be acquainted with trends of political developments in early India.
- Be oriented to continuity of cultural evolution beginning from Lithic Ages.
- Be familiar with regional and Indian stylistic development of aesthetics.

Recommended Books:

1. Basham, A. L. (1985). *The Wonder that was India*. New Delhi: Rupa.
2. Jha, D.N, Shrimali, K.M. (2000). *Prachim Bharat ka Itihasa*. New Delhi: Hindi Madhyam Karyanvaya Nideshalaya, Delhi University.
3. Raychaudhari, H. C. (2005). *Political History of Ancient India from the Accession of Parikshit to the Extinction of the Gupta Dynasty*, Delhi: Motilal Banarsidass.
4. Sastri, K.A.N. (2002). *History of South India*. Delhi: OUP.
5. Sharma, Ramsharan. (2009). *Prarambhik Bharat ka Parichay*. New Delhi: Orient Blackswan.
6. Singh, Upinder. (2009). *A History of Ancient and Early Medieval India from the Stone Age to the 12th Century*. Delhi: Pearson Longman.
7. Thapar, Romila. (2004). *Early India - From the Origins to AD 1300*. New Delhi: Penguin.

Suggested E-Resources:

- Dhammika, Ven S. (1994). The edicts of King Asoka: an English rendering. *Wheel publication*. No. 386/387. Retrieved from <https://trove.nla.gov.au/work/31973752?q&versionId=38817501>
- Childe, Vere Gordon. (1944). *The Story of Tools*. London, NY: Cobbett Publishing. Retrieved from <https://www.marxists.org/archive/childe/1944/tools/childetools.htm>.
- McKnight, J. Michael. (1977). Kingship and Religion in India's Gupta Age: An Analysis of the Role of Vaisnavism in the Lives and Ideology of the Gupta Kings. *Journal of the American Academy of Religion*. Volume XLV, Issue 2. Pages 227. Retrieved from <https://doi.org/10.1093/jaarel/XLV.2.227>.

Selected Issues in Medieval Indian History (1000-1526 AD)

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

- Section I** Overview on sources of Delhi Sultanate; India on the eve of Turkish invasion; Theory of Kingship under Balban, Alauddin Khalji, Firozshah Tughluq, Bahlol Lodi.
- Section II** Administration and Institutions: Central and provincial structure, Iqta, Revenue administration, Military Organization; Economy: Changes in Agricultural production; Monetization; Market regulations; growth of urban centers; Trade and commerce; Indian Ocean trade.
- Section III** Society and Culture: Origin and concepts of Bhakti and Sufism Movements; Change in Indian Society; Characteristic of Art and Architecture; System of Education; Growth of Literature: Persian and Hindawi.

Learning Outcomes:

After completion of the course, the student will be able to:

- Answer queries on sources of writing Delhi Sultanate's history, the circumstances that paved way for the Turkish invasion of India.
- Describe the different theories of kingship under various Sultans, their administrative, military and revenue organizations.
- Determine the changes in economy, society and culture during the Mughal time period.

Recommended Books:

1. Ashraf, K.M. (2006). *Hindustan ke Nivasiyon ka jeevan aur unki paristhithiyam*. Delhi: Hindi Madhyam Karyanvay Nidheshalay, Punamudhran.
2. Chandra, Satish. (2007). *History of Medieval India*. New Delhi: Orient Black-Swan,
3. Chandra, Satish. (2007). *Madhyakaleen Bharath, rajneeti Samaj aur Sanskriti*. New Delhi: Orient Longman.
4. Gopal, Lallanji. (1965). *Economic Condition in Northern India, A.D.750-1200*. Delhi: Motilal Banarsidas.
5. Habib, Irfan. (2007). *Medieval India: The Study of Civilization*. Delhi: NBT.
6. Kulke, H. (ed.). (1998). *The State in India. 1000-1700*. Delhi: OUP.
7. Mukhia, Harbans. (2010). *Exploring India's Medieval Centuries: Essays In History, Society, Culture and Technology*. Delhi: Aakar Books.
8. Tarachand. (1963). *Influence of Islam on Indian Culture*. Allahabad: Kitabmahal.

Suggested E-Resources:

- Delhi Sultanate. Retrieved from <https://www.britannica.com/place/Delhi-sultanate>
- Jackson, Peter. (1999). *The Delhi Sultanate: A Political and Military History*. New York, NY: Cambridge University Press. Retrieved from <https://muse.jhu.edu/article/15986>

Economy, Education and Empire (1757-1947AD)

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I Transition to Colonialism: Mercantile Imperialism, Industrial Imperialism and Finance Imperialism; Land settlement and State: Recasting the relationship; Left-nationalist Paradigm and the Idea of Poverty; De-industrialization in India: Theoretical Implications.

Section II Infrastructural and Entrepreneurship development: Railways, Irrigation, Telegraph; Cotton Textile and Indigenous Entrepreneurship, and Steel industry (TISCO); The Impact of Great Depression on Indian Economy; Emergence of Colonial Cities: Urbanisation and Planning.

Section III Masks of conquest: institutionalisation of knowledge, English education and the establishment of Universities (1857); The Evolution of the Professional Structure: the Legal and Medicine Profession; Science, Institution and Colonialism: the Thomason College of Engineering; The Regulation and Commission: Indian Universities Act, 1904, Sadler Commission, Wardha Plan and Nai Talim.

Learning Outcomes:

After completion of the course, the student will be able to:

- Develop an analytical approach about the consequences of colonization of Indian economy on agriculture, industry, commerce.
- Write a research paper pertaining to related aspects of syllabus.
- Develop their insight and debate on nationalist and imperial perspective of British impact on India.

Recommended Books:

1. Arnold, David. (1993). *Colonizing the Body, State Medicine and Epidemic Disease in Nineteenth-Century India*. U.S.A. University of California Press.
2. Bagchi, Amiya. (2010). *Colonialism and Indian Economy*. U.K. : Oxford University Press.
3. Bhattacharya, Sabhyasachi. (trans.). (1990). *Adhunik Bharat Ka Arthik Itihas 1850-1947*. Delhi : Rajkamal Prakashan.
4. Crawford, D. G. (1914). *A History of the Indian Medical Service, 1600-1913*. London: W. Thacker.
5. Guha, Ranajit. (1982). *A Rule of Property for Bengal: An Essay on the Idea of Permanent Settlement*. Delhi: Orient Longman.
6. Kumar, Dharma & Raychaudhuri, Tapan. (Ed.). (1982). *Cambridge Economic History of India*. Vol II. U.K. Cambridge University Press.
7. Viswanathan, Gauri. (1989). *Masks of Conquest: Literary Study and British Rule in India*. New York: Columbia University Press.

Suggested E-Resources:

- 'Early European trade and commerce'. E-Pathshala, National Mission on Education Through ICT. Retrieved from <https://epgp.inflibnet.ac.in/ahl.php?csrno=829>
- Naoroji, D. (1901). 'Poverty and Un-British Rule in India'. Paternoster Square, NY: Swan Sonnenschein & Co. Retrieved from <https://archive.org/details/povertyandunbri00naorgoog/page/n6>
- Premchand. 'Godaan'. Retrieved from <https://www.youtube.com/watch?v=3ZwcFPLHoUc>

Fundamentals of Historical Investigations

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I – Meaning and Nature of History; Establishment of historical fact and its significance; Sources - Primary and Secondary; Visual and Oral Evidences; Criticism of Sources.

Section II – Subjectivity and Objectivity; Causation; Periodisation in History; Quantitative techniques; The Historian's craft.

Section III – Archaeological Exploration and Excavation; Identification of 'Cultures' from physical finds; Dating Methods; 'New Archaeology'; Problems of historical Cartography and Place names.

Learning Outcomes:

After completion of the course, the student will be able to:

- Understand the basic fundamentals of the discipline of history.
- Familiarise oneself with the concepts and techniques of writing history.
- Get accustomed with archaeological excavations and explorations, dating methods and 'new archaeology'.

Recommended Books:

1. Ali, B. Sheik. (1978). *History, Its Theory and Method, Madras*. Delhi: Macmillan.
2. Black, Jesminy & Macrailld, Donald M. (1997). *Studying History*. London UK : Macmillan Publication.
3. Braudel, Fernand. (1980). *On History*. London, NY: Sarah Matthews.
4. Carr, E.H. (1967). *What is History?* U.K. Penguin Books.
5. Collingwood, R.G. (1951). *The Idea of History*. U.K. Oxford.
6. Gardiner, Patrick. (ed.). (1959). *Theories of History*. New York: Free Press.
7. Hockett, H.C. (1958). *The Critical Method in History*. New York: Macmillan.
8. Laduses, E. Leroy. (1979). *The Territory of the Historians*. U.K. : The Harvester Press.
9. Laduses, E. Leroy. (1971). *Times of Feast, Times of Famine: A history of climate since the year 1000*. New York : Farrar Straus & Giroux.

Suggested E-Resources:

- Fry, Amelia. R. & Hoffman, Alice. M. (1972). Oral History in Great Britain. *The Journal of Library History*. Vo.7, No.3, 1972, pp.275-285. Retrieved from <https://www.jstor.org/stable/pdf/25540365.pdf?refreqid=excelsior%3A8471004a142a4c3f1029382a5f69485b>
- Modern Disturbances: On the Ambiguities of Archaeology, Gavin Lucas, Modernism/modernity, Johns Hopkins University Press, Volume 11, Number 1, January 2004, pp. 109-120. Retrieved from <https://muse.jhu.edu/article/53085>

Selected Issues in Medieval Indian History (1526-1740 AD)

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I Overview on sources of Mughal history; Foundation of Mughal Rule in India; Babar, Humayun. Rise of Sher Shah Suri; Religious and Deccan policy of Akbar and Aurangzeb.

Section II Mughal Administration and Institution: Central Structure, Provincial Structure, Mansabdari, Jagirdari and Zamindari System; Decline of Mughal Empire: Theoretical Implications

Section III Economy and Society in Mughal India: Agrarian Economy and the State; Industries and artisans; Urbanization, External and Internal trade, Trade routes and traders; Banking system; Social Stratification; Social Mobility, Features of synthesized Art and Architecture.

Learning Outcomes:

After completion of the course, the student will be able to:

- Acquaint themselves with the medieval Indian political systems, strategies and administrative reforms under different rulers.
- Enhance their analytical skills as the course includes theoretical implications regarding specific topics.
- Gain knowledge of cultural contributions of the Mughals.

Recommended Books:

1. Alam, M. & Subramanyam, S. (ed.). (2000). *The Mughal State*. Delhi: OUP.
2. Bhargav, Meena. (2014). *The Decline of the Mughal Empire*. Delhi: OUP.
3. Chandra, Satish. (2008). *Religion, State and Society in Medieval India*. New Delhi: OUP.
4. Chaudhuri, K.N. (1985). *Trade and Civilization in the Indian Ocean: An Economic History from the Rise of Islam to 1750*. U.K. Cambridge University Press.
5. Habib, Irfan. (1999). *The Agrarian System of Mughal India 1556-1707*. U.K : Oxford University Press.
6. Marshall, P.J. (Ed.). (2002). *The Eighteenth Century in India – Evolution or Revolution*. U.K. Ford University Press.
7. Mukhia, H. (1994). *Perspectives on Medieval India*. Delhi: Vikas Publishing House Pvt Ltd.
8. Moosvi, Shireen. (2008). *People, Taxation, and Trade in Mughal India*. New Delhi: OUP.

Suggested E-Resources:

- Gier, Nicholas F. (2006). From Mongols to Mughals: Religious Violence in India, 9th to 18th Centuries, Presented at the Pacific North West Regional Meeting. *American Academy of Religion*. NY: Gonzaga University. Retrieved from, <http://www.webpages.uidaho.edu/ngier/mm.htm>
- Mughal History. <https://www.britannica.com/topic/Mughal-dynasty>
- Three Muslim Empires, Stephen Dale (bio). *Historically Speaking*. Vol.13, No.2, 2012. NY: John Hopkins University Press. Retrieved from <https://muse.jhu.edu/article/476939>

Social and Economic Life in Ancient India (up to 1000 AD)

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I Concept of Dharma – Varna – Jati – Ashram – Purushartha – Samskara – Institution of Family and Marriage – Evolution of Education under Vedic, Buddhist and Jaina Systems.

Section II Economic Thought: Varta- Land Ownership – Taxation – Guilds – Credit and Banking Systems – Slavery and Labour - Stages of Economy: Chalcolithic Village Economy – Harappan Economy – Vedic Pastoral Economy.

Section III Urbanization under Mahajanapadas – Mauryan Imperial Economy – Trade and Commerce during 200 BC to 300 AD – Economic Affluence under the Guptas – Land grants and Feudalism (Outline of Debate) – South Indian Temple Economy – Rajput Society and Economy.

Learning Outcomes:

After completion of the course, the student will be able to:

- Critically assess the social stratifications emerging in due course of time.
- Comprehend fundamentals involved in Indian economic processes as taxation, banking, credit, land grants, etc.
- Establish linkage between political formations and process of urbanization.

Recommended Books:

1. Basham, A.L. (1954). *The Wonder that was India*. New Delhi: Rupa.
2. Jha, D.N., & Shrimali, K.M. (2000). *Prachin Bharat ka Itihasa*. New Delhi: Hindi Madhyam Karyanvaya Nideshalaya, Delhi University.
3. Raychaudhari, H. C. (2005). *Political History of Ancient India from the Accession of Parikshit to the Extinction of the Gupta Dynasty*. Delhi: Motilal Banarsidass.
4. Sastri, K.A.N. (2002). *History of South India*. Delhi: OUP.
5. Sharma, Ramsharan. (2007). *Material Culture and Social Formations in Ancient India*. Delhi: Macmillan.
6. Sharma, Ramsharan. (2005). *Indian Feudalism*. New Delhi: MacMillan.
7. Singh, Upinder. (2009). *A History of Ancient and Early Medieval India (From the Stone Age to the 12th Century)*. New Delhi: Pearson.
8. Thapar, Romila. (2003). *The Penguin History of Early India*. Penguin.

Suggested E-Resources:

- Bételle, André. (1996). 'Varna and Jati'. *Sociological Bulletin*. Vol. 45, No. 1 (MARCH 1996), pp.15-27. Retrieved from <https://www.jstor.org/stable/pdf/23619694.pdf?refreqid=excelsior%3Ad333b7e41bb6055424ddf00062c6fd29>
- Chakravarty, Uma. (2003). 'A Glance at the Word Varna in the Vedic Literature'. *Annals of the Bhandarkar Oriental Research Institute*. Vol. 84 (2003), pp. 1-11. Retrieved from <https://www.jstor.org/stable/pdf/41694745.pdf?refreqid=excelsior%3A8aa1100beafb34685ff4350a82631677>.

An Outline of the History of Rajasthan

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I Importance of Regional History; Sources of Rajasthan History – Archaeological, Archival, Literary, Oral; Early history, Phases and Theories of State Formation in Rajputana; Resistance and Collaboration of Rajputs States with the Mughals.

Section II British Treaties and expansion in Rajputana (1818-1857); 1857 and Responses from the Princely States; Social Reformers Inclination towards Rajputana; Walterkrit Rajputana Hitakarini Sabha and Social legislation in Rajputana state.

Section III Nature of Peasants and Tribal Movements; Establishment of Prajamandals in Rajputana with Special reference to Jaipur and Mewar States; Integration: from Rajputana to Rajasthan; Trade of Opium and Salt; Trade routes and Growth of Urban Centers; Migration of Business Community.

Learning Outcomes:

After completion of the course, the student will be able to:

- Comprehend the evolution of Rajputana to Rajasthan and evaluate the importance of Rajputs during medieval India.
- Assess British expansion, economic-social changes and reforms in modern Rajputana.
- Analyze the popular movements and integration of Rajasthan.

Recommended Books:

1. Das, Shyamal. (1886). *Vir Vinod*. 4 Volumes. Udaipur : Stosius incl Advent- Book Division.
2. Devra, G.S.L. (ed.). (1980). *Some Aspects of Socio-Economic History of Rajasthan*. Jodhpur: Hindi Sahitya Mandir.
3. Pemaram. (1990) *Shekhawati Kisan Aandolan ka Itihas*. Jasnagar, Nagour: Shree Ganesh Sewa Samiti.
4. Ratnawat, Shyam Singh & Sharma K.G. (2004). *History and Culture of Rajasthan*. Jaipur: Rajasthan Study Centre.
5. Sharma, Dasharath. (1966). *Rajasthan through the Ages* vol.1, Bikaner: Rajasthan State Archives.
6. Sharma, G.N., & Bhatnagar, V.S. (1992). *The Historians and Sources of the History of Rajasthan*. Jaipur: Rajasthan Study Centre.
7. Sharma, G.N. (1986). *Social and Political Awakening among the Tribals of Rajasthan*. Jaipur: Rajasthan Study Centre.
8. Sinha-Kapoor, Nandini. (2002). *State Formation in Rajasthan: Mewar during 7th to 15th century*. New Delhi: Manohar.
9. Tod, James. (1832). *Annals and Antiquities of Rajasthan* 2 Vols. New Delhi.
10. Vyas, R.P. (1995). *Adhunik Rajasthan ka Vrhat Itihas*. Jaipur: Rajasthan Hindi Granth Akadami.

Suggested E-Resources:

- Popular Trade Routes of Rajasthan. Retrieved from

www.gsldevra.com/publications/settlement...and.../popular-trade-routes-of-rajasthan/

Rajasthan mein Prajamandal Aandolan. Retrieved from ignca.nic.in/coilnet/rj070.htm

India since Independence

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I India after Independence : Integration of Nation; Linguistic Controversy; Rajbhasha and reorganization of states; Communalism; Kashmir Problem; Architects of Modern India: Jawaharlal Nehru, Lal Bahadur Shastri, and Indira Gandhi; India's Foreign policy during Jawaharlal Nehru.

Section II Party, Politics and Coalition Government : Emergency – General Election of 1977; Janta Government; Coalition Politics and Governance; Regional Resurgence – Punjab-Assam; Dalit Movements; Mandal Commission;

Section III Economic and Social Perspectives, Changes and Continuity : Phases of Indian Economy; Industrialization; Five Year Plans; Green Revolution; Globalization; Information and Technological Revolution; Environmental Movement; MGNREGA

Learning Outcomes:

After completion of the course, the student will be able to:

- Comprehend the various trends of writing history of contemporary India.
- Realize the repercussions that the colonial rule had produced over the social, political and economic aspects of the country.
- Develop an analytical power of their own.

Recommended Books:

1. Ali, Mohd. Ashraf. (2012). *Jawaharlal Nehru: Maker of Modern India*. Delhi: Rajpal Publications.
2. Anderson, P. (2012). *The Indian Ideology, (Three Essays collective)*. Delhi : Verso Books
3. Chandra, Bipan. (Ed.). (2000). *India after Independence*. Delhi: Penguin.
4. Guha, R.C. (2007). *India after Gandhi*. New Delhi: Picador.
5. Menon, V.P. (1972). *The Story of the Integration of the Indian States* (World Affairs: National and International Viewpoints) New York.. Arno Press.
6. Rahman, A. & Chaudhary, P.N. (1980). *Science and society*. New Delhi: CSIR.
7. Rothermund, D. (2013). *Contemporary India*. Delhi: Pearson.

Suggested E-Resources:

- "The Hindu: Patel vs. Gandhi?". *Thehindu.com*. Retrieved from <https://www.thehindu.com/2002/04/06/stories/2002040600081000.htm>
- "The Green Revolution in India". U.S. Library of Congress (released in public domain). Library of Congress Country Studies. Retrieved from <http://countrystudies.us/india/104.htm>
- "Economic Survey of India 2007: Policy Brief" (PDF). OECD. Retrieved from <https://web.archive.org/web/20110606112149/http://www.oecd.org/dataoecd/17/52/39452196.pdf>

Exploring Science, Technology and Medicine in Indian History

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I – Science and Technology – the beginnings:

Science and Technology – (meaning, scope and importance); Developments in Medicine and Surgery and Astronomy - (Charaka, Sushruta, Aryabhatta, Varahmihira, Bhaskara); Beginning of Agriculture and its impact on the growth of science and technology.

Section II – Development in science and technology:

New developments in Technology – (Persian Wheel; Gun-Powder; Textiles; Bridge Building; etc.); Developments in Medical Knowledge and interaction between Unani and Ayurveda; Concept of Rationality & Scientific ideas in Arab Thought and its reception in India.

Section III – Science and Colonial explorations, Indian response & development:

East India Company and Scientific Explorations – (Surveyors, physicians, Doctors); Indian Response to New Scientific Knowledge; Science and Indian Nationalism; Planning for Development– (National Planning Committee; Bombay Plan); the contribution of CSIR and ISRO in Post-Independent India.

Learning Outcomes:

After completion of the course, the student will be able to:

- Recognize science and technology as an integral part of Indian Culture.
- Analyze the development of technology and medicine during the various phases of Indian history as a response to scientific ideas in Arab thought and colonial explorations.
- Perceive the Indian Renaissance as one which coincided with the Independence Struggle and the innate ability to perform creatively in sciences backed with an institutional set up.

Recommended Books:

1. Adas, Michael. (1992). *Machines as the Measure of Men: Science, Technology and Ideologies of Western Dominance*. Delhi: OUP.
2. Arnold, David. (1999). *Science, Technology and Medicine in Colonial India*. The New Cambridge History of India Series. Cambridge: OUP.
3. Dasgupta, Subrata. (1999). *Jagadish Chandra Bose and the Indian Response to Western Science*. Delhi: OUP.
4. Grove, R. (1994). *Green Imperialism*. Delhi: OUP.
5. Headrick, D.R. (1981). *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century*. Delhi: OUP.
6. Kumar, Deepak. (1995). *Science and the Raj*. Delhi: OUP.
7. Kumar, Deepak. (2000). *Disease and Medicine in India: A Historical Overview*. Delhi: Tulika Publication.
8. Sangwan, S. (1990). *Science, Technology and Colonization: Indian Experience*. Delhi: Anamika.

Suggested E-Resources:

- Kumar, Deepak. Science and Society in Colonial India: Exploring an Agenda. Retrieved from <https://www.jstor.org/stable/3518179?Search=yes&resultItemClick=true&search>
- Baig, A.K. History of Technology in India. Retrieved from <https://archive.org/details/in.ernet.dli.2015.205662>

Gender History

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I Conceptualizing Gender and Patriarchy, Contemporary Debates on Feminism; Gender as a category in Historical analysis, its contribution towards understanding social relations in ancient societies; Historiography.

Section II Cultural Perspectives: Prehistoric Ancient Technology, Social organization and Religious beliefs; Gendering the Early Indian Societies; Women in Indian religion – Divinities and Devotees; Women in Indian philosophy; Domesticity and Power in Medieval India; Devadasis, Courtesans and Concubines

Section III 'Women's Question' in colonial India; Defining women through social reforms; Organizations and activism in colonial India; Birth control and public health; Post-Independence women related issues

Learning Outcomes:

After completion of the course, the student will be able to:

- Conceptualise Gender, its origin, approaches and the development of Feminism through historical analysis.
- Explain women's status and position in various aspects of society such as religion, philosophy and domestic life from ancient to contemporary times.
- State how women's question is raised in modern period by the European scholars and Indian social reformers and activists.

Recommended Books:

1. Archer, Fischler. & Wyke. (ed.). (1994). *Women in Ancient Societies*. Routledge.
2. Beauvoir, Simone. (1989). *The Second Sex*. New York : Vintage Books.
3. Chakravarti, Uma. (2006). *Everyday Lives, Everyday Histories: Beyond the Kings and Brahmanas of 'Ancient' India*. New Delhi: Tulika Books.
4. Coontz & Henderson. (ed.). (1986). *Women's Work Men's Property: The Origin of Gender & Class*. London : Verso.
5. Lerner, Gerda. (1986). *The Creation of Patriarchy*. OUP.
6. Pomeroy, Sarah. (1995). *Goddesses, Whores, Wives and Slaves: Women in Classical Antiquity*. Schocken Books.
7. Roy, Kumkum. (ed.). (1999). *Women in early Indian Societies*. Delhi: Manohar Publication.
8. Sangari, Kumkum. & Chakravarti, Uma. (1999). *From Myths to Markets*. Delhi: Manohar Publisher.

Suggested E-Resources:

- Kumar, Radha. (1989). Contemporary Indian Feminism. *Feminist Review*. No. 33. pp.20-29. Retrieved from https://www.jstor.org/stable/1395212?seq=1#metadata_info_tab_contents
- Meyerowitz, Joanne. (2008). A History of "Gender". *The American Historical Review*. Vol. 113, No. 5 pp. 1346-1356. Retrieved from https://www.jstor.org/stable/30223445?seq=1#metadata_info_tab_contents

Survey of Folk Culture of Rajasthan

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Section I Folk Culture: Theories and Concept, Folk History as a tool of understanding of past; Issues related to folk arts and Artists; folk culture of Rajasthan as a source of Oral History and the Identity of Heritage of Rajasthan.

Section II Elements of Folk Culture: Folk beliefs, Customs, Life Mannerisms, Fair And Festivals; Folk Deities - Panch Peer as a composite gods of folks; Bhomia ji, Kuldevi as a Shakta worships of Rajputs; An outline of Folk Arts and Crafts- Important Crafts as (i) traditional occupations and (ii) identity markers of various Castes, (iii) as reflection of rural life.

Section III Performing Arts: Portrayal of Regional and Vibrant Culture; Visual Art: A sketch of Tradition of Folk Dramas (Khayal Theater) and Cinematic Representation of Rajasthani folklore; Folk Literature: Articulation of societal thoughts and oral expressions of folk psychology; Patrons - Sketching Folklorists (Vijaydana Detha, Rani Lakshmi Kumari Chundawat), and Institutions (Rupayana, Borunda; Bhartiya Lok Kala Mandal, Udaipur).

Learning Outcomes:

After completion of the course, the student will be able to:

- Discuss Folk studies as an important source of History.
- Analyze the vibrant data with a critical eye and be motivated to begin to question that data.
- Relate to folk life, art and traditions and thus to the importance of preservation of their surrounding culture by the example of significance of folk culture and art of Rajasthan in the history, culture and tourism of Rajasthan.

Recommended Books:

1. Borana, Ramesh. (2015) *Rajasthan ke Lok Vadhya*. Jodhpur: Rajasthan Sangeet Natak Akadami.
2. Chundawat, Rani Lakshmi Kumari (2007). *Sanaskritik Rajasthan*. Jaipur: Rajasthan People's Publishing House.
3. Devra, G.S.L. (2010). *Rajasthan ke Itihas ke Abhigyan Roop*. Jaipur: Rajasthan Hindi Granth Akadami.
4. Jaisingh, Neeraj. (ed.). (2016). *Rajasthan ki Sanaskritik Parampara*. Jaipur: Rajasthan Hindi Granth Akadami.
5. Sharma, Krishan Kumar. (2010). *Rajasthani Lok gathaye*. Kolkata: Bhartiya Vidya Mandir.
6. Singh, Chandramani. (2000). *Performing Arts of Rajasthan-Lok Rang*. Jaipur: Jawahar kala Kendra.
7. Vashishtha, V.K., Vyas, Namita. & Sharma, Preeti. (ed.). (2008). *Cultural Heritage of Rajasthan*. Banasthali Vidyapith.

Suggested E-resources:

- Rupayan Sansthan's role in Documenting Oral Tradition and Cultural Aspects of Intangible Natural Heritage of Rajasthan. Retrieved from <https://www.sahapedia.org/institutional-history-of-rupayan-sansthan-jodhpur>
- Bhartiya Lok Kala Mandal. Retrieved from www.udaipurplus/Lokkalamandal/index.htm

Concepts in the Study of History

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale: This course aims to introduce students to important issues related to historical method by giving them a broad overview of significant, including recent, historiographical trends and to acquaint them with important historiographical interventions and issues related to the historian's craft.

1. Pre-modern historical traditions; Modern Historical Traditions - Enlightenment, Romanticism, Positivism
2. Historicism
3. Neo-Marxist Tradition
4. Intellectual History
5. Art History - Psychoanalytics, Structuralism, Multiculturalism
6. Environmental history
7. Oral history
8. Cinema history
9. Book History
10. Connected Histories: Emotions, Peoples, Commodities, Sports

Books Recommended:

1. Alier, Joan Martinez, Padua, Jose Augusto and Rangrajan, Mahesh eds. Environmental History as if Nature Existed ,Delhi: Oxford University Press, 2010.
2. Aymard, Maurice and Mukhia, Harbans eds., French Studies in History, vol. 1, New Delhi: Orient Longmans, 1989.
3. Bloc, Marc; The Historian's Craft with an Introduction by Peter Burke, Manchester: Manchester University Press, 2004.
4. Burke, Peter; Varieties of Cultural History ,Cornell University Press, 1997.
5. Carr, E.H, What is History ,Penguin [1961], 2008. (also available in Hindi)
6. Popper, Karl, The Poverty of Historicism , Routledge & Kegan Paul, 1974.
7. Portelli, Alessandro, The Death of Luigo Trastulli and Other Stories: Form and Meaning in Oral History ,CUNY Press, 1990.
8. Sarkar, Sumit, Writing Social History ,USA: Oxford University Press, 1995.
9. Singh, Anita Inder, The Partition of India ,New Delhi: National Book Trust, 2006.
10. Stern, Fritz ed., Varieties of History: From Voltaire to the Present, New York: Vintage, 1973

Themes and Debates in the Study of History

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale: The course aims to instill curiosity amongst the students regarding the prominent debates and issues giving them insight into the moving forces and dynamics of the discipline and to engage researchers to re-explore the domain of the past with their inquisitiveness.

1. Sindhu Saraswati Civilization / Myth of Aryan Invasion.
2. From Lineage to States - The Formation of Empires.
3. Discourses on Feudalism.
4. Defining Periodization in Medieval Indian History.
5. Process of Urbanization.
6. Theories on decline of the Mughal Empire.
7. Changing dimensions of Agriculture, Ecology and Politics: The Transition to Colonialism.
8. Orientalism and the Construction of the 'Other'.
9. Construction of Nation and the Post-Colonial Discourse.
10. Emerging Areas: STEM (Science & Technology, Environment and Medicine), Forms of Resistance and the marginalized class, Migration Studies.

Suggested Readings:

1. Alam, Muzaffar, The Crisis of Empire in Mughal North India: Awadh and the Punjab, 1707-48, Delhi ,Oxford University Press, 1986.
2. Alavi, Seema, The Eighteenth Century in India ,New Delhi: Oxford University Press, 2002.
3. Ayer, S. A., Story of the I.N.A. ,New Delhi: National Book Trust, 1972.
4. Banerjee, Sir Surendranath, A Nation in Making: Being the Reminiscences of Fifty Years of Public Life ,Oxford University Press, 1925.
5. Bhargava, Meena, The Decline of the Mughal Empire ,Oxford University Press, 2014.
6. Byres,T.J. Harbans Mukhia, Feudalism and Non-European Societies ,Frank Cass & Co. Ltd. 1985.
7. Chandra, Satish, Parties and Politics at the Mughal Court, 1707-1740, Oxford University Press, 2002.
8. Corfield, Sir Conrad, The Princely India I Knew From Reading to Mountbatten, Madras: Indo-British Historical Society, 1975.
9. Habib, Irfan, Technology in Medieval India, C. 650-1750, Aligarh Historians Society, 2008.
10. The Agrarian System of Mughal India 1556-1707 , Oxford University Press, 2014
11. Jha and Shrimali, Prachin Bharat ka Itihas ,Delhi: University of Delhi Hindi Directorate, 2015.
12. Lahiri, Nayanjot, Ashoka in Ancient India ,Delhi: Permanent Black /Asoka University, 2015.
13. Lal, B.B.,The Rigvedic People: Invaders, Immigrants or Indigenous ,New Delhi: Aryan Books International, 2015.
14. Marshall, P. J., The Making & Unmaking of Empires - Britain, India and America, c.1750-1783 ,Oxford University Press, 2005.
15. Mill, John Stuart, Utilitarianism ,London: Parker, Son, and Bourn, 1863.
16. Said, Edward W., Orientalism ,Vintage, 1979.
17. Sarkar, Susobhan, Chandra, Bengal Renaissance and Other Essays,People's Publishing House, 1970.
18. Sarkar, Jadunath, Fall of the Mughal Empire Volume 1,Delhi: Orient Blackswan, 1991.
19. Sharma, R.S., Indian Feudalism ,Delhi: Macmillan, 2005.
20. Singh, Chetan, Region and empire: Panjab in the seventeenth century, Oxford University Press, 1991.

21. Spear, Thomas George Percival, *Twilight of the Mughals: Studies in Late Mughul Delhi* ,Cambridge University Press, 1951.
22. Stokes, Eric, *The English Utilitarians and India*, Oxford Clarendon Press, 1959.
23. Thapar, Romila, *Early India: From the Origins to A. D. 1300* ,University of California Press, 2004.

Sources of Indian History

L T P C
2 2 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Rationale: The course intends to introduce the practitioners of history with the primary readings so that they can be oriented with the styles of the masters.

1. Arthasastra, (adhikarana 1, chap.1,2,3,6/18,19,20)/History of Dharmasastra (Chapter XXXIV, Kalivarjya, pp. 885-902, 923-968) / Sacred Books of East (chap. on Mitakshara)/ Epigraphia Indica (Aihole Inscription, Prayag Prasasti/ 2 Regional Inscriptions).
2. Fa hien (full text)/ Rajtarangini (Chapter V, pp. 71-132)/ Francis Bernier (Description of Delhi and Agra)/Nicolo Conti (Account given in R.H.Major).
3. Tarikh-i-Firozshahi (Description of Tughluq Statecraft)/ Baburnama (Description of Hindustan, (pp. 478-521)/ Ain-i-Akbari (Description of Suba).
4. Regional Sources - Khyat (any one chapter) / Roznamacha (any 1) / Akhbarat (any 1)/ Bahi (any 1).
5. Census / Gazetteer of area concerned (Period of research).
6. India by J. Stratchey (chap. XVII, pp.221-246)/ Poverty and Unbritish Rule in India by Naoroji (pp.1-38).
7. Private Papers of Nehru (National Planning Committee 1938).
8. Pratyaksha Jeewan Shastra by Pt. Hiralal Shastri (Vol. I, pp.295-340/ 474-498).
9. Presidential Address of INC (1931) / Muslim League (1940).
10. Visit to APRI, Tonk (any 2 source). (For Project Purposes).

Suggested Readings:

1. Arthasastra of Kautilya, (ed.) Shri Vachaspati Gairola, The Vidya Bhawan Sanskrit Granthamala 75 ,Varanasi: The Chowkhamba Vidya Bhawan, 2009.
2. Bernier, Francois, Travels in the Mogul Empire, Tran. A. Constable, revised by V.A. Smith ,OUP, 1916.
3. Beveridge, A.S., Babur-Nama: Zahir-ud-din Muhammad Babur,Delhi: Ancient Book Reprint Corporation, 1970.
4. Childe, Gordon V., The Urban Revolution, Liverpool University Press Stable, 1950.
5. Cornfield, Sir Conrad, The Princely India I Knew From Reading to Mountbatten ,Madras: Indo-British Historical Society, 1975.
6. Habib, Irfan, Economic History of the Delhi Sultanate: An Essay in Integration., Indian Historical Review 4, no. 2 ,1978.
7. Jarret and Sankar, J.N., Ain-i-Akbari (Vol-III) - Abul Fazal Allawi, Delhi: Ancient Book Reprint Corporation.
8. Kane, Mahamahopadhyaya Pandurang Vaman, History of Dharmasastra (Vol-III) Ancient and Medieval Religious and Civil Law, Poona: Bhandarkar Oriental Research Institute, 1946.
9. Major, R.H., India in the Fifteenth Century: Being a Collection of the Voyages to India, London: The Hakluyat Society, 1857.
10. Naoroji, Dadabhai, Poverty and Un-British rule in India, Swan Sonnenschein & co. Lim., London, 1901.
11. Nehru, J.L., (Private Papers): A Bunch of Old Letters Jawahar Lal Nehru, Calcutta: Asia Publishing House, 1958.
12. Shastri, Hiralal, Pratyksha Jeevan Shastra, Jaipur: Anupam Prakashan, 1970, 1974.
13. Stein, M.A., Kalhana's Rajtarangini: A Chronicle of the Kings of Kashmir, Delhi: Motilal Banarasidass, 1961.
14. Strachey, J., India, London: Trench Trubner, 1894.
15. Tokarev, Sergei, History of Religion ,Union of Soviet Socialist Republics: Progress Publisher, 1989.
16. Zaidi, A.M. (ed.), Congress Presidential Addresses, Indian Institute of Applied Political Research, 1985.

Survey of the History of Rajasthan

L T P C
2 2 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Rationale: It surveys the political history of Rajasthan from ancient times till the integration of Rajasthan encompassing the study of historical sources, resistance and collaboration of Rajputana/princely states towards imperial powers.

1. Importance of Regional History
2. Sources of Rajasthan History - Archaeological, Literary, Oral.
3. Phases and Theories of State Formation.
4. Impact of Turks and Mughals on Regional Polity.
5. British Policy towards Rajputana States (1818-1857).
6. 1857 and Responses from the Princely States.
7. Social Reformers Inclination towards Rajputana.
8. Nature of Peasants; Tribal Movements.
9. Establishment of Prajamandals in Rajputana with Special reference to Jaipur and Mewar States.
10. Integration: from Rajputana to Rajasthan.

Suggested Readings:

1. Bhattacharya, Sukumar, The Rajput States and the East India Company from the Close of 18th century to 1820, New Delhi: Munshiram Manoharlal, 1972.
2. Das, Shyamal, Vir Vinod , 4 Volumes, Udaipur, 1886.
3. Menon, V.P., The Story of the Integration of the Indian States, New Delhi, 1961.
4. Pemaram, Shekhawati Kisan Aandolan ka Itihas, Jasnagar, Nagore: Shree Ganesh Sewa Samiti, 1990.
5. Rajasthan State Gazetteer, Land and People, Vol. I, Jaipur: Government of Rajasthan Publ., 1995.
6. Ratnawat, Shyam Singh and Sharma K.G., Essays on Bardic Literature, Jaipur: Rajasthan Study Centre.
7. History and Culture of Rajasthan ,Jaipur: Rajasthan Study Centre, 2004.
8. Sharma G.N. and Bhatnagar, V.S., Peasantry through the ages in Western India with special reference to Rajasthan, Jaipur: Rajasthan Study Centre, 1993.
9. The Historians and Sources of the History of Rajasthan, Jaipur: Rajasthan Study Centre, 1992.
10. Sharma, Dasharatha, Rajasthan through the Ages, Bikaner: Rajasthan State Archives Vol. I, 1966.
11. Sharma, G.N., Rajasthan ka Swatantrata Sangram ka Itihas, Bikaner: Rajasthan State Archives, 1991.
12. Social and Political Awakening among the Tribals of Rajasthan, Jaipur, Rajasthan Study Centre, 1986.
13. Shukla, D.C., Early History of Medieval Rajasthan, Varanasi: Bhartiya Vidya Prakashan, 1978.
14. Sinha-Kapoor, Nandini, State Formation in Rajasthan: Mewar during 7th to 15th century, New Delhi: Manohar, 2002
15. Tod, James, Annals and Antiquities of Rajasthan 2 Vols., New Delhi: Reprint, 1829-1832)
16. Vyas, R.P., Adhunik Rajasthan ka Virat Itihas, Jaipur: Rajasthan Hindi Granth Akadami, 1995.

An Outline of Indian Art History

L T P C

2 2 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale: Traversing through the domain of Indian artistic creations the objective of the paper is to familiarize the student with the manner in which interpretations of visual culture may impact understanding of the discipline of history and thereby the historical processes.

1. Historiography; European reactions to Indian art and architecture and the Nationalist response
2. Early Art Characteristics; Mauryan art, Debates; Traditions of Rock-cut Architecture
3. Urban milieu, gender and power relations during c.100 to c.300 CE art; Gandhara; Mathura Centres
4. Development of temple architecture; Paintings at Bagh and Ajanta
5. Formation of regional cultural identities during 6th-13th Centuries CE
6. Composite Art during Medieval India
7. Colonial Art; Contemporary Art
8. Folk and popular craft and art
9. Authorship and agency in art, the role of the artist; Rituals of power and patronage in art
10. Theories: Formalism, Positivism, Psychoanalytic, Structuralism, Multiculturalism

Suggested Readings:

1. Agrawala, Vasudev Sharan, Indian Art (A History of Indian Art from the earliest Times up to the third century AD, Vol.I, Varanasi: Prithivi Prakashan, 1965.
2. Banerjea, J.N., The Development of Hindu Iconography, New Delhi: Munshiram Manoharlal, 2002.
3. Brown, Percy, Indian Architecture (Buddhist and Hindu), Mumbai: D.B. Taraporewala Sons and Co., 1956.
4. Chandra, Pramod, ed., Studies in Indian Temple Architecture, Varanasi: American Institute of Indian Studies, 1975.
5. Coomaraswamy, Ananda K., History of Indian and Indonesian Art, New Delhi: Munshiram Manoharlal, 1972 reprint.
6. Dehejia, Vidya, Representing the Body, Delhi: Kali for Women, 1997.
7. Dehejia, Vidya, Early Buddhist Rock Temples: A Chronological Study, London: Thames and Hudson, 1972.
8. Dhaky, M.A., Meister, Michael et al., Encyclopaedia of Indian Temple Architecture, New Delhi: American Institute of Indian Studies.
9. Dhar, Parul, Pandya ed., Indian Art Historiography: Issues, Methods and Trends, New Delhi: D.K. Printworld and National Museum Institute, 2011.
10. Guha-Thakurta, Tapati, Monuments, Objects, Histories: Institutions of Art in Colonial and Postcolonial India, Permanent Black, Delhi, 2004.
11. Gupta, S.P., The Roots of India Art: A Detailed Study of the Formative (Mauryan and Later Mauryan) Period of Indian Art, 300 BC - 200 BC, New Delhi: B.R. Publishing Corp., 1980.
12. Hatt, Michael, Art History: A Critical Introduction to its Methods, Manchester: Manchester University Press, 2006.
13. Huntington, Susan L., The Art of Ancient India, New York, Tokyo: Weatherhill, 1985.
14. Misra, R.N., Ancient Artists and Art-Activity, Shimla: Indian Institute of Advanced Study, 1975.
15. Misra, Ramnath, Yaksha Cult and Iconography, Munshiram Manoharlal, 1981.

16. Mitter, Partha, *Much Maligned Monsters: History of European Reactions to Indian Art*, Oxford: Clarendon Press, 1977.
17. Miller, Barbara Stoler, ed., *The Powers of Art: Patronage in Indian Culture*, Delhi: Oxford University Press, 1992. (Introduction)
18. Ray, Amita, *Life and Art of Early Andhradesha*, Delhi: Agam Kala Prakashan, 1983.
19. Ray, Himanshu Prabha and Carla M. Sinopoli, eds., *Archaeology as History in Early South Asia*, New Delhi: Indian Council of Historical Research and Aryan Books International, 2004.
20. Ray, Niharranjan, *Maurya and Shunga Art*, 2nd edition, *Indian Studies: Past and Present*, Calcutta, 1965.
21. Sharma, Preeti, *Rock-Cut Architecture of South India: Architectural Perspectives*, New Delhi: Aryan Books International, 2015.
22. Sivaramamurti, C., *South Indian Bronzes*, New Delhi Lalit Kala Akademi, 1963.
23. Willis, Michael, *The Archaeology of Hindu Ritual: Temples and the establishment of the Gods*, New Delhi: Cambridge University Press, 2009.
24. Zimmer, Heinrich, *The Art of Indian Asia: Its Mythology and Transformations*, 2 vols. Completed and edited by Joseph Campbell, Bollingen Series, Vol.39, New York: Pantheon Books, 1955.
25. Verma, S.P., *Aspects of Mughal Painting: Expressions and Impressions*, New Delhi: Vedic Books, 2009.

Psychological Testing and Research Methodology

L T P C

6 0 0 6

Max. Marks : 90

(CA : 30 + ESA : 60)

Objective: The basic purpose of this paper is to develop and understanding amongst students of basic Tests and techniques of psychological assessment and research methods and Designs used in psychological research.

Note: The paper will contain 10 questions having two questions from each unit. Candidates will be required to attempt five questions taking at least one question from each unit.

Exam Duration: 3 Hours

Total Marks: 90

Contact Hours: 6 hours/week

Semester Exam Marks: 60

Continuous Assessment: 30

Unit 1 Nature and Scope of Human assessment, Scaling Techniques: Psychological Scaling and Psychophysical Scaling. Assumption of Science, Characteristics of Scientific Method, Theory and fact, Nature of Psychological Research- Quantitative and Qualitative Research.

Unit 2 Nature and Types of Psychological tests and Techniques- Verbal, Performance, Individual/group, Personality, Achievement, Ability and Aptitude tests, Inventory, Rating scales, Checklists, Questionnaire, Objective and Projective techniques. Uses and Limitations of Psychological Tests. Precautions and Problems in test Administration, Controlling the use of Psychological Tests.

Unit 3 Principles of Psychological Test Construction- Item Analysis: Item Difficulty and Item Discrimination. Reliability and Validity: Meaning, Types and Comparison. Norms: Meaning, Types, and Comparison. Standardization of Test.

Unit 4 Assessment of General Ability, Special Ability and Assessment of Personality. Assessment in Educational Setup. Occupational tests and Assessment in Occupational setup. Socio-Cultural Factors in Psychological Assessment.

Unit 5 Experimental Designs- Pre test-Post Test Design, Factorial Design and Randomized Block Design. Sampling- Probability and Non-Probability Samples, Sample Size and Sample Errors. Problem, Hypothesis, Variables and Controls in Experiments, Analysis of Data and Report Writing.

Note: Experiential Learning:

The subject teacher could encourage students to plan some experiential learning activity from each topic. 5 Marks of Internal Assessment could be allotted to such activity.

Books Recommended:

1. Anastasi, A., & Urbina, S. (1997). Psychological Testing. NJ: Prentice Hall.
2. Ciminero, A.R. (1986). Handbook of behavioral assessment (Eds.). New York: John Wiley.
3. Dillon, R.F. (Ed.) (1997). Handbook on Testing, U.S.A.: Greenwood Press.
4. Freeman, F.S. (2008). Theory and practice of psychological testing. New Delhi: Oxford & IBH.
5. Kerlinger, F.N. (2008), Foundations of behavioural research. New Delhi: Surjeet Publications.
6. Kulkarni, S.S., & Puhan, B.N. (1988). Psychological assessment. In J. Pandey (ed.). Psychology in India: The state-of-the-Art, Vol. I. New Delhi: Sage.
7. Neuman, W.L. (1991). Social research methods: Qualitative and quantitative. Boston: Allyn & Bacon.
8. Nunnally, I.C. (1994). Psychometric theory. NY: McGraw Hill.
9. Puhan, B.N. (1982). Issues in Psychological Testing. Agra: National Psychological Corporation.
10. Salking, N.J. (1997). Exploring Research. NJ: Prentice Hall.
11. Whitley, Jr., B.E. (1997). Principles of Research in Behavioral Science. London & Toronto: Mayfield.

Clinical Psychology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completion of the course, the students will be able to:

- Identify how psychologists study human behavior and how this knowledge can be used to explain, predict, and influence behavior.
- Identify and critically evaluate psychological research methods.
- Explain various methods for collecting information from the client.
- Perform personality assessment by using various methods and approaches.

Section-A

1. Introduction to Clinical Psychology: Definition, Historical background, Separation of Clinical Psychology from related Professionals, Work Settings of Clinical Psychologists.
2. Psychological Models and Interventions: Biological, Psychoanalysis, Interpersonal, Humanism, Behavioral, Cognitive, Social, Clinical, Custodial, and Community.
3. Clinical Interviewing: Types of Clinical Interviews (Intake, Case History, Diagnostic Interview, Mental Status Exam and Crisis Interview), Interview with Children, Communication Strategies (Verbal, Non-verbal and Listening Skills).

Section-B

4. Psychological Assessment: Process of Psychological Assessment (Planning, Data Collection, Processing Assessment Data, Communicating Assessment Findings).
5. Intellectual and Educational Assessment: Intelligence (Definition, Theories and Measurement), Issues and Controversies (Correlates of IQ, Heritability of IQ, Malleability of IQ). Educational Assessment: Aptitude tests and Achievement tests.
6. Personality Assessment: Projective Methods (Rorschach, TAT, Projective Drawings), Self-Report Technique/Objective Methods (MMPI), NEO-Personality (Millon's Clinical Multi-axial Inventory). Behavioral Assessment: Concept, Traditional Approaches (Syndrome-based Diagnosis, Empirically based Classification and Traditional Psychodynamic Approaches), Behavioral Assessment Methods (Behavioral Interviews, Structured Interviews, Questionnaires, Behavior Rating Scales, Analogue Techniques, Self-Monitoring, Direct Observation, Psycho-physiological Recording Methods), Functional Analysis (Problem Description, Identifying Controlling Variables, Adaptive Significance of the Problem Behavior, Selection of Treatment, Evaluation of Treatment Progress and Outcome), Assessment of Dysfunctional Cognitions.

Section- C

7. Clinical Neuro-Psychology: Brain-behavior Relationship, Causes of Brain Dysfunction (Trauma, Cerebro-vascular Disease, Degenerative Diseases, Tumors, Chronic Alcohol abuse and Nutrition Deficits), Neuropsychological Assessment (Comprehensive Batteries, Individualized Neuropsychological Assessment).
8. Clinical Health Psychology: Concept, Models of illness and health (Biomedical, Bio-psycho-social), Behavior and Health, Illness (Diabetes mellitus, Headache, Cancer).

9. Forensic Psychology: Definition, Expert Witnesses, Psychology and Criminal Laws, Civil Commitment (Laws and Procedures), Child Abuse, Child Custody in Divorce.

Recommended Books:

1. Feltham, C. (1997). *Which Psychotherapy?* Thousand Oaks: Sage.
2. Hecker, J. E., & Thorpe, G. L. (2007). *Introduction to Clinical Psychology: Science, Practice & Ethics*. Dorling Kindersley Pvt. Ltd.
3. Jopfer, S. J. (1988). *Modern Clinical Psychology*. Delhi: C.S. Publication.
4. Kendall & Norton-Ford (1982). *Modern Clinical Psychology*. New York, Wiley.
5. Korchin, S. J. (2004). *Modern Clinical Psychology: Principal of intervention in the clinical and the community*. CBS Publication.
6. Shaffer, G. W., & Lazarus, R.S. (2007). *Fundamental concepts in Clinical Psychology*. Surjeet Publications.

Suggested E-learning Material:

- Contemporary Clinical Psychology
<http://www.al-edu.com/wp-content/uploads/2014/05/Plante-Contemporary-Clinical-Psychology.pdf>
- The Technique Of Psychotherapy https://www.israppsych.org/books/wp-content/uploads/2015/05/technique_of_psychotherapy.pdf
- Living With Chronic Depression: A Rehabilitation Approach <https://freepsychotherapybooks.org/psychotherapy/checkout/task-step/step-1>

Counseling Psychology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completion of the course the students will be able to:

- Summarize the process of counseling and its principles.
- Analyze the basic concept, approaches, history and trends in counseling.
- Explain implication of Indian and integrative approaches of counseling.
- Describe the counseling processes and its relationship involve in different classical and modern counseling therapies.

Section A

1. Counseling- Meaning & Nature, Distinction Between Counseling, Guidance & Psychotherapy, Goals of Counseling, Basic assumptions behind Counseling, Characteristics of Effective Counselors.
2. Approaches to Health and Wellness: Personal Characteristics Models, Psychological Health Models, Multi-Dimensional Health and Wellness Models.
3. History of and Trends in Counseling, Movement in India, Current trends in the Twenty-first century. Ethical issues in Counseling.

Section-B

4. Counseling Process and Relationship: Stages in Counseling Rapport Building, Assessment of client's problem and concerns, Mechanism of Entering, Maintaining, and Terminating Relationship.
5. Psychoanalytic & Existential Therapies: Classical & Modern, Transactional Analysis, Gestalt Counseling, Logo therapy & Reality Therapy
6. Behavior Therapies: Systematic Desensitization, Flooding, Aversive Therapy, Biofeedback Technique, Assertiveness Training
7. Cognitive & Humanistic Therapies: REBT, Beck's cognitive therapy, Roger's Client Centered Therapy

Section C

8. Indian Approach: Yoga and Meditation, Reality Therapy. Chemical Therapies: Drug Therapy, ECT and Psychosurgery.
9. Career Planning and Decision Making in Schools, Multicultural Counseling: Difficulties and issues, The Development of Clinical Mental Health counseling. Marriage, Couple, family, Feminist, Individual and Group counseling,
10. Integrative approaches: Expressive Arts, Narrative & Symbolism, eclectic Approach.

Recommended Books:

1. Brown, S. D., & Lent, R. W. (2000). *Handbook of Counseling Psychology* (3rd Ed.). John Willey & Sons, Inc.
2. Capuzzi, D., & Gross, D. R. (2008). *Counseling and Psychotherapy: Theories and Interventions*. Dorling Kindersley Pvt. Ltd.
3. Chaudhury, H. (1975). *Yoga Psychology*. In C. T. Tart (Ed.), *Transpersonal Psychologies*. London: Routledge & Kegan Paul.
4. Erford, B. T. (2007). *Assessment for Counselors*. Lahaska Press, Houghton Mifflin Company: New York.
5. Gibson, R.L. & Mitchell, M.H.(2005). *Introduction to Counseling and Guidance*. New Delhi: Pearson education

6. Gladding S.T. (2014) *Counselling: A Comprehensive Profession*. (7th Ed) Dorling Kindersley Pvt. Ltd. of Pearson Education. New Delhi, India.
7. Kakar, S. (1982). *Shamans, Mystics and Doctors: A Psychological Enquiry into India and its Healing Traditions*. Bombay: Oxford University Press.
8. Kottler J.A. and Shepard D.S. (2008). *Counselling theory and Practices*. Cengage learning India Pvt. Ltd. New Delhi
9. Pederson, P. B., Draguns, J.G., Lonner, W. J., & Trimble, J. (1996). *Counseling across Cultures*. Thousand Oaks: sage.
10. Rao, S.N. (2006). *Counselling and guidance* (2nd Ed). Tata McGraw-Hill Publishing Co. Ltd. New Delhi
11. West, M. A. (Ed.) (1987). *The Psychology of Meditation*. Oxford: Clarendon Press.

Suggested E-learning Material:

- How To Stop Worrying And Start Living , Dale Carnegie
http://www.coachcurran.com/media/Dale_Carnegie_How_To_Stop_Worrying_And_Start_Living.pdf
- Counseling Psychology www.researchgate.net/publication/16827917_Counseling_Psychology
- Module 2 Counselling http://www.unesco.org/education/mebam/module_2.pdf
- Guidance and Counselling <http://ncert.nic.in/textbook/pdf/lehe108.pdf>

Organisational Behaviour and Human Resource Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completion of the course, the students will be able to:

- Analyze challenges and issues of organizational behavior.
- Identify and apply the theories, principal and skills of organizational behavior and HRM.
- Compare and evaluate approaches and methodology of organizational behavior.
- Examine challenges of effective functions of HRM organizational communication.

Section A

1. Historical development of Organisational Behaviour: Contributions of Taylor, Weber, and Fayol. The Hawthorne Studies. Concept of OB: Definition, disciplines contributing to OB. Theoretical Framework: Cognitive, Behaviouristic and Social Cognitive.
2. Theories of Motivation: Content Theories - Maslow's Hierarchy of Needs, Herzberg's Two-factor Theory, Alderfer's ERG Theory. Process Theories- Vroom's Expectancy Theory, The Porter-Lawler Model. Contemporary Theories of Motivation- Equity theory of Work Motivation.
Employee Engagement: Job characteristics Model, Job Enrichment, Job Rotation, Ways of Motivating Employee.
3. Stress: Causes and strategies of Stress. Conflict: Individual and Interactive Conflict. Conflict Resolution Strategies. Causes and prevention of accidents.

Section B

4. Theories of Leadership: Trait, Behavioural, Contingency and Contemporary theories. Leadership styles and skills, Contemporary issues in leadership.
5. Organizational Culture: Definition of organizational culture, Types and Underlying Dimensions of Organisational Culture. Functions of Organizational Culture. Culture as a Liability. Creating and Sustaining Culture. Methods of learning culture.
6. Human Resource Development: Functions and goals of HRM, HRM in changing Environment. Planning: Definition and Process of Planning in Organizational Framework.
Assessment: Human Resource Management System, Replacement Charts, Demands and Supply of Labor.

Section C

7. Job Analysis: Definition and Methods, Steps in a job analysis, techniques of structured job analysis, Purpose of job analysis. Reward system: Monetary & Non-monetary Aspects of Reward System. Job Evaluation, Practices and Issues in Wage Payment.
8. Recruiting: Goals, Sources, alternatives.
Selection: Goals, Process Key elements for successful selection, Predictors: Reliability, Validity. Selection Devices.
Socialization Process.
9. Training and Development: Training Needs, Training Approaches, Concept of Employee Development. Employee Development Methods, Organization Development: Intervention Techniques. Evaluation of Effectiveness of Training and Development Program.

Recommended Books:

1. Aswathappa, K. (2005). *Human Resource Management*. New Delhi: McGraw Hill.
2. Beardwell, I. & Holden, L. (1996). *Human resource management: A contemporary perspective*. New Delhi: Macmillan India Ltd.
3. Beer, M., Spector, B. (1988). *Resources Development*. London : Free Press
4. Bhatia, S.K., & Singh, N. (2000). *Principal techniques of personnel management/human*
5. Blum, N. L. & Naylor, J. C. (2004). *Industrial Psychology: Its Theoretical and Social Foundations*. New Delhi: CBS Publications.
6. Costley, D.L. (1994). *Human Relations in Organizations*. NY: West.
7. Davis, K. & Newstrom, J.W. (1989). *Human behavior at work : Organizational behavior*. NY: McGraw-Hill.
8. DeCenzo, D.A., & Robbins, S.P. (1999). *Human resource management* (6thed.). New York: John Wiley.
9. Dessler, G. (2004) *Human Resource Management* (10th ed.): Prentice Hall
10. Dwivedi, R. S. (2001). *Human Relations & Organizational Behaviour*: Macmillan India Ltd.
11. French, W.H., & Bell, C.H. (1995). *Organizational development*. ND: Prentice Hall.
12. Greenberg, J. & Baron, R.A. (2005). *Behavior in Organizations: Understanding and managing the human side of work*. Delhi: Pearson Education.
13. Hersey, P., Blanchard, K.H., & Johnson, D.E. (2006). *Management of Organizational Behavior*. Delhi: Pearson Education.
14. Johns, G. (1996). *Organizational Behaviour* : Harper Collins College.
15. Jyoti P. & Venkatesh D.N. (2006). *Human Resource Management* : Oxford
16. Kanungo, R.N., & Mendonca, M. (1994). *Work Motivation: Models for Developing Countries*. ND: Sage.
17. Luthans, F. (2005). *Organizational Behavior*. Delhi: McGraw Hill.
18. Pareek U & Rao T. V. (2003) : *Designing and Managing Human Resource Development System*, Oxford and IBH Publishing Co. Pvt. Ltd.
19. Pareek U: (2002) *Training Instruments for HRD* : Tata McGraw Hill Publishing company Limited.
20. Pareek, U. (2004). *Understanding Organisational Behavior*. Delhi: Oxford University Press.
21. Pareek, U. Rao, T. V., & Pestonjee, D.M. (1981). *Behavioural processes in organizations*. ND: Oxford & IBH.
22. Prasad, L. M. (2013). *Organizational Behaviour*. Delhi: Sultan Chand & Sons.
23. Robbins, S.P. (2003). *Organizational Behavior*. Delhi: Pearson Education.
24. Schultz, D.P., & Schultz, S.E. (2004). *Psychology and Work Today: An Introduction to Industrial and Organizational Psychology*. Delhi: Pearson Education.

Suggested E-learning Material:

- Organizational Behaviour, Stephen P. Robbins & Timothy A. Judge, by Pearson Education, Inc., publishing as Prentice Hall
http://bba12.weebly.com/uploads/9/4/2/8/9428277/organizational_behavior_15e_-_stephen_p_robbins_timothy_a_judge_pdf_qwerty.pdf
- Organizational Behaviour, Luthans, McGraw Hill https://bdpad.files.wordpress.com/2015/05/fred-luthans-organizational-behavior_-an-evidence-based-approach-twelfth-edition-mcgraw-hill_irwin-2010.pdf

- Organizational Behaviour, V.G.Kondalkar http://www.damits.ac.in/library_doc/Organizational_Behaviour.pdf
- Harvard Business Review, Magazine <https://hbr.org/topic/psychology>
- Organizational Behavior and Human Decision Processes <https://www.sciencedirect.com/journal/organizational-behavior-and-human-decision-processes>
- Annual Review of Organizational Psychology and Organizational <https://www.annualreviews.org/journal/orgpsych>
- Journal of Organization Behaviour Management, Taylor & Francis online <https://www.tandfonline.com/loi/worg20>

Positive Psychology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completion of the course, the students will be able to:

- Analyze the importance of positive emotions in well-being and mental health.
- Apply concepts of positive psychology for the development of positive values.
- Analyze the role and importance of positive relationships in the lives of human-beings.
- Synthesize the role of flexibility and complexity in intra- and interpersonal well-being.

Section- A

1. Introduction to Positive Psychology: Definition, Significance, History, Goals, Perspectives: Western and Eastern.
2. Principles of Pleasure: Concept of Affect, Distinguish between Positive & Negative Affect.

Happiness: Concept, Hedonic and Eudaimonic Happiness, Subjective Well-being (Hedonic base of Happiness), Self-Realization (Eudaimonic base of Happiness), Compare Hedonic and Eudaimonic views of Happiness.

Positive Emotions: Concept, Positive Emotions and Health Resources, Positive Emotions and Wellbeing, Cultivating Positive Emotions.

Sense of Humor: Concept, Cultivation and measurement of Sense of Humor.

3. Positive Relationships: Concept of Attachment, Types and Adult Attachment.

Love: Concept, Typologies, Triangular Theory of Love, Self-Expansion Theory.

Flourishing Relationships.

Section- B

4. Prosocial Behavior: Concept of Altruism, Egotism Motive, Empathy Motive and Empathy-Altruism Hypothesis, Genetic & Neural foundations of Empathy, Cultivating Altruism, Measuring Altruism.

Gratitude: Concept, Cultivating, Measuring Gratitude, Psychophysiological foundations of Gratitude. Forgiveness: Concept, Cultivating, Measuring, Evolutionary and Neurological bases of Forgiveness.

5. Positive Cognitive States & Processes-

- a) Self-Efficacy: Concept, Neurobiology of Self-Efficacy, Measuring Self-Efficacy, Collective Self-Efficacy.
- b) Optimism: Concept, Measuring, Learned Optimism, Neurobiology of Learned Optimism, Measuring Learned Optimism.
- c) Hope: Concept, Neurobiology of Hope, Measuring Hope, Collective Hope. Resilience: Concept, Perspectives, Skills & Applications.
- d) Wisdom: Concept, Theories, Developing Wisdom, Measurement of Wisdom.
- e) Courage: Concept, Theories, Becoming Courageous, Measurement, Relationship between Fear & Courage.

Section- C

6. Mindfulness: Concept, Benefits of Mindfulness.

Flow: Flow State, Autotelic Personality, Fostering Flow. Spirituality: Indian & Western View, Benefits of Spirituality.

7. Positive Institutions: Positive Parenting, Skills of Positive Parenting.

Positive Schooling: Goals, Components and Skills. Organization (Work Place): Goals, Strengths.

Religion: Goals, Strengths.

8. Betterment of Communities-

Individualism: History, Emphases in Individualism.

Collectivism: History, Emphases in Collectivism.

ME/WE Balance.

Recommended Books:

1. Aspinwall, L. G. & Staudiger, U. M. (2002). *A Psychology of human strengths: Fundamental questions and future directions for a positive psychology*. Washington, (Eds.)
2. Averill, J. R. & Nunley, E. P. (1992), *Voyages of the heart: Living an emotionally creative life*. New York: Free Press.
3. Baltes, P. B. (2005). *Wisdom: The orchestration of mind and character*. Boston: Basil Blackwell.
4. Baumgardner, S. R. & Crothers, M. K. (2009). *Positive Psychology*. New Delhi: Dorling Kindersley.
5. Branden, N. (1994). *The six pillars of self-esteem*. New York: Bantam Books.
6. Buchanan, G. and Seligman, M.E.P. (1995). *Explanatory Style* (Eds.). Hillsdale, N.J.: Erlbaum.
7. Buckingham, M. & Clifton, D. O. (2001). *Now, discover your strengths*. New York: Free Press.
8. Carr, A. (2007). *Positive Psychology: The science of happiness and human strength*. Routledge Taylor & Francis group London, New York.
9. Csikszentmihalyi, M. (1990). *Flow: The psychology of optimum experience*. New York: Harper & Row.
10. Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. New York: Harper Collins.
11. DC: American Psychological Association.
12. Gillham, J.E. (2000). *The Science of Optimism and Hope: Research Essays in Honor of Martin* (Ed.) E. P. Seligman. Radnor, PA: Templeton Foundation Press.
13. Linley, P. A. & Joseph, S. (2003). *Positive psychology in practice*. (Eds.) Hoboken, NJ: Wiley.
14. Lopez, S. & Snyder, C. R. (2003). *Positive psychological assessment: A handbook of models and measures* (Eds.). Washington, DC: APA.
15. McCullough, M. E. Pargament, K. I. & Thoresen, C. E. (2000). *Forgiveness: Theory, research, and practice* (Eds.). New York: Guilford Press.
16. McDermott, D., & Snyder, C. R. (1999). *Making hope happen: A workbook for turning possibilities into realities*. Oakland, CA: New Harbinger Publication.
17. McDermott, D., & Snyder, C. R. (2000). *The great big book of hope*. Oakland, CA: New Harbinger Publications.
18. Peterson C, & Seligman, M.E.P. (2004). *Character Strengths and Virtues A Handbook and Classification*. Washington, D.C.: APA Press and Oxford University Press.
19. Peterson, C. (2006). *A primer in Positive Psychology*. New York: Oxford University.
20. Saarni, C. (1999). *Developing emotional intelligence*. New York: Guilford.
21. Seligman, M. E. P. (1999). *Learned optimism*. NY: Knopf.

22. Seligman, M. E. P. (2002). *Authentic happiness: Using the new positive psychology to realize your potential for lasting fulfillment*. NY: Free Press.
23. Seligman, M. E. P., Reivich, K., Jaycox, L., & Gillham, J. (1995). *The optimistic child*. NY: Houghton Mifflin.
24. Snyder, C. R. (2000). *Handbook of hope: Theory, measures, and applications*. San Diego, CA: Academic Press.
25. Snyder, C. R., & Lopez, S. J. (2002). *The handbook of positive psychology* NY: Oxford University Press.
26. Snyder, C. R., McDermott, D. Cook W., & Rapoff, M. (2002). *Hope for the journey: Helping children through the good times and the bad* (Rev. ed) Clinton Corners, NY: Percheron.
27. Snyder, C. R. & Lopez, S. J. (2009). *Positive Psychology: The scientific and practical explorations of human strengths*. Lawrence: Sage.
28. Snyder, C. R., & Lopez, S. J. (2009). *Positive Psychology*. Sage Publication India Pvt. Ltd.

Suggested E-learning Material:

1. Positive psychologist on positive psychology <https://www.pdfdrive.com/positive-psychologists-on-positive-psychology-e26890470.html>
2. Positive psychology in practice <https://www.pdfdrive.com/positive-psychology-in-practice-researchgate-e13947710.html>
3. Positive psychology <https://www.pdfdrive.com/positive-psychology-e33549648.html>

Psychopathology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completion of the course, the students will be able to:

- Apply various psychological theories to the conceptualization of individual with various mental disorders.
- Identify the major mental disorder throughout the life span.
- Describe the principles of the Diagnostic and Statistical Manual of Mental Disorders (DSM5).
- Discuss various research approaches used for the study of various mental problems.

Section-A

1. Introduction of Abnormal Psychology, Abnormal Behavior: Meaning, Incidence; Classification of Mental disorder: Need, Disadvantages, DSM-V, ICD-10.
2. Historical and contemporary views of abnormal behavior.
3. Models of Abnormal Behavior: Biogenic, Psychoanalytic, Humanistic and existential, Behavioral, Cognitive, Family systems, Multicultural perspectives, psychosocial causal factors.
4. Clinical Assessment: Basic Elements, Physical and Psychosocial Assessment; Ethical issues in assessment.
5. Research Approaches: Sources, Forming Hypotheses, Sampling and generalization, Methods: Experiments, Observational, Field studies, Single Subject Studies: case study, single subject experiment, Correlations.

Section-B

(Symptoms, Etiology and Treatment of the disorders)

6. Anxiety Disorders: Phobia, Generalized Anxiety Disorder (GAD), Panic disorder. Separation Anxiety Disorder, Selective Mutism, Specific Phobia, Social Anxiety Disorder, Panic Disorder, Agoraphobia, Substance/Medication-Induced Anxiety Disorder.
7. Obsessive-Compulsive and Related Disorders.
8. Trauma- and Stressor-Related Disorders.
9. Depressive Disorders.
10. Bipolar and Related Disorders.

Section-C

(Symptoms, Etiology and Treatment of the disorders)

11. Schizophrenia Spectrum and Other Psychotic Disorders.
12. Personality Disorders: Cluster A, B, C; Other Personality Disorders.
13. Dissociative Disorders: Dissociative Identity Disorder; Dissociative Amnesia.
14. Depersonalization/ Derealization Disorder; Other Specified Dissociative Disorder.
15. Unspecified Dissociative Disorder.
16. Somatoform.

Recommended Books:

1. Buss, A. H. (1999), *Psychopathology*. New York John Wiley.

2. Carson, R. C., Butcher, J. N., Mineka, S., & Hooley, J. M. (2015). *Abnormal Psychology (16th edition)*. Pearson, New Delhi.
3. Carson, R. C., Butcher, J. N., Mineka, S., & Hooley, J. M. (2006). *Abnormal Psychology (13th edition)*. Dorling Kindersley Pvt. Ltd.
4. Diagnostic Statistical Manual for Mental Disorders. (2013). *American Psychiatric Publishing*.
5. Korchin, S. J. (2004). *Modern Clinical Psychology*, Tokoyo. Harper International Edition.
6. Lamm, A. (1997), *Introduction to Psychopathology*. New York. Sage.
7. Sarason, I. G. & Sarason, B. R. (2006) *Abnormal Psychology: The problem of Maladaptive Behavior*. XI Edition, Prentice Hall of India.

Suggested E-learning Material:

- DSM-5

<https://psychiatryonline.org/pb-assets/dsm/update/DSM5Update2015.pdf>

- Abnormal Psychology

<https://www.pdfdrive.com/abnormal-psychology-e27099525.html>

Clinical

<https://www.pdfdrive.com/clinical-psychology-e19366899.html>

Psychology

Advanced Quantitative and Qualitative Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completion of the course, the students will be able to:

- Explain research process and its fundamental steps in terms of hypothesis, problem and variables.
- Discuss quantitative and qualitative analysis techniques for analyzing and interpretation of psychological data.
- Discuss and explain the concept of research design and its types in terms of between and within group design.
- Illustrate factorial, correlational and regression analysis.

Section A

1. Research Problem, Hypotheses, Variables and Operationalization.
2. Methods of Research: Experimental; Quasi-Experimental; Field Experiment; Field Studies; Ex-Post Facto; Survey, Case Study; Ethnographic Study.
3. Research Designs: Meaning, purpose, Principles. Between-group; Within-group design.

Section B

4. Quantitative Analysis: Conceptual Foundation, ANOVA: Concept; One-Way ANOVA; Two-Way ANOVA; Three-Way; Concept of MANOVA; ANCOVA.
5. Factorial Analysis; Discriminant Analysis.
6. Correlational Analysis; Regression Analysis.

Section C

7. Qualitative Analysis: Conceptual Foundation; Phenomenology; Interpretative. Phenomenological Analysis; Grounded Theory; Narrative Analysis; Conversation Analysis; Discourse Analysis.

Recommended Books:

1. Breakwell, G. M., Hammond, S., & Fife-Schaw, C. (2000). *Research methods in psychology* (2nd Ed.). London: Sage Publications.
2. Broota, K. D. (1989). *Experimental designs in behavioural research*. New Delhi: Wiley Eastern.
3. Corbin, J. & Strauss, A. (2008). *Basics of Qualitative Research*. USA: Sage.
4. Gliner, J. A., Morgan, G. A., & Leech, N. L. (2009). *Research methods in applied settings* (2nd Ed.). New York: Routledge.
5. Gravetter, F. J. & Forzano, L. B. (2006). *Research Methods for behavioural sciences*. Singapore: Thomson-Wadsworth.
6. Howell, D. C. (2010). *Statistical Methods for Psychology*. Belmont: CA: Cengage Wadsworth.
7. Silverman, D. (2012). *Qualitative Research* (3rd ed.). South Asia: Sage.
8. Smith, J. A. (2008). *Qualitative Psychology: A practical guide to research methods*. London: Sage.

Suggested E-learning Material:

1. Research Design: Quantitative, Qualitative and Mixed methods

https://www.pdfdrive.com/john-w-creswell-research-design_-qualitative-quantitative-and-mixed-methods-approaches-e24960021.html

2. Social Research Methods: Quantitative and Qualitative approaches

<https://www.pdfdrive.com/social-research-methods-qualitative-and-quantitative-approaches-e19744746.html>

3. Qualitative Research Methods

<https://www.pdfdrive.com/qualitative-research-methods-e18822833.html>

Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Acquaint with the general characters and classification of cryptogams and phanerogames.
- Understand the evolutionary relationship among lower to higher plant species with differentiating characteristics.
- Appreciate and understand economic importance and application of every group of plants.

Unit 1

- Algae: Classification, general account with special reference to *Anabaena*, *Oscillatoria*, *Volvox*, *Chara*, *Oedogonium*, *Ectocarpus*, *Polysiphonia*. Economic importance of algae.

Unit 2

- Fungi: Classification, general account with special reference to *Albugo*, *Aspergillus*, *Puccinia*, *Ustilago* and *Alternaria*. Economic importance of fungi.

Unit 3

- Bryophytes: Classification, general account with special reference to important features in the life cycles of *Riccia*, *Marchantia*, *Anthoceros* and Mosses: *Funaria*, *Sphagnum*.

Unit 4

- Pteridophytes: Classification, general account, evolution of stelar systems, apospory, apogamy and seed habit. Outline of life cycle of *Selaginella*, *Equisetum* and *Marsilea*.

Unit 5

- Gymnosperms: Classification and evolution, distribution with special reference to Indian gymnosperms. Special features in life cycle of *Cycas*, *Pinus* and *Ephedra*. Economic importance.

Suggested Books:

- Alam, A. (2015). *Text book of Bryophyta*. New Delhi: I K International Publishers.
- Alexopoulos, C. (1979). *Introductory Mycology*. New York: John Wiley & Sons.
- Bhatia, K. (1975). *A Treatise on Algae*. New Delhi: S. Chand & Company.
- Biswas, C., & Johri, B.M. (2010). *Gymnosperm*. Springer-Verlag Berlin and Heidelberg GmbH & Co. KG
- Chamberlain, C.J. (1919). *Morphology of Gymnosperms*. Allahabad: Central Book Depot.
- Chapman, V.J. (2013). *An Introduction to the Study of Algae*. UK: Cambridge University Press.
- Dubey, H.C. (2011). *Introduction to Fungi*. India: Vikas Publishing House.
- Dutta, S.C. (1967). *Introduction to Gymnosperms*. Asia Publishing House.
- Ganguli, H.C., Das, K.S., & Dutta C. (2011). *College Botany Vol. I*. India: New Central Book Agency.
- Kumar, H.D. (1999). *Introductory Phycology*. New Delhi: Affiliated East-West.
- Parihar, N.S. (1956). *Bryophyta Pteridophyta*. Allahabad: Central Book Depot.
- Rashid, A. (1999). *An Introduction to Pteridophyta*. New Delhi: Vikas publications.
- Saxena, S. (2000). *A text book of Botany (Vol. I & II)*. Agra: Ratan Prakash Mandir.
- Sharma, O.P., & Gupta, R.C. (2010). *Text Book of Fungi*. IBH. New Delhi, India: Vedams eBooks (P) Ltd.

- Sporne, K.R. (1966). *Morphology of Pteridophytes*. London: Hutchinson University Library.
- Vashistha, B.R., & Sinha, A.K. (2010). *Botany for Degree Students-Algae*. New Delhi: S. Chand Publication.
- Vashistha, B.R., & Sinha, A.K. (2016). *Botany for Degree Students-Fungi*. New Delhi: S. Chand Publication.
- Vashistha, B.R., Sinha, A.K., & Kumar, A. (1987). *Botany for Degree classes- Gymnosperms*. New Delhi: S. Chand Publication.
- Vashistha, B.R., Sinha, A.K., & Kumar, A. (2010). *Botany for Degree Students-Bryophyta*. New Delhi: S. Chand Publication.
- Vashisthai, B.R., & Vashistha, P.C. (1987). *Botany for Degree Students Pteridophyta*. New Delhi: S. Chand Publication.
- Webster, J., & Weber, R. (2007) *Introduction to Fungi*. New York: Cambridge University Press.

Suggested e-Resources:

- **Bryophytes: General account, classification and structure**
<http://nsdl.niscair.res.in/jspui/bitstream/123456789/150/1/BRYOPHYTES%20.pdf>
- **Gymnosperms**
<http://www.plb.ucdavis.edu/courses/bis/1c/text/Chapter24nf.pdf>
- **Pteridophytes**
<http://nsdl.niscair.res.in/jspui/bitstream/123456789/556/1/PTERIDOPHYTES%20april609%20-%20formatted.pdf>

Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Identify bryophyte and pteridophyte.
 - Interpret the characteristics & life cycles of various lower plants.
 - Learn about practical technique in lab for detail study of plant structure, anatomy and reproduction.
1. Study of algae and fungi as mentioned in the syllabus (museum specimen of the affected plants and permanent prepared slides).
 2. Study of vegetative and reproductive parts in *Selaginella*, *Equisetum* and *Marsilea*.
 3. Study of vegetative and reproductive parts in *Riccia*, *Marchantia*, *Anthoceros* and *Funaria* by the preparation of temporary slides.
 4. Gymnosperms: Study of *Cycas* (coralloid root, rachis, leaflet, male cone, megasporophyll), *Pinus* (needle, dwarf shoot, long shoot, male cone, female cone) *Ephedra* (morphology, stem, male cone, female cone) by the preparation of temporary slides.

Suggested Books:

- Bendre, A., & Kumar, A. (2009). *A Textbook of Practical Botany- I*. Meerut: Rastogi Publications.

Taxonomy, Classification and Evolution

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Gain fundamental understanding of the taxonomy and systematics.
- Describe salient features and classification of major phyla of invertebrates and protochordates.
- Develop a better understanding about classical and modern theories of evolution along with factors affecting evolution and detail of evolution of man, camel and horse.

Unit 1

- Basic concept of taxonomy and systematics: Terms, definition, contribution and role of systematics.
- Zoological classification: International code of zoological nomenclature, principles of nomenclature, kinds of classification, Linnaean hierarchy.

Unit 2

- Distinguishing characters and classification up to orders (excluding extinct forms) of the followings:
- Lower non-chordates (protozoa, porifera, coelenterata, platyhelminthes & nematods).
- Higher non-chordates (annelida, arthropoda, mollusca and echinodermata).
- Protochordates.

Unit 3

- Lamarckism, Neo Lamarckism, Darwinism and Neo Darwinism.
- Theory of mutation with special reference to chromosomal aberrations and gene mutations.
- Modern synthetic theory of evolution.

Unit 4

- Evidences in favour of organic evolution.
- Role of variations, adaptation, speciation and isolation in the process of evolution.
- Fossils: Formation of fossils, kinds of fossils, significance of the study of fossils.

Unit 5

- Genetic basis of evolution including Hardy-Weinberg's law.
- Geological time scale and the distribution of animals in time and space.
- Evolution of man, horse and camel.

Suggested Books:

- Arora, M.P. & Arora, H. (2013). *A Textbook of Organic Evolution*. New Delhi: Himalaya Publishing House.
- Chaki, K.K., Kundu, G. & Sarkar, S. (2016). *Introduction to General Zoology Vol-II*. Kolkata: New Central Book Agency.
- Ghoshe, K.C. & Manna, B. (2012). *Fundamentals of Zoology*. Kolkata: New Central Book Agency.
- Kapoor, V.C. (2018). *Theory & Practice of Animal Taxonomy and Biodiversity* (8th ed.). New Delhi: CBS Publishers & Distributors.
- Kotpal, R.L. (2014). *Modern Textbook of Zoology: Invertebrates* (11th ed.). Meerut: Rastogi Publications.

- Mayr, E. & Ashlock, P.D. (1991). *Principles of Systematic Zoology* (2nd ed.). New Delhi: McGraw-Hill College.
- Nigam, H.C. (2013). *Biology of Non-Chordates*. New Delhi: Vishal Publishing Co.
- Prasad, S.N. & Kashyap, V. (2012). *A text book of Invertebrate Zoology* (14th ed.). New Delhi: New Age International (P) Limited.
- Rastogi, V.B. (2016). *Organic Evolution* (1st ed.). Medtech.

Suggested e-Resources:

- **Taxonomy & classification**
<http://www.austincc.edu/sziser/Biol%201413/LectureNotes/lnexamI/taxonomyClassification.pdf>
<http://www.iaszoology.com/zoological-nomenclature/>
- **Evolution**
<http://www.iaszoology.com/category/evolution/>
- **Origin of life**
<https://nptel.ac.in/courses/122103039/10>
- **Chromosomal mutations**
<http://www.wou.edu/~guralnl/311Chromosomal%20Mutations.pdf>
<https://facultystaff.richmond.edu/~lrnyenj/bio554/lectnotes/chapter9.pdf>
- **Invertebrate phyla**
<https://www.slideshare.net/godhxbwnkkdn/animal-diversity-zoology-notes>
- **Geological time scale**
<http://geoscience.msc.sa.edu.au/library/3-3%20Geological%20Timescale.pdf>

Taxonomy, Classification and Evolution Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Identify and characterize different organisms of major phyla of non chordates based on the morphology.
- Understand the internal structures of lower non chordates through microscopic study of prepared slides.
- Understand the anatomy of *Fasciola*, *Pheretima* and *Unio* with the help of charts.
- Learn the technique of preparation of permanent slide.
- Apply acquired knowledge for the preparation of phylogenetic tree of invertebrates.

1. Study of museum specimens:

- Porifera: *Sycon*, *Hyalonema*, *Euspongia*.
- Coelenterata: *Porpita*, *Velella*, *Gorgonia*, *Pennatula*, *Alcyonium*, *Adamsia*.
- Platyhelminthes: *Fasciola*, *Echinococcus*.
- Nematelminthes: *Dracunculus* and *Enterobius*.
- Annelida: *Pheretima*, *Aphrodite*, *Terebella*, *Pontobdella*
- Arthropoda: *Lepus*, *Sacculina*, Crab, Hermit crab, *Melanopus*, Queen-termite, *Limulus* and *Peripatus*.
- Mollusca: *Chiton*, *Aplysia*, *Dentalium*, *Mytilus*, *Teredo*, *Sepia*, *Loligo*.
- Echinodermata: *Asterias*, *Holothuria*, *Echinus*, *Clypeaster*.
- Protochordata: *Ascidia*, *Botryllus*.

2. Study of microscopic slides:

- Protozoa: *Euglena*, *Plasmodium*, *Opalina*, *Nyctotherus*, *Vorticella*, *Balantidium*, *Foraminiferous* shells.
- Porifera: W.M. of *Leucosolenia*, Sponge gemmule.
- Coelenterata: *Hydra*, *Obelia* medusa.
- Platyhelminthes: W.M. of *Planaria*, W.M. of scolex, gravid proglottid, onchosphere and bladder worm of *Taenia*, T.S. of the proglottid of *Taenia*.
- Nematelminthes: T.S. through the body of male and female *Ascaris*.
- Annelida: T.S. of *Hirudinaria* through jaws, pharynx and crop region.
- Arthropoda: Male and female *Drosophila*, sex comb of *Drosophila*.
- Mollusca: V.S. of molluscan shell, T.S. of gill of *Pila*, radula of *Pila*.
- Echinodermata: T.S. through the arm of *Asterias*, *Pedicellaria* of *Asterias*.
- Hemichordata: W.M. of tornaria larva.
- Protochordata: W.M. of *Pyrosoma*, *Doliolum* and *Oikopleura*.

3. Anatomy:

- Anatomical study of various systems with the help of chart/model/CD.

Fasciola hepatica

1. Digestive system
2. Excretory system
3. Reproductive system

Pheretima posthuma

1. Digestive system
2. Nervous system
3. Reproductive system

Unio

1. Digestive system
2. Nervous system

4. Organization and working of optical microscope: Dissecting and compound microscopes.

5. Preparation of permanent slides:

- Protozoa: *Euglena*.
- Porifera: Sponge spicules.
- Coelenterata: *Hydra* with extended tentacles, *Hydra* with bud.
- Annelida: Setae of earthworm, Parapodium of *Nereis*.
- Arthropoda: Statocyst of *Palaemon*, *Cyclops*, *Mysis* and *Daphnia*.
- Mollusca: Radula of *Pila*.
- Echinodermata: Pedicellaria.

6. Collection and culture methods

- (i) Collection of animals from their natural habitat: *Amoeba*, *Paramecium*, *Euglena*.
- (ii) Culture of *Paramecium* in the laboratory and study of its structure, life processes and behavior in live state.

7. Preparation of phylogentic tree/cladogram of invertebrates including minor phyla.

8. Preparation of permanent mount of mouth parts of mosquito.

9. Study the evidences of evolution (Analogy and homology) through charts/ models.

Suggested Books:

- Lal, S. S. (2015). *Practical Zoology Invertebrates* (11thed.). Meerut: Rastogi Publication.
- Verma, P. S. (2010). *A Manual of Practical Zoology: Invertebrates* (11thed.). New Delhi: S Chand Publishing.

Angiosperm Anatomy, Embryology and Tissue Culture

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Gain knowledge of plant cells, tissues and their functions.
- Identify and compare structural differences among different taxa of vascular plants.
- Correlate anatomical structure with ecological adaptation of plants for survival under drought, salinity & aqueous environment.

Unit 1

- Angiosperm: Tissues, structure and function.
- Meristematic and permanent tissues, simple, complex and secretory tissue.
- Anamalous secondary growth in stem and roots: *Boerhaavia*, *Bignonia*, *Salvadora*, *Nycatanthes*, *Dracaena* and *Aristolochia*.

Unit 2

- Ecological Anatomy: General adaptations of Hydrophytes, Xerophytes and Halophytes.
- Anatomical adaptations of Hydrophytes: *Hydrilla*, *Nymphaea*.
- Anatomical adaptation of Xerophytes: *Calotropis*, *Nerium*, *Capparis*.
- Halophytes: Mangrove plants- *Rhizophora*, *Avicennia*.

Unit 3

- Angiosperm Embryology: Structure and development of culture, male gametophyte, ovule.
- Monosporic, bisporic and tetrasporic types of embryo sacs (one example each of *Polygonum*, *Allium* and *Adoxa*).
- Pollination and Fertilization.

Unit 4

- Experimental Embryology: Apomixis, Agamospermy and Apospory, Parthenocarpy.
- Adventive embryony.
- Control of fertilization.
- Endosperm and embryo development.

Unit 5

- Tissue culture: Basic techniques-sterilization and media preparation.
- Concept of totipotency.
- Protoplast isolation and culture; somatic hybridization; anther, embryo and organ culture.
- Tissue culture as a technique in regeneration of plants and its role in Industry.

Suggested Books:

- Bhojwani, S.S., Bhatnagar, S.P., & Dantu, P.K. (2014). *The embryology of Angiosperms* (6th ed.). Vikas Publishing House Pvt. Ltd.

- Eames, A.J. (1961). *Morphology of the Angiosperms*. New York: McGraw Hill.
- Eames, A.J., & MacDaniels, L.H. (1947). *Introduction to Plant Anatomy*. New York: McGraw Hill.
- Fahn, A. (1997). *Plant Anatomy*. New Delhi: Aditya Books (Pvt) Ltd.
- Kumar, V. (2011). *Methods in Plant tissue culture* (3rd ed.). Jodhpur: Agrobios.
- Maheswari, P. (1950) *Introduction to the Embryology of Angiosperms*. New York: McGraw Hills.
- Pandey, B.P. (2018). *A Text Book of Botany: Angiosperms Taxonomy, Anatomy and embryology*. New Delhi: S Chand and Company Ltd.
- Pandey, S.N., & Chadha, A. (2007). *Plant Anatomy and Embryology*. New Delhi: UBS publishers and distributors Pvt. Ltd.
- Razdan, M.K. (2018). *Introduction to Plant Tissue Culture*. New Delhi: CBS Publishers and Distributors Pvt. Ltd.
- Tayal, M.S. (2004). *Plant Anatomy*. Meerut: Rastogi Publication.

Suggested e-Resources:

- **Plant tissues types, structure and functions**
http://edudel.nic.in/PAHAL/biology_260309/biology_dt_270309.pdf
<http://lib.du.ac.ir/documents/10157/60298/Anatomy+of+Flowering+Plants.pdf>
- **Secondary anomalous structures**
<http://www.biologydiscussion.com/anatomy/anatomy-of-anomalous-dicot-stems-botany/56969>
- **General account of angiosperms**
<http://www.nhptv.org/natureworks/nwep14f.htm>
- **Secondary growth**
<http://egyankosh.ac.in/bitstream/123456789/16401/1/Unit-10.pdf>
- **Embryology of angiosperms**
krishikosh.egranth.ac.in/bitstream/1/2023583/1/BPT10611.pdf
- **Plant tissue culture techniques**
<https://nptel.ac.in/courses/102103016/4>
- **Introduction to plant tissue culture**
http://shodhganga.inflibnet.ac.in/bitstream/10603/110292/12/12_chapter%202.pdf

Angiosperm Anatomy, Embryology and Tissue Culture Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Detailed knowledge of angiosperm families and plant adaptations in different environment.
 - Understanding plant tissue culture and preparation of MS medium for in vitro culture of plants.
1. Vegetative structure of hydro - and xerophytes (ecological anatomy of *Calotropis*, *Capparis*, *Nerium*, *Hydrilla* and *Nymphaea*).
 2. Anamolous secondary growth in stem/root of angiosperms (*Boerhaavia*, *Bignonia*, *Salvadora*, *Aristolochia*, *Nyctanthes* and *Dracaena*).
 3. Slides and models on embryology.
 4. MS media preparation
 5. Embryo culture.

Suggested Books:

Bendre, A., & Kumar, A. (2010). *A Textbook of Practical Botany*- II. Meerut: Rastogi Publications.

Non-Chordates and Proto-Chordates

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Describe the habit, habitat, morphology, structure and functions of important animals of different major phyla of invertebrates and lower chordates.
- Understand the economic importance of various invertebrate phyla and affinities of lower chordate animals.
- Gain a high degree of competence in its field of specialization in response to the changing demands of the times.

Unit 1

Protozoa

- Habitat, habits, external features, locomotion, osmoregulation, nutrition, reproduction and life cycle of *Euglena*, *Paramecium* and *Monocystis*.
- Economic importance of protozoans.

Porifera

- Habitat, habits, structural organization, canal system, reproduction and development of *Sycon* including evolution of canal system in sponges.
- Economic importance of sponges.

Unit 2

Coelenterata

- Habitat, habits, external features, nutrition, structural organization, reproduction and life cycle of *Obelia*.
- Corals and coral reefs.

Helminthes

- Habitat, habits, external features, different systems and life history of following animal types: *Fasciola*, *Taenia* and *Ascaris*.
- Parasitic adaptations and diseases caused by helminthes.

Unit 3

Annelida

- Habitat, habits, external features, different systems and development of *Pheretima*.
- Habitat, habits, external features and life history of *Neanthes*.

Arthropoda

- Habitat, habits, external features and different systems of *Palaemone*.
- Economic importance of insecta.

Unit 4

Mollusca

- Habitat, habits, external features, various organs and organ systems of *Pila* and *Unio*; pearl formation.
- Economic importance of mollusca.

Echinodermata

- Habitat, habits, external features and water-vascular system of *Asterias*.

- Larval forms of echinoderms.

Hemichordata

- Habitat, habits, external features and different system of *Balanoglossus*.
- Affinities of hemichordates.

Unit 5

Urochordata

- Habitat, habits, structural organisation and various systems of *Herdmania*.
- Tadpole larva and retrogressive metamorphosis in *Herdmania*.

Cephalochordata

- Habitat, habits, morphology, different systems and affinities of *Amphioxus*.
- Development of coelom and atrium of *Amphioxus*.

Suggested Books:

- Chaki, K.K., Kundu, G. & Sarkar, S. (2014). *Introduction to Economic Zoology*. Kolkata: New Central Book Agency.
- Chaki, K.K., Kundu, G. & Sarkar, S. (2015). *Introduction to General Zoology Vol-I*. Kolkata: New Central Book Agency.
- Dhami P.S. & Dhami, J.K. (2015). *Invertebrate Zoology*. New Delhi: R. Chand and Co.
- Hyman, L.H. *The Invertebrates*. Vol-I-IX. New York: McGraw Hill.
- Jordan, E.L. & Verma, P.S. (2018). *Invertebrate Zoology*. New Delhi: S. Chand & Company Ltd.
- Kotpal, R.L. (2014). *Modern Textbook of Zoology: Invertebrates* (11th ed.). Meerut: Rastogi Publications.
- Kotpal, R.L. (2018). *Modern Text book of Zoology: Vertebrates* (4th ed.). Meerut: Rastogi Publications.
- Lahiri, B.K. (2013). *College Zoology Vol-I*. Mumbai: Himalaya Publishing House.
- Majumuria, T.C. (1962). *A textbook of invertebrate Zoology* (1st ed.). Jullundur City: S. Nagin Publishers.
- Nigam, H.C. (2013). *Biology of Non-Chordates*. New Delhi: Vishal Publishing Co.
- Pechenik, J.A. (2015). *Biology of the Invertebrates* (7th ed.). New Delhi: Mc Graw Hill Education.
- Prasad, S.N. & Kashyap, V. (2012). *A Textbook of Invertebrate Zoology* (XIV Ed.). New Delhi: New Age International (P) Limited.
- Rastogi, V.B. (2017). *Invertebrate Zoology*. Meerut: Kedar Nath Ram Nath.
- Shukla, G.S. & Upadhyay, V.B. (2017). *Economic Zoology* (5th ed.). Meerut: Rastogi Publication.

Suggested e-Resources:

- **Corals**
<https://www.icriforum.org/about-coral-reefs/what-are-corals>
- **Paramecium**
<https://www.microscopemaster.com/paramecium.html>
- **Prawn**
<http://www.biologydiscussion.com/invertebrate-zoology/phylum-arthropoda/study-notes-on-prawn/33417>
- **Amphioxus**
https://embryology.med.unsw.edu.au/embryology/index.php/Book_-_Text-Book_of_Embryology_4
- **Invertebrate animals**
<http://www.iaszoology.com/category/animal-diversity-nonchordata/>
- **Non chordate animals**
<https://www.slideshare.net/godhxbwnkkdn/animal-diversity-zoology-notes>
<http://abacus.bates.edu/acad/depts/biobook/AnimPhyl.pdf>

Non-Chordates and Proto-Chordates Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Identify and characterize different organisms of invertebrate based on the external features.
- Describe different organ systems of important invertebrate animals like *Palaemon*, *Pila* and *Asterias*.
- Gain practical understanding of preparation of permanent slide and study of internal structures of higher invertebrate animals through microscopic study of prepared slides.
- Understand the collection of certain arthropods from their natural habitat and develop the skills of vermiculture.

1. Study of museum specimens:

- Porifera: *Euplectella*, *Chalina*, *Grantia* and *Spongilla*.
- Coelenterata: *Physalia*, *Aurelia*, *Millipora*, *Tubipora*, *Corallium*, *Antipathes* (black only), *Fungia* (mushroom coral).
- Platyhelminthes: *Schistosoma* and *Taenia*.
- Nematelminthes: Male and female *Ascaris*.
- Annelida: *Nereis*, *Chaetopterus*, *Sabella*, *Arenicola*, *Hirudinaria*.
- Arthropoda: *Balanus*, *Squilla*, *Julus*, *Scolopendra*, Locust, Butterfly, *Cimex*, Scorpion, Spider.
- Mollusca: *Patella*, *Cyprea*, *Pecten*, *Octopus*, Pearl oyster, *Nautilus*.
- Echinodermata: *Antedon*, *Clypeaster*, *Cucumara*, *Ophiothrix*.
- Hemichordata: *Balanoglossus*.
- Protochordata: *Ciona* and *Salpa*.

2. Study of microscopic slides:

- Protozoa: *Amoeba*, *Polystomella*, *Monocystis*, Binary fission and conjugation in *Paramecium*.
- Porifera: T.S. and L.S. of *Sycon*, Spicules of sponge, Canal system of sponge.
- Coelenterata: *Obelia*.
- Platyhelminthes: W.M. of miracidium, sporocyst, redia, cercaria and metacercaria larva of *Fasciola*.
- Annelida: T.S. of *Nereis* through trunk region, T.S. of *Pheretima posthuma* through gizzard, typhlosolar region, prostrate glands and seminal vesicles.
- Arthropoda: V.S. of compound eye, *Pediculus*.
- Mollusca: T.S. of gill of *Unio*, Glochidium larva.
- Echinodermata: Larval forms (Bipinnaria, Echinopluteus, Ophiopluteus).
- Hemichordata: T.S. of *Balanoglossus* through proboscis, collar and trunk region.
- Protochordata: W.M. velum and pharyngeal wall of *Amphioxus*, T.S. of *Amphioxus* through various regions; tadpole larva of *Ascidia*.

3. Anatomy:

- Anatomical study of various systems with the help of chart/model/CD.

Palaemon

1. Appendages
2. Digestive system

3. Nervous system

Pila globosa

1. Digestive system
2. Structure of radula
3. Nervous system

Asterias

1. Water vascular system

4. To study methods of preservation of museum specimens.

5. Preparation of permanent slides

- Protozoa: *Paramecium*.
- Porifera: Spongin fibers and gemmule.
- Coelenterata: *Obelia* colony and medusa of *Obelia*.
- Annelida: Parapodium of heteronereis.
- Arthropoda: Crustacean larva (nauplius, metanauplius, megalopa, Zoea).
- Mollusca: Glochidium larva of *Unio*.
- Echinodermata: Tube feet of *Asterias*.

6. Collection and culture methods

- (i) Collection of animals from their natural habitat: *Pheretima*, *Daphnia*, *Cyclops*, house flies, mosquitoes.
- (ii) Culture of *Pheretima*.

7. Preparation of permanent mount of mouth parts of cockroach/housefly.

Suggested Books:

- Lal, S.S. (2015). *Practical Zoology: Invertebrates* (11th ed.). Meerut: Rastogi Publication.
- Verma, P.S. (2010). *A Manual of Practical Zoology: Invertebrates* (11th ed.). New Delhi: S Chand Publishing.

Angiosperms Taxonomy and Economic Botany

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Identify characteristic features of angiosperm families and their interdisciplinary approaches Understand plant morphology terminologies and distinguishing features with morphological peculiarities.
- Know the economic importance of angiosperms and its use in various industries.

Unit-I

- International code of nomenclature for algae, fungi and plants- history, rules, principles. Concept of family, genus and species, citation of author's name.
- Numerical taxonomy and chemical taxonomy (brief ideas only).
- A brief account of national herbaria and botanical gardens of India.

Unit 2

- Classification: System of Bentham and Hooker, a brief account of classification by Engler and Prantl, Hutchinson and Takhtajan, merits and demerits.
- Study of following families with emphasis on their diagnostic features:
 - Ranunculaceae
 - Papaveraceae
 - Capparidaceae
 - Caryophyllaceae
 - Rutaceae
 - Myrtaceae
 - Malvaceae

Unit 3

- Study of following families with emphasis on their diagnostic features:
 - Cucurbitaceae
 - Rubiaceae
 - Asclepiadaceae
 - Apocynaceae
 - Asteraceae
 - Amaranthaceae
 - Acanthaceae
 - Solanaceae
 - Apiaceae
 - Lamiaceae
 - Euphorbiaceae
 - Brassicaceae
 - Fabaceae
 - Caesalpinaceae
 - Mimosaceae
 - Poaceae
 - Arecaceae

- Liliaceae

Unit 4

- Food plants: Maize, bajra, wheat, legumes, potato, sugarcane.
- Spices: General account (coriander, turmeric, chillies, *Cumin*, fennel, *Asafoetida*).
- Beverages: Tea and coffee.
- Fatty oils: Mustard, groundnut, sesame, coconut.

Unit 5

- Fibre plants: *Gossypium*, *Corchorus*, *Saccharaum munja*.
- Drug plants: *Cinchona*, *Rauwolfia*, *Papaver*, *Digitalis*.
- Timber plants: *Tectona*, *Dalbergia*, *Pinus*. Rubber: *Hevea brasiliensis*.

Suggested Books:

- Alam, A., & Sharma, V. (2012). *Economic Botany*. Jaipur: Pointer Publishers.
- Dutta, S. (2009). *A Hand Book of Systematic Botany*. New Delhi: New Age International (P) Limited.
- Khetrapal, Y.T. *An Introduction to the Taxonomy of Angiosperms*. Jaipur: Ramesh Book Depot.
- Kochhar, S.L. (2016). *Economic Botany of the Tropics*. London: Macmillan India Limited
- Kumar, A., & Bendra, A. (1983). *Economic Botany: for university students*. Meerut: Rastogi Publications.
- Lawrence, G.H.M. (2017). *Taxonomy of vascular plants*. Jodhpur: Scientific publisher
- Radford, A.R., & Caddell, G.M. (1986). *Fundamentals of Plant systematics*. USA: Harper & Row Publishers.
- Sharma, O.P. (2011). *Taxonomy of Angiosperm*. New Delhi: TATA McGraw-Hill.
- Singh, V., & Jain, D.K. (2010). *Taxonomy of Angiosperm*. Meerut: Rastogi Publication.
- Verma, V. (2010). *A text book of economic botany*. New Delhi: Emkay publications.

Suggested e-Resources:

- **Angiosperms: APG system of classification**
<https://academic.oup.com/botlinnean/article/181/1/1/2416499>
- **Angiosperms: Classification and reproduction**
<https://www.toppr.com/guides/biology/plant-kingdom/angiosperms/>
- **Economic botany**
<http://nsdl.niscair.res.in/jspui/bitstream/123456789/130/1/beverages.pdf>

Angiosperms Taxonomy and Economic Botany Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Develop skills for plant identification, with reference to systematic position, morphological characters, floral formula and floral diagram.
 - Diagnose the structural features of plant organs and differentiate microscopically their tissue elements.
 - Study fiber, gum, resin, timber, spices and medicinal plants and its applications.
1. Study of locally available plants of the families mentioned in the syllabus.
 2. Study of economically important plant products as mentioned in the syllabus.
 3. Preparation of herbarium.

Suggested Books:

Sahu, A.C. (2015). *Text book of Practical Botany*. New Delhi: Kalyani Publishers.

Cell Biology, Molecular Biology, Histology and Genetics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Understand the fundamental knowledge of cell and its organization.
- Describe the classification, structure and functions of carbohydrates, proteins and lipids.
- Understand the theoretical aspects of structure and location of various tissues and histology of various body organs.
- Describe the molecular structure and types of nucleic acids along with DNA replication and translation.
- Describe fundamental and molecular principles of genetics and human genetic traits.

Unit 1

- Definition of cell and molecular biology and the differences between the two sciences. Cell theory; morphology, size, shape and characteristics of prokaryotic and eukaryotic cells.
- Physical and biochemical makeup of protoplasm, formation of cell membranes and movement of protoplasm.
- Classification, structure and functions of carbohydrates, proteins and lipids. Classification, nomenclature and functions of enzymes. Structure and functions of vitamins and hormones.

Unit 2 Biological organization of cell:

- Plasma membrane, cell wall and endoplasmic Reticulum (rough and smooth)
- Structure and functions of mitochondria, golgi body and lysosomes.
- Nucleus, nucleolus and chromosomes with special reference to polytene and lampbrush chromosomes.

Unit 3

- An idea about the structure and location of epithelial and connective tissue; cartilage and bone.
- Histology of digestive organs and associated glands, blood vessels, trachea and lung.
- Histology of kidney, ovary, testis, vas deferens and oviduct.

Unit 4

- Occurrence, morphology, chemical composition, molecular structure, functions and replication of DNA.
- Occurrence, morphology, chemical composition, molecular structure and functions of various types of RNA.
- Mechanism of protein synthesis and genetic code.

Unit 5

- Overview of Mendel's law of inheritance, concept of gene: allele, multiple alleles, extensions of Mendelian principles: codominance, incomplete dominance, gene interactions, pleiotropy, linkage and crossing over.
- Sex chromosomes, sex determination in animals, sex-linked inheritance.
- Human genetics: Pedigree analysis, karyotypes, disorders of allosomes & autosomes. Quantitative genetics: Polygenic inheritance, heritability and its measurements.

Suggested Books:

- De Robertis, E.D.P. & De Robertis, E.M.F. (1987). *Cell and Molecular Biology* (8thed.). USA: Lea & Febiger.
- Gardner, E.J., Simmons, M.J. & Snustad, D.P. (2005). *Principles of Genetics* (8thed.). New Jersey, USA: John Wiley & Sons Ltd.

- Gardner, E.J., Simmons, M.J. & Snustad, D.P. (2006). *Principles of Genetics* (8thed.). USA: John Wiley & Sons.
- Gartner, L.P. (2016). *Text Book of Histology* (4thed.). Elsevier.
- Gupta, P.K. (2018). *Cell and Molecular Biology* (5th ed.). Meerut: Rastogi Publications.
- Gupta, S.N. (2015). *Biochemistry* (2nded.). Meerut: Rastogi Publication.
- Kar, D.K. & Halder, S. (2018). *Cell Biology, Genetics & Molecular Biology*. Kolkata: New Central Book Agency.
- Karp, G., Iwasa, J. & Marshall, W. (2018). *Karp's Cell Biology*. New Jersey: Wiley Publication.
- Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino, M.A. & Killian, D. (2018). *Concepts of Genetics* (12thed.). USA: Pearson.
- Lodish, H., Berk, A. Kaiser, C.A., Krieger, M. & Scott, M.P. (2007). *Molecular Cell Biology* (6thed.). USA: W H Freeman.
- Malacinski, G.M. (2015). *Freifelders Essentials of Molecular Biology* (4th ed.). USA: Jones & Bartlett.
- Miglani, G.S. (2007). *Advanced Genetics*. New Delhi: Narosa.
- Powar, C.B. (2014). *Essentials of Cytology*. Mumbai: Himalaya Publishing House.
- Rastogi, V.B. (2010). *Fundamental of Molecular Biology*. New Delhi: ANE Books.
- Rastogi, V.B. (2016). *Introductory Cytology – Knrn*. Meerut: Kedar Nath Ram Nath Publishers.
- Rej, S.K. (2018). *General Concepts of Histology & Endocrinology*. Kolkata: New Central Book Agency.
- Russell, P.J. (2009). *iGenetics: A Molecular Approach* (3rded.). Pearson Education India.
- Satyanarayana, U. & Chakrapani, U. (2017). *Essentials of Biochemistry* (2nded.). Kolkata: Booka & Allied Ltd.
- Tamarin, R.H. (2004). *Principles of Genetics* (7thed.). USA: McGraw-Hill Higher Education.
- Verma, G. P. (2001). *Fundamentals of Histology*. New Delhi: New Age International (P) Limited Publishers.
- Verma, P.S. & Agarwal, V.K. (2004). *Cell Biology, Genetics, Molecular Biology, Evolution & Ecology*. New Delhi: S. Chand Publisher.

Suggested e-Resources:

- **Introductory genetics**
http://depts.washington.edu/genetics/courses/genet371b-aut99/overheads/pdfs/all_lect.pdf
- **Cell biology**
<https://nptel.ac.in/courses/102103012/6>
- **Cell biology & organelles**
<https://www.nicholls.edu/biol-ds/biol155/Lectures/Cell%20Biology.pdf>
- **Biomolecules**
http://www.biologie.ens.fr/~mthomas/L3/intro_biologie/2-sucres-lipides-acides-nucleiques.pdf
- **Enzymology**
<https://nptel.ac.in/courses/102102033/14>
- **Human genetics**
<https://nptel.ac.in/courses/102104052/>
- **Mendelian genetics & deviation**
<https://www.khanacademy.org/science/biology/classical-genetics/variations-on-mendelian-genetics/a/multiple-alleles-incomplete-dominance-and-codominance>
<http://download.nos.org/srsec314newE/PDFBIO.EL21.pdf>

Cell Biology, Molecular Biology, Histology and Genetics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Learn the preparation of buffers and different concentration solutions.
 - Demonstrate the practical skills of various biochemical tests of carbohydrates, proteins and lipids.
 - Carry out enzyme assay and salt precipitation of protein from moong seeds.
 - Develop competency in the genetic problems.
1. Preparation of normal and molar solutions.
 2. Preparation of buffers.
 3. Tests for carbohydrates:
 - (i) Molisch's test for general carbohydrates
 - (ii) Benedict's test and Fehling's test for reducing sugars (glucose, maltose, lactose)
 - (iii) Tollen's phloroglucinol test for galactose
 - (iv) Tests for non reducing sugar (sucrose)
 - (v) Barfoed's test for monosacharides
 - (vi) Seliwanoff's test for ketoses (fructose)
 - (vii) Iodine tests for polysaccharides-starch and glycogen
 4. Tests for proteins:
 - (i) Biuret's test
 - (ii) Million's test
 - (iii) Xanthoproteic test
 - (iv) Ninhydrin test
 - (v) Sakaguchi test
 - (vi) Fohl's test (sulfur test)
 5. Test for lipids:
 - (i) Sudan IV test
 - (ii) Emulsion test
 - (iii) Saponification test
 6. To prepare standard curve of ammonium sulfate.
 7. Preparation of enzyme extract from mung seeds and measurement of asparaginase activity.
 8. Purification of an enzymatic protein by salt precipitation.
 9. Demonstration of salivary amylase activity.
 10. Acetocarmine preparation from the material available and identifying mitotic or meiotic stages.
 11. Study of permanent slides:
 12. Study of the prepared slides of nucleic acids proteins and mucopolysaccharides.
 13. Study of salivary gland, lampbrush and polytene chromosomes.
 14. Genetic problem (Linkage and crossing over).

Suggested Books:

- Boya, R.F. (2006). *Modern Experimental Biochemistry* (3rd ed.). Noida: Pearson Education.

- Deb, A.C. (2013). *Comprehensible Viva & Practical Biochemistry* (2nded.). Kolkata: New Central Book Agency.
- Kumar, A., Grg, S. & Garg, N. (2017). *Biochemical Tests: Principles & Protocols*. New Delhi: Viva Books.
- Rao, B.S. & Deshpande, V. (2012). *Experimental Biochemistry*. New Delhi: I.K. International Publisher.
- Sadasivam, S. & Manickam, A. (1996). *Biochemical Methods* (2nded.). New Delhi: New Age International Publishers.
- Sharma, S. (2007). *Experiments and Techniques in Biochemistry* (1sted.). New Delhi: Galgotia Publication

Microbiology and Plant Pathology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Understand the structure and life process of prokaryotes and virus.
- Know about sources of plant pathogens, identify symptoms & methods of studying plant diseases
- Identify the role of various microbes in food and beverage industries.

Unit-1

- Microbiology- Brief history.
- General account of bacteria- Brief classification and structure; nutrition-types, media; bacterial growth- brief idea, factors affecting growth.
- Recombination in bacteria- conjugation, transformation and transduction.
- Pure culture techniques, staining techniques- a brief idea.

Unit-2

- Techniques for sterilization.
- Preservation of microorganisms.
- General account of viruses: introduction, structure and composition.
- Replication of viruses: lytic and lysogenic cycles.
- Cultivation of viruses.

Unit-3

- Microbiology of foods and beverages: Bread making, alcoholic beverages (beer and whisky), cheese, fermented milk products, sauerkraut.
- Microbes in spoilage of food.

Unit 4

- Bacterial diseases: General symptoms and types of bacterial diseases.
 - (i) Soft rot of carrot
 - (ii) Bacterial wilt of maize
 - (iii) Brown rot of potato
 - (iv) *Citrus* canker
- Viral diseases: General symptoms, survival and transmission of plant viruses.
 - (i) Tomato leaf curl
 - (ii) Cucumber mosaic
 - (iii) Potato mosaic
 - (iv) Tobacco mosaic

Unit 5

- Fungal diseases: General symptoms and disease cycle.
 - (i) Wart disease of potato
 - (ii) Damping off
 - (iii) Green ear of bajra

- (iv) Powdery mildew on wheat
- (v) Black rust
- (vi) Smut - Wheat and bajra
- (vii) White rust
- (viii) Early blight of potato.

Suggested Books:

- Agrios, G.N. (2005). *Plant Pathology* (5th ed.). Elsevier Science.
- Alexopoulos, C.J., Mims, C.W., & Blackwell, M. (2007). *Introductory Mycology*. New York: John Wiley & Sons.
- Ananthanarayan, R., & Paniker, C.K.J. (2009). *Ananthanarayan and Paniker's Textbook of Microbiology* (9th ed). Universities Press (India) Private Limited.
- Biswas, S.B. (2009). *An Introduction to Viruses*. New Delhi: Vani Education.
- Butler, E.J. *Plant Pathology- Fungi & Diseases in Plants*. Kolkata: Thacker Spink & Co.
- Dubey, H.C. (2013). *Introduction to Fungi*. Jodhpur: Scientific Publishers.
- Dubey, R.C., & Maheshwari, D.K. (2008). *A Text book of Microbiology*. New Delhi: S. Chand and Company.
- Kumar, H.D., & Kumar S. (2001). *Modern Concepts of Microbiology*. New Delhi: Vikas Publishing House.
- Madigan, M., Martinko, J., Stahl, D., & Clark, D. (2010). *Brock Biology of Microorganisms* (13th ed.). Pearson.
- Mehrotra R.S. (2006). *Plant Pathology*. New Delhi: Tata McGraw-Hill.
- Pelczar, M.J., Chan, E.C.S., & Kreig N.R. (2008). *Microbiology*: New Delhi: Tata McGraw Hill.
- Purohit, S.S. (2009). *Microbiology - Fundamentals and Applications*. Bikaner: Agro Botanical Publishers.
- Ross, F.C. (1983). *Introductory Microbiology*. Columbus: Charles E. Merrill.
- Sharma, P.D. (2016). *Microbiology & Plant Pathology*. Meerut: Rastogi Publications
- Sharma, P.D. (2017). *Plant Pathology*. Meerut: Rastogi Publications
- Singh, R.S. (2013). *Plant Disease*. New Delhi: Oxford & IBH.
- Willey, J.M., Sherwood, L.M., & Woolverton, C.J. (2014). *Prescott's Microbiology* (9th ed). McGraw-Hill Education.

Suggested e- Resources:

- **Plant diseases: Identification and control**
<https://www.planetnatural.com/pest-problem-solver/plant-disease/>

Microbiology and Plant Pathology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Learn techniques for microbial isolation, purification, handling and maintenance.
 - Gain knowledge of different methods for the isolation of microbial organisms.
 - Identify the plant diseases based upon symptoms & its causal organism.
1. Knowledge of instruments and equipments used in microbiology and plant pathology.
 2. Preparation of media: PDA, NA, EMB.
 3. Isolation of soil microorganisms by Warcup method.
 4. Isolation of microorganisms from air, water and soil.
 5. Measurement of thermal death time and thermal death point of bacterial culture.
 6. Streaking techniques: Continuous and discontinuous.
 7. Bacterial staining: Simple staining, negative staining, differential staining, endospore staining.
 8. Preservation of cultures by making glycerol stock and revival of culture.
 9. Study of bacterial and viral diseases of plants mentioned in the syllabus with help of specimens (Cucumber mosaic, tobacco mosaic, brown rot of potatoes, *Citrus canker*).
 10. Study of fungal diseases in plants mentioned in the syllabus by: a) Museum specimens; b) temporary and prepared slides (Smut-wheat and bajra, early blight of potato).

Suggested Books:

- Aneja, K.R. (2003). *Experiments in microbiology, plant pathology and biotechnology*. New Age International Publishers.
- Mitra, A. (2013). *Practical manual of modern microbiology*. Mumbai: Himalaya Pub. House.

Comparative Anatomy and Embryology of Chordates

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Understand the comparative anatomy of various organ systems with special reference to *Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*.
- Gain the fundamental knowledge about the development of frog, Hen's egg and chick to understand the principles of developmental biology.
- Gain an elementary idea about reproductive biology.

Unit 1

Comparative anatomy with special reference to *Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*:

- Integumentary system: Skin and its derivatives.
- Skeleton System: Development of chondrocranium and Vertebra; Jaw suspension.
- Digestive system: Alimentary canal and associated glands.

Unit 2

Comparative anatomy with special reference to *Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*:

- Respiratory system: Respiratory organs.
- Circulatory system: Evolution of heart and aortic arches.
- Urinogenital system: Evolution of kidney and Urinogenital ducts.

Unit 3

Comparative anatomy with special reference to *Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*:

- Nervous system: Brain and Spinal Cord.
- Eye.
- Ear.

Unit 4

- Elementary idea about the formation of egg and sperm.
- Fertilization, parthenogenesis, induction and regeneration.
- Development of Frog upto the end of neurulation, Tadpole larva and its metamorphosis.

Unit 5

- Detailed structure of Hen's egg and its development upto 4th somite stage.
- Structure, development and functions of extra embryonic membranes in chick.
- Definition of placenta, types and functions of mammalian placenta.

Suggested Books:

- Balinsky, B.I. (2012). *An Introduction to Embryology* (5thed.). New Delhi: Cengage Learning India.
- Chaki, K.K., Kundu, G. & Sarkar, S. (2016). *Introduction to General Zoology Vol-II*. Kolkata: New Central Book Agency.
- Dhami P.S. & Dhami, J.K. (2015). *Chordate Zoology*. New Delhi: R. Chand and Co.

- Jain, P.C. (2013). *Elements of Developmental Biology* (Chordate Embryology) (7thed.). New Delhi: Vishal Publishing Co.
- Kardong, K.V. (2011). *Vertebrates: Comparative Anatomy, Function, Evolution* (6thed.). McGraw-Hill Education.
- Kent, G. C. & Carr, R. K. (2000). *Comparative Anatomy of the Vertebrates* (9thed.). Europe: McGraw-Hill Science.
- Kotpal, R.L. (2018). *Modern Text book of Zoology: Vertebrates* (4th ed.). Meerut: Rastogi Publications.
- Kotpal, R.L., Sastry, K.V. & Shukla, V. (2017). *Comparative Anatomy & Developmental Biology*. Meerut: Rastogi Publication.
- Lahiri, B.K. (2014). *College Zoology Vol-II*. Mumbai: Himalaya Publishing House.
- Prasad, S.N. & Kashyap, V. (2010). *A text book of Vertebrate Zoology* (14thed.). New Delhi: New Age International (P) Limited.
- Sastry, K.V. & Shukla, V. (2017). *Developmental Biology*. Meerut: Rastogi Publications.
- Saxena, R.K. & Saxena, S. (2016). *Comparative Anatomy of Vertebrates* (2nded.). Viva Books Private Limited.
- Srivastava, M.L. (1985). *An Introduction to the Comparative Anatomy of Vertebrates*. Allahabad: Central Book Depot.
- Verma, P.S. & Agrawal, V.K. (2017). *Chordate Embryology: Developmental Biology*. New Delhi: S Chand.

Suggested e-Resources:

- **Comparative anatomy**
<http://www.iaszoology.com/category/comparative-anatomy/>
- **Chick development**
<http://www.notesonzoology.com/vertebrates/chick/development-of-chick-with-diagram-vertebrates-chordata-zoology/8645>
http://www.macollege.in/app/webroot/uploads/department_materials/doc_139.pdf
- **Developmental biology**
<https://www.shomusbiology.com/developmental-biology.html>
- **Frog development**
<http://www.notesonzoology.com/frog/development-of-frog-with-diagram-vertebrates-chordata-zoology/8626>

Comparative Anatomy and Embryology of Chordates Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Identify higher chordate animals based on the external features.
 - Identify and distinguish bones of *Rana*, *Varanus*, Fowl and *Oryctolagus*.
 - Understand histology of organs and endocrine glands through microscopic study of slides.
 - Understand the development of frog and chick through microscopic slides.
1. Permanent mountings:
 - i. Placoid and ctenoid scales
 - ii. Cartilage and striated muscle fibres of amphibian.
 - iii. Filoplumes.
 - iv. Blood film of mammal.
 2. Osteology: A comparative study of articulated and disarticulated bones of *Rana*, *Varanus*, Fowl and *Oryctolagus*.
 3. Comparative study of microscopic slides with special reference to amphibian and mammal:
 - i. V.S. of skin, oesophagus, stomach, intestine, liver, pancreas, lung, kidney, testis, ovary, spinal cord.
 - ii. T.S. of endocrine glands of a mammal (pituitary, thyroid, parathyroid, adrenal).
 4. Study of museum specimens:
 - i. Cyclostomata: Amnocoete larva, *Petromyzon*, *Myxine* and *Bdellostoma*.
 - ii. Pisces: *Sphyrna*, *Torpedo*, *Pristis*, Stingray, *Chimaera*, *Acipenser*, *Amia*, *Labeo*, *Wallago*, *Saccobranclius*, *Anguilla*, *Exocoetus*, *Belone*, *Hippocampus*, *Syngnathus*, *Echieries*, *Porcupine* and *Protopterus*.
 - iii. Amphibia: *Ichthyophis*, *Ambystoma*, Axolotal larva, *Salamandra*, *Necturus*, *Siren*, *Alytes*, *Pipa*, *Hyla* and *Rhacophorus*.
 - iv. Reptilia: *Chelone*, Turtle, *Testudo*, *Sphenodon*, *Phrynosoma*, *Chaemeleon*, *Calotes*, *Hemidactylus*, *Draco*, *Hydrophis*, *Eryx*, *Python*, *Naja*, *Viper*, *Bungarus* and *Crocodilus*.
 - v. Aves: *Archaeopteryx*, *Psittaculla*, *Passer*, *Columba* and *Pavo*.
 - vi. Mammalia: *Ornithorynchus*, *Tachyglossus*, *Pteropus*, *Funambulus*, *Hedgehog*, *Mongoose* and *Oryctolagus*.
 5. Development of Chordates:
 - i. Study of the development and metamorphosis of frog with the aid of permanent prepared slides.
 - ii. W.M. of primitive steak, head folds, 18hrs, 24hrs and 33hrs of chick embryo, T.S. of chick embryo through various regions upto 4th somite state with aid of permanent prepared slides.

Suggested Books:

- Ghose, K. & Manna, B. (2016). *Practical Zoology* (4thed.). Kolkata: New Central Book Agency.
- Lal, S.S. (2015). *Practical Zoology: Vertebrates* (11thed.). Meerut: Rastogi Publication.
- Poddar, T., Mukhopadhyay, S. & Das, S.K. (2003). *An advanced Laboratory Manual of Zoology*. Kolkata: Macmillan India Limited.
- Verma, P.S. (2010). *A Manual of Practical Zoology: Chordates* (11thed.). New Delhi: S Chand Publishing.

Plant Physiology and Ecology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Comprehend about life processes happening inside plants and how they cope with varied biotic and abiotic factors.
- Understand maintenance of ecological balance and role of man in the degradation of the environment and to suggest remedies.
- Highlight the potential of these studies to become an entrepreneur.

Unit 1

- Plant water relations: Importance of water to plant life; movement of water across the membranes, ascent of sap; transpiration.
- Mineral nutrition: Methods to study the availability of macro and micro elements, uptake and roles of mineral elements.
- Translocation of organic substances: General principle and mechanism.

Unit 2

- Photosynthesis: Photosynthetic pigments, factors affecting photosynthesis, mechanism of photosynthesis, role of light, carbon fixation in plants, Photophosphorylation.
- Respiration: Significance and mechanism, factors affecting respiration, release and utilization of biochemical energy, ATP synthesis.

Unit 3

- Fat Metabolism: Mechanism of synthesis and break down of fats.
- Nitrogen metabolism: Nitrate assimilation, nitrogen fixation, amino acid synthesis and nitrogen cycle.
- Growth and development: Physiology of dormancy and seed germination, vegetative and reproductive growth, vernalization and photoperiodism.
- Growth regulators: Auxins, gibberellins, cytokinins, ethylene and abscissic acid, their physiological importance.

Unit 4 Ecology

- Plant environment: Climatic, edaphic, topographic and biotic factors.
- Ecosystem: Brief concept, food chains, ecological pyramids (pyramids of number, mass and energy), energetics, biochemical cycling.

Unit 5

- Plant communities: Structure, classification, diversity, dynamics.
- Applied ecology: Introduction to restoration ecology.
- Environmental pollution (air, water, noise and radioactive), Conservation, plant indicators.

Suggested Books:

- Ambast, R.S. (2008). *Plant Ecology*. New Delhi: CBS.
- Dutta, S.C. (2012). *Plant Physiology*. New Delhi: New age International Publishers.
- Hopkins, W.G., & Huner, N.P.A. (2008). *Introduction to Plant Physiology*. New Jersey: John Wiley and Sons Inc.
- Narst, V., Devlin & Witham. (1974) *Plant Physiology*. New Delhi: East West Press.
- Noggle, G.R., & Fritz, G.J. (1992). *Introductory Plant Physiology*. New Delhi: Prentice Hall of India.
- Odum, E.P. (2004). *Fundamentals of Ecology*. Dehradun: Natraj Publishers.
- Pandey, S.N., & Sinha, B.K. (2015). *Plant Physiology*. New Delhi: Vikas Publishing House.

- Salisbury & Ross. (2012). *Plant Physiology*. New Delhi: Prentice Hall of India.
- Sharma, P.D. (2003). *Ecology & Environment*. Meerut: Rastogi Publications.
- Srivastava, H.S. (2005). *Plant Physiology*: Meerut: Rastogi Publications.
- Taiz, L., & Zeiger, E. (2010). *Plant Physiology*. London: Sinauer Associates.

Suggested e- Resources:

- **Plant Physiology**

https://www.udemy.com/plant-physiology/?siteID=zOCYiUhWwNM-1RExiYvhsJfnMd_rZR_ivg&LSNPUBID=zOCYiUhWwNM

- **Ecological communities**

<http://www-plb.ucdavis.edu/courses/bis/1c/text/Chapter27nf.pdf>

Plant Physiology and Ecology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Understand the physiological details of photosynthesis and respiration.
- Design experiments, collect and analyze data, critically evaluate and present the data produced in physiology or ecology.
- Demonstrate skills related to laboratory as well as field based studies.

A. List of Physiology experiments

1. Osmosis
 - a. Grapes and dried raisins.
 - b. Potato osmoscope and semi permeable membrane.
 - c. Plasmolysis and deplasmolysis.
2. Root pressure
 - a. An experiment on root pressure.
3. Transpiration
 - a. Ganong's potometer and Farmer's photometer.
 - b. Unequal transpiration from two surfaces of a leaf
 - i. Cobalt chloride paper method.
 - ii. Four leaf method with greased surface.
 - c. Demonstration of water lifting power of transpiration (suction force).
 - d. Ringing experiment.
 - e. Study of stomata
4. Photosynthesis
 - a. Oxygen is given off during photosynthesis (Wilmott's bubbler apparatus).
 - b. Light is necessary for photosynthesis.
 - c. Chlorophyll is necessary for photosynthesis.
 - d. CO₂ is necessary for photosynthesis.
 - e. RQ by Ganong's respirometer (Demonstration).
5. Respiration
 - a. CO₂ is produced during respiration.
 - b. Loss of dry weight in respiration.
 - c. Anaerobic respiration.

B. List of Ecological experiments

1. To determine the soil temperature by soil thermometer.
2. To measure relative humidity of the atmosphere by wet and dry-bulb thermometer or psychrometer.
3. To determine soil texture.
4. To test the presence of carbonate, nitrate, pH value and base deficiency in soil.

5. To measure the light intensity.
6. To study the structure of the plant community of an area by quadrat method and to determine the plant density, abundance and frequency.
7. To determine the water holding capacity of different soils.

Suggested Books:

Bendre, A., & Kumar, A. (2010). *A Textbook of Practical Botany- II*. Meerut: Rastogi Publications.

Environmental Biology

L T P C

6 0 0 6

Max. Marks : 90

(CA : 30 + ESA : 60)

- Unit 1**
- **Terminology and scope of ecology.**
 - Environment :
 - (i) Biosphere – Lithosphere, Hydrosphere and Atmosphere.
 - (ii) Physical factors – with special reference to temperature, light and water.
 - (iii) Biotic factors – Intra and Inter specific relationship among animals.
 - (iv) Principles of limiting factors – Leibig's law of minimum, Shelford's Law of tolerance, combined concept of limiting factors.
 - Biogeochemical Cycles: Carbon, Oxygen, Nitrogen and Phosphorus cycles.
- Unit 2**
- Ecosystem Ecology: Structure and dynamics of the ecosystem including food chain, food webs trophic levels, productivity and energetics.
 - Fresh Water Ecosystem: Physiochemical factors, Biotic communities and lake eutrophication.
 - Marine Ecosystem: Zonation factors and biotic communities of deep sea only.
 - Terrestrial Ecosystem: Salient features of grass land, forest and desert ecosystem.
- Unit 3**
- *Population Ecology.*
 - (i) Definition and attributes of animal population: Population density and its measurement, natality, mortality, growth form, age distribution, age pyramids, Sex ratio, dispersal and dispersion.
 - (ii) Regulation of Population density: Population fluctuations and interactions.
 - *Community Ecology :*
 - (i) Definition of types of communities (micro and macro communities).
 - (ii) Community dominance and species diversity.
 - (iii) Ecotone, edge effect and ecological Niche.
 - (iv) Succession and Climax.
- Unit 4**
- *Pollution Ecology :*
 - (i) Pollution, Biodegradable and non-biodegradable pollutants.
 - (ii) Air pollution: Sources, nature, prevention and control.
 - (iii) Water pollution: Source, nature abatement.
 - (iv) Noise pollution
 - (v) Radioactive pollution and effects of radioactive substance on living organisms.
 - (vi) Environmental health and welfare.
- Unit 5**
- *Applied Ecology :*
 - (i) Conservation of Natural resources.
 - (ii) Wild life management.
 - (iii) National parks and Wild life sanctuaries in India.
 - (iv) Extinction in animals.
 - (v) Zoogeographical regions of the world along with the boundaries and fauna.

Books Recommended :

- Elements of Ecology : Clarke.
- Ecology : E.P. Odum, New Delhi : Amerind Publishing, 1965.
- Environmental Analysis : M.M. Saxena, Bikaner Agro Botanical Pub., 1990.
- Ecology with special reference to animal and man : S. Charles Kendeigh.
- Principles of Animal Ecology : Allee, Emerton, Park and Schmidt.
- Animal Ecology : S.P. Singh.
- Ecology and Environment : P.D. Sharma, Rastogi Publications.
- Ecology : C.V.S. Bahura.
- Ecology : C.J. Krebs.
- Ecology 2000 : Edited by Edmand Hillary, London Michael Joseph, 1984.

Environmental Biology Lab

L T P C

0 0 4 2

Max. Marks : 30

(CA : 10 + ESA :20)

- To find the depth and visibility in a pond by Sachi disc method.
- To determine the pH of water sample.
- To determine the content of dissolved oxygen in the water sample.
- To determine free CO₂ content in the water sample.
- To determine the Chloride content of the water sample.
- To determine the total hardness of water.
- To study the effect of environmental stimulation on paramecium.
- To study parasitic, desert, aquatic and aerial adaptations in animals
 - (i) Parasite : *Hirudinaria*, *Taenia*, *Ascaris*, *Schistosoma*, *Fasciola*, Head louse.
 - (ii) Desert : *Phrynosoma*, *Uromastix*, Camel, *Heloderma*, Rattle snake, Golden mole.
 - (iii) Aquatic : *Pleuronectus*, *Exocoetus*, Turtle, *Hippocampus*, *Dolphin*, *Hydrophis*, *Duck*, Crocodile.
 - (iv) Aerial: Any Bird, *Draco*, Bat.
- To study different types of associations existing among living organisms.
 - (i) Symbiosis: *Chlorohydra*, Termite and Aphid.
 - (ii) Commensalism: Harmit-crab and Sea anemone and Gastropod shell, *Euplectella* and Shrimps.
 - (iii) Socialization: Ants, Termites, Honey bees.
- Draw a map of world and identify the Zoogeographical regions of the world along with their major fauna.
- Report on any current topic related to Environmental Biology.

Introduction to Genetics and Genetic Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Acquire knowledge of the structure and arrangement of the genome in living organisms.
- Understand the biochemical nature of nucleic acids, their role in living systems.
- Impart basic genetic manipulation techniques and their application for human welfare.
- Translate concepts in genetic engineering to their own research.

Unit 1

- Organization of eukaryotic chromosomes.
- Bacterial genetics.
- Cell cycle, mitosis and meiosis.
- Eugenics and genetic counseling.

Unit 2

- Genetic terminology, Mendel's experiments: Laws of inheritance, interaction of factors (Modified dihybrid ratios).
- Quantitative inheritance, linkage, crossing over, multiple alleles.
- Sex determination and sex linked inheritance.
- Extra chromosomal inheritance.

Unit 3

- Chromosomal aberrations- structural and numerical.
- Mutations.
- Gene: Basic concept.
- Isolation of eukaryotic mRNA, cDNA synthesis and library.
- Genomic library.

Unit 4

- Restriction enzymes.
- Vectors- plasmids, phages, cosmids.
- Construction of recombinant DNA.
- Screening and selection of recombinant clones.

Unit 5

- Isolation of DNA- plasmid, plant genomic DNA, phage DNA.
- General idea of patents and bio safety guidelines.
- Biotechnology: Definition, application of biotechnology, basic concept of biotechnological processes.
- Edible vaccines.

Suggested Books:

- Borem, A., Santos, F.R., & Bowen, D.E. (2003). *Understanding Biotechnology* (1st d.). USA: Prentice Hall.
- Brown, T. (2011). *Introduction to Genetics –A molecular approach* (1st ed.). USA: Garland Science.
- Brown, T.A. (2010). *Gene Cloning and DNA Analysis: An Introduction* (6th ed.). USA: Wiley-Blackwell.

- Gardner, E.J., Simmons, M.J., & Snustad, D.P. (2005). *Principles of Genetics* (8th ed.). New Jersey, USA: John Wiley & Sons Ltd.
- Glick, B.R., & Patten, C.L. (2017). *Molecular Biotechnology: Principles and Applications of Recombinant DNA* (5th ed.). USA: American Society for Microbiology Press.
- Griffiths, A.J.F., Miller, J.H., Suzuki, D.T., Lewonith, R.C. & Gelbert, W.M. (2000). *An Introduction to Genetic Analysis* (7th ed.). New York, U.S.: W. H. Freeman.
- Gupta, P.K. (2009). *Genetics*. Meerut: Rastogi Publications.
- Gupta, P.K. (2010). *Plant biotechnology*. Meerut: Rastogi Publications.
- Hartl, D.L. & Jones, E.W. (1997). *Genetics: Analysis of Genes and Genome* (9th ed.). Canada: Jones and Barlett Publishers.
- Hartwell, L., Hood, L., Goldberg, M., Reynolds, A.E., & Silver, L. (2010). *Genetics: From Genes to Genomes* (4th ed.). New York: McGraw-Hill Education.
- Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino, M.A., Killian, D. (2018). *Concepts of Genetics* (12th ed.). USA: Pearson Education.
- Krebs, J.E., Goldstein, E.S., & Kilpatrick, S.T. (2012). *Lewin's Genes XI* (11th ed.). USA: Jones and Bartlett Publishers.
- Maloy, S.R., Cronan, J.E., & Friefelder, D. (1994). *Microbial Genetics* (2nd ed.). USA: Jones and Bartlett.
- Primrose, S.B., & Twyman, R. (2006). *Principles of Gene Manipulation and Genomics* (7th ed.) UK: Oxford University Press.
- Singh, B.D. (2015). *Biotechnology*. New Delhi: Kalyani Publishers.
- Strickberger, M.W. (1995). *Genetics* (3rd ed.). New Delhi: Prentice Hall India Learning Private Limited.
- Tamarin, R.H. (2004). *Principles of Genetics* (7th ed.). USA: McGraw-Hill Higher Education.
- Watson, J.D., Tania, A.B., & Stephen, P.B. (2017). *Molecular Biology of the Gene* (7th ed.). USA: Pearson Education.
- Winnacker, E.L. (1987). *From Genes to Clones: Introduction to Gene Technology*. Germany: Wiley VCH.

Suggested e- Resources:

- **Genetics**
<https://www.britannica.com/science/genetics>
- **Recombinant-DNA-technology**
<https://www.britannica.com/science/recombinant-DNA-technology>
<https://nptel.ac.in/courses/102103013/4>
<http://www.agbioworld.org/biotech-info/topics/dev-world/policies4.html>
- **Principles & processes of recombinant-DNA-technology**
<https://www.toppr.com/guides/biology/biotechnology-principles-and-process/processes-of-recombinant-dna-technology/>
- **Vectors used in genetic engineering**
<http://www.biologydiscussion.com/genetic-engineering/vectors-used-in-genetic-engineering-biotechnology/61382>
- **Patent rights in India**
<https://www.hg.org/legal-articles/patent-rights-in-india-4995>

Introduction to Genetics and Genetic Engineering Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Develop skills and understanding about different techniques used in genetics and genetic engineering
 - Critically analyze and interpret data generated from each practical
 - Develop knowledge about genetic problems such as genetic mapping, test cross etc.
1. Problems of genetics.
 2. Models based on Mendel's law.
 3. Human genetics: Tongue rolling, widow's peak, ear lobes, little finger.
 4. Estimation of standard DNA by DPA method.
 5. Determination of purity of standard DNA.
 6. Determination of a_{max} of standard DNA.
 7. Isolation of DNA from plant cells.
 8. Restriction digestion of DNA.
 9. Agarose gel electrophoresis of DNA.
 10. Basic biosafety guidelines in the laboratory.

Suggested Books:

- Purohit, S.D. (2007). *Molecular Biology and Biotechnology: A Practical Manual*. Udaipur: Apex Publishing House.
- Vats, S. (2015). *A Laboratory Textbook of Biochemistry, Molecular biology and Microbiology*. GRIN Verlag.

Animal Physiology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

- Gain basic understanding of structure and functions of each physiological system of human.
- Describe principles and pathway of metabolism of carbohydrate, protein and lipids.
- Develop an understanding about principles of human anatomy and physiology.

Unit 1

- Physiology of Digestion: Various kinds of digestive enzymes (carbohydrases, proteinases and lipases) and their digestive action to corresponding food stuffs in the alimentary canal of mammals; hormonal control of digestive functions; mechanism of absorption of various end-products of digestion and other materials such as vitamins, minerals and trace elements.
- Physiology of respiration in mammals: Mechanism and control of breathing; transport of oxygen and carbon dioxide; oxygen dissociation curves of hemoglobin, Bohr effect, chloride shift, Haldane effect, lung volumes and capacities, regulation of respiration, respiration at cellular level.

Unit 2

- Metabolism: (structure formula of metabolites not essential) Carbohydrate metabolism oxidation of glucose (glycolysis); Embden–Meyerhof-Parnas pathway, tricarboxylic acid cycle and oxidative phosphorylation, shuttle mechanisms (malate-aspartate and glycerol-phosphate), glycogenolysis and glycogenesis; gluconeogenesis and the role of dicarboxylic acid shuttle, role of insulin and glucagons on carbohydrate metabolism.
- Protein metabolism: Essential and non-essential amino-acids, oxidative deamination, transamination and decarboxylation of amino acids, fate of glucogenic and ketogenic amino acids, role of hormones in protein metabolism.
- Fat metabolism: Oxidation of fatty acids (β -oxidation), glycerol, and unsaturated fatty acids; fate of Acetyl CoA; synthesis of fatty acids & lipids; role of hormones in fat metabolism.

Unit 3

- Physiology of excretion: Kinds of nitrogenous excretory products, structure of kidney, role of liver in the formation of urea; composition and formation of urine; role of hormones in urine formation; micturition.
- Physiology of vascular system: Composition and functions of blood; lymph & lymphatic system; blood groups, Rh factor; platelet plug formation; blood clotting mechanism and its significance; structure and functions of hemoglobin. Blood pressure & its regulation; origin, conduction and regulation of heart beat; nervous and hormonal regulation of heart beat; cardiac cycle.

Unit 4

- Physiology of muscle contraction: Functional architecture of smooth, skeletal and cardiac muscles; mechanism of muscle contractions (skeletal muscle). Fuel for muscle contraction, mechanical properties of muscle: simple muscle twitch; wave summation, tetanus and muscle fatigue.
- Physiology of nerve impulse and reflex action: Functional architecture and classification of neuron; nature, origin and propagation of nerve impulse along a neuron (myelinated and unmyelinated), synapse; reflex arc, reflex action and its central control.

Unit 5

- Physiology of endocrine glands: Structure and functions of hypothalamus; pituitary; thyroid; parathyroid; adrenal and pancreas.
- An elementary idea about neuro-secretion.
- Physiology of reproduction: Structure and physiology of human male and female reproductive system; spermatogenesis and oogenesis; reproductive cycles- estrous and menstrual cycle.
- Hormonal regulation of ovulation, fertilization, implantation, abortion, gestation, parturition and lactation.

Suggested Books:

- Chatterjee, C.C. (2005). *Human Physiology* Vol-II (11thed.).
- Chatterjee, C.C. (2018). *Human Physiology* Vol-I (12thed.). New Delhi: CBS Publishers & Distributors.
- Guyton, A.C. & Hall, J.E. (2015). *Textbook of Medical Physiology* (13thed.). USA: Saunders.
- Jurd, R.D. (2003). *Instant notes in Animal Biology*. New Delhi: Viva Books Pvt. Ltd.
- Kumar, N. (2016). *Animal Physiology*. Jaipur: RSBA Publishers.
- Pandey, K. & Shukla, J.P. (2005). *Regulatory Mechanism in Vertebrates*. Meerut: Rastogi Publications.
- Randall, D., Burggren, W., & French, K. (2001). *Eckert Animal Physiology* (5thed.). W. H. Freeman.
- Roy, R.N. (2018). *Textbook of Physiology: with Biochemistry & Biophysics* Vol-I. Kolkata: New Central Book Agency.
- Tortora, G.J. & Grabowski. (2003). *Principles of Anatomy & Physiology* (10thed.). New Jersey, USA: John Wiley & Sons.
- Verma, P.S., Tyagi, B.S. & Agarwal, V.K. (2000). *Animal Physiology*. New Delhi: S. Chand publisher.

Suggested e-Resources:

- **Digestive system**
<https://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookDIGEST.html>
- **Unsaturated fatty acid oxidation**
<https://pharmaxchange.info/2013/10/oxidation-of-unsaturated-fatty-acids/>
- **Urine formation**
<http://medschool.slu.edu/gpbs/syllabus/2008/renal2/Kidney%20Lecture-2%20Core%202008.pdf>
- **Muscles**
<http://www.onlinebiologynotes.com/muscular-tissue-skeletal-smooth-cardiac-muscle/>
- **Endocrine glands**
<http://what-when-how.com/nursing/the-endocrine-system-structure-and-function-nursing-part-1/>
- **Physiological systems**
<https://nptel.ac.in/courses/102104042/>
<https://nptel.ac.in/courses/122103039/18>

Animal Physiology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

- Gain hands on experience in hematological tests such as counting of RBCs, WBCs, preparation of haemin crystals, determination of blood haemoglobin, calcium, cholesterol, sugar, protein, clotting time.
 - Demonstrate the skills of pathological analysis of urine through the detection glucose and albumin.
1. To prepare Haemin Crystals.
 2. Estimation of Haemoglobin percentage by Haemometer.
 3. Enumeration of the total number of red blood corpuscles (R.B.C.)
 4. Enumeration of the total number for white blood corpuscles (W.B.C.)
 5. Determination of ABO blood groups and Rh factor.
 6. Study of effect of isotonic, hypotonic and hypertonic solutions on R.B.C.
 7. Determination of the presence of sugar and albumin in the urine sample.
 8. Determination of blood sugar content.
 9. Estimation of total protein from blood.
 10. Estimation of total calcium from blood.
 11. Estimation of total cholesterol from blood.
 12. Determination of the clotting time of blood.

Suggested Books:

- Poddar, T., Mukhopadhyay, S. & Das, S.K. (2003). *An advanced Laboratory Manual of Zoology*. Kolkata: Macmillan India Limited.
- Sharma, S. (2007). *Experiments and Techniques in Biochemistry* (1sted.). New Delhi: Galgotia Publication.
- Sharma, S. & Sharma, R. (2016). *Practical Manual of Biochemistry* (2nded.). New Delhi: Medtech.

Micro Economics -I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Describe nature and scope of Economics.
- Analyze cardinal and ordinal approaches to consumer behaviour.
- Illustrate uses of indifference curves.
- Discuss various concepts of elasticity and its measurement.
- Analyze short run and long run law of Production.
- Illustrate various concepts related to cost.

- Unit 1** Nature and scope of Economics. Consumer Equilibrium: Utility Approach – Assumptions and laws, Indifference curve Approach – Concepts and properties of Indifference curves, Budget Line, Changes in consumer equilibrium - Price, Income and Substitution effects.
- Unit 2** Derivation of demand curve from price consumption curve for Normal and Giffen goods. Substitute and complementary goods. Comparison between utility and indifference curve approach. Applications and uses of indifference curves.
- Unit 3** Elasticity of Demand - concept and measurement of Price elasticity of demand, determinants of price elasticity of demand. Income and cross elasticity of demand. Consumer surplus - concept and measurement.
- Unit 4** Production function: Law of variable proportions, Returns to scale-concept of Isoquants and Iso-cost line, Least-Cost combination, concept of ridge lines.
- Unit 5** Concept of cost: Money, opportunity and real. Short- Run Cost curves: Total cost, Total Fixed and Variable costs, Average cost and Marginal cost. Long Run Total, Average and Marginal cost curves.

Recommended Books:

1. Gauld, J. P. and Edward P. L. (1996). *Micro Economic Theory*. Richard Irwin, Homewood.
2. Lipsey, R. G. and K. A. Chrystal (1999). *Principles of Economics* (9th Edition). Oxford: Oxford University Press.
3. Mansfield, E. (1997). *Microeconomics* (9th Edition). New York: W.W. Norton and Company.
4. Samuelson, P.A. and W.D. Nordhaus (1998). *Economics*. New Delhi: Tata McGraw Hill.
5. Varian, H.R. (2000). *Intermediate Microeconomics: A modern Approach (5th Edition)*. New Delhi: East West Press.
6. माथुर, पी. एन. : मूल्य सिद्धान्त
7. जैन, के. पी. : व्यष्टिअर्थशास्त्र

E- Learning Material

1. www.aeaweb.org
2. <https://www.oswego.edu/economics/resources>

Micro Economics - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Describe various revenue concepts and explain the behaviour of revenue under different market structures
- Identify structure of a market
- Analyze short run and long run equilibrium of firms under perfect and imperfect competition.
- Discuss various concepts related to profit and to analyse the determination of profit
- Discuss various concepts related to rent and to analyse the determination of rent.
- Discuss various concepts related to interest and to analyse the determination of interest.

Unit 1 Revenue concepts – Shape of Total Revenue, Average Revenue and Marginal Revenue curves under perfect and imperfect competition. Relationship between Average Revenue, Marginal Revenue and Price elasticity of demand.

Market structures – Short run and long run equilibrium of a firm and industry under perfect competition. Effect of increase in demand on long run equilibrium price and output under perfect competition.

Unit 2 Determination of price and output in short run and long run under Monopoly. Third degree price discrimination under monopoly.

Determination of price and output in short run and long run under Monopolistic competition. Introduction to Oligopoly.

Unit 3 The nature of demand for factors of production. General theories of distribution: The Marginal Productivity theory and demand supply theory (Modern Theory). Wages: Real and money wages – Demand and supply theory of wages, Role of trade unions in the determination of wages.

Unit 4 Profit: Normal and surplus, Gross and Net Profit - Risk, uncertainty bearing, Innovation and marginal productivity theories. Rent: Ricardian and Modern Theories – Rent and Price – Quasi Rent – situation and ability rent.

Unit 5 Interest: Gross and net interest, real and money interest – bond prices and rate of interest, saving and investment, liquidity preference and modern theories of interest.

Recommended Books:

1. Gauld, J. P. and Edward P. L. (1996). *Micro Economic Theory*. Homewood: Richard Irwin.
2. Lipsey, R. G., and K. A. Chrystal (1999). *Principles of Economics* (9th Edition). Oxford: Oxford University Press.
3. Mansfield, E (1997). *Microeconomics* (9th Edition). New York: W.W. Norton and Company.
4. Samuelson, P.A. and W.D. Nordhaus (1998). *Economics*. New Delhi: Tata McGraw Hill.
5. Varian, H. R. (2000). *Intermediate Microeconomics: A Modern Approach (5th Edition)*. New Delhi: East West Press.
6. माथुरपी. एन. : मूल्य सिद्धांत
7. जैन के. पी. : व्यष्टिअर्थशास्त्र

E-Learning Materials:

1. www.aeaweb.org
2. <https://www.oswego.edu/economics/resources>

Macro Economics -I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Describe nature of Micro Economic analysis and Macro Economic Analysis
- Analyze Static, Comparative and Dynamic Economic Analysis
- Identify Central Problems of Economic Systems and their solutions
- Calculate National Income and its related aggregates and analyse the problems and limitation of National income estimation
- Describe Circular flow of income and expenditure.
- Analyze concepts of employment unemployment and fullemployment.

Unit 1 Methods of Economic Analysis: Micro and Macro Economic analysis, Static, Comparative Static and Dynamic analysis and General and Partial equilibrium analysis.

Unit 2 Central Problems of Economic Systems, Solutions of central problems in different economies – Capitalist, Socialist and Mixed Economy.

Stock and Flow Variables. Economy as a circular flow of income and expenditure in two, three and four sector economies, Major leakages and injections.

Unit 3 National Income and its related aggregates – GDP, GNP, NDP NNP, Private income, Personal income and Personal disposable income; Components of National Income, Inter-relationship among National Income aggregates. Uses and limitation of national income statistics.

Unit 4 Methods of Measuring National Income- Product or value added method, Income method and Final Expenditure method. Precautions and limitations of various methods, Problems in the estimation of national income. National Income and Economic Welfare.

Unit 5 Theory of Employment: Definition of full employment, Types of Unemployment. Say's Law of Market and classical Theory of Employment.

Recommended Books:

1. Lewis, M.K. and P.D. Mizan (2000). *Monetary Economics*. New Delhi: Oxford University Press.
2. Lipsey, R. G. (1963). *An Introduction to positive Economics*. London: Weidenfeld& Nicolson.
3. Mithani, D.M. (1990). *Macro Economics*. New Delhi: Himalaya Publishing House.

E-Learning Materials:

1. <http://sites.northwestern.edu/neweresources/2009/03/11/american-economic-journal-macroeconomics/>
2. <https://www.rbi.org.in/SCRIPTs/PublicationsView.aspx?id=18466https://www.rbi.org.in/SCRIPTs/PublicationsView.aspx?id=18467>
3. https://www.economicsonline.co.uk/Competitive_markets/The_economic_problem.html
4. <https://www.marxists.org/reference/subject/economics/keynes/general-theory/ch02.htm>
5. <http://www2.econ.iastate.edu/tesfatsi/sources.html>

Macro Economics - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Understand the basic concepts of consumption, savings, investment, inflation.
- Understand the tenets of Keynesian Economics and apply them through the aggregate demand and supply model.
- Explain how the equilibrium interest rate is determined in the money market.
- Define the investment multiplier; explain its calculation, and relevance.
- Explain the working of acceleration principle and its weaknesses.

Describe the business cycles and their phases

Unit 1 Consumption Function: Meaning, Types of consumption Function – Linear and Non-Linear consumption Functions. Keynesian Psychological Law of Consumption, Factors Influencing Consumption Function.

Saving Function – Derivation of saving function from consumption function, APS and MPS.

Investment Function – Types of Investment: Induced Investment and Autonomous Investment, Gross and Net Investment, Financial and Real Investment. Factors affecting Investment Decision. Concepts of MEC (Marginal Efficiency of Capital) and NPV (Net Present Value).

Unit 2 Keynesian objection to the classical theory. Keynesian Theory of Employment – Aggregate demand and Aggregate supply function, The Principle of Effective demand, Equilibrium in Money Market.

Unit 3 Determination of Equilibrium of National Income: Keynesian Theory – Aggregate Demand and Aggregate Supply Approach and Saving and Investment Approach. Relevance of Keynesian theory in underdeveloped countries.

Unit 4 Investment Multiplier: Concept and Working of static Multiplier. Assumptions and Leakages of Multiplier. It's Effectiveness in less developed countries (LDC's)

Acceleration Principle: Concept, Operation and Weaknesses.

Unit 5 Business cycles: Phases and theories of Business cycle – Hicks and Samuelson.

Inflation: Meaning and Types Cost Push and Demand Pull inflation, Inflationary Gap, Measures to control inflation

Deflation: Meaning and causes, Deflationary Gap, Measures to control deflation.

Recommended Books:

1. Ahuja, H.L. (2006). *Advanced Economic Theory*, New Delhi: Sultan Chand and Co.
2. Mankiw, N. G. (2010). *Macroeconomics*. New York: Worth Publishers.
3. Mithani, D.M. (1990). *Macro Economics*. New Delhi: Himalaya Publishing House.
4. Shapiro, E. (1996). *Macroeconomic Analysis*. New Delhi: Galgotia Publication.
5. एस. के. मिश्र : समष्टि अर्थशास्त्र
6. एस. के. मिश्र : समष्टि अर्थशास्त्र, नीति और विश्लेषण

E-Learning Material:

1. <http://www.oswego.edu/~kane/eco200.html>
2. <http://www.stanford.edu/~sargent/ljungqvist.html>

<http://www.econport.org/content/handbook.html>

Money and Banking

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Understand the role of money in the broader economy.
- Understand the unique role of banking financial system.
- Analyse a Bank's balance sheet.
- Acquire adequate knowledge of theories related to supply of, and demand of money, and its relationship with prices.
- Analyse the role of a central bank and instruments of monetary policy.

Unit 1 Definition and functions of money, Gresham's law, Role of money in capitalist, socialist and mixed economies.

Unit 2 Supply of money: Concepts and Components, Approaches regarding measures of money supply – Traditional approach, Chicago School's Monetarist approach, Gurley Shaw approach and Radcliffe or Liquidity approach. A brief discussion of RBI's measures of money supply. Demand for money: Pre-Keynesian and Keynesian approach.

Unit 3 Money and Prices : (i) Traditional Quantity theory of money (Fisher's equation and Cambridge equations) (ii) Income theory of money and prices (iii) General theory of money and prices.

Unit 4 Banking - Meaning and Functions of commercial banks, Process of credit creation, Balance-Sheet of a commercial bank: Format and Portfolio Management.

Unit 5 Central Banking: Definitions, Functions, Methods of credit control – Quantitative and Qualitative measures.
Reserve Bank of India – Organisation and Functions.

Books Recommended:

1. Chaturvedi, D.D. (2011). Macroeconomics: Analysis and Policy. New Delhi: IBH.
2. Gupta, S. B. (1983). Monetary Economics. Oxford: Oxford University Press.
3. Mithani, D. M. (1989). Money, Banking, International Trade and Public Finance. New Delhi: Himalaya Publishing House.
4. Seth, M. L. (1981). Money, Banking, International Trade and Public Finance. Agra: Lakshmi Narain Agarwal Educational Publishers.

E-Learning Materials:

1. <https://rbi.org.in/Scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy>
2. https://www.rbi.org.in/scripts/fs_overview.aspx?fn=2752
3. <https://rbi.org.in/CommonPerson/english/scripts/banksinindia.aspx>

Quantitative Techniques

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Solve numerical problems related to Correlation and Regression analysis and identify its applications
- Explain meaning of Index numbers and demonstrate ability to construct Index numbers using various techniques.
- Solve various types of numerical based on Probability and related theorems.
- Measure trend using various techniques of Time Series Analysis.
- Define various concepts and solve numerical related to Quadratic equations, Matrices, Arithmetic and Geometric Progression, and Straight Line.

Unit 1 Analysis of Bivariate Data: Simple Correlation – Karl-Pearson’s Coefficient of Correlation, Spearman’s rank correlation. Simple regression – Estimation of regression lines by method of least squares. Numerical exercises based on correlation and regression.

Unit 2 Index Numbers – concept and uses. Problems in construction of index numbers. Construction of simple and weighted index numbers by aggregative and average of price relative methods. Base shifting, splicing and deflating of index numbers. Cost of living index numbers.

Unit 3 Meaning, Objectives and components of Time Series. Measurement of linear trend by Graphic Method, Method of Semi-Averages, Method of Moving Averages and Method of Least Squares. Measurement of seasonal variation by the Method of seasonal average.

Unit 4 Concepts of events and probability, addition and multiplication theorems. Conditional probability and independence of events. Numerical problems based on probability.

Unit 5 Solution of quadratic equations. Arithmetic and Geometric progressions. Straight line. Simple applications of straight line. Addition, subtraction and multiplication of matrices.

Books Recommended:

1. Black, J., & Bradley, J. F. (1973). *Essential Mathematics for Economists*. New Jersey, US: John Wiley and Sons.
2. Bose, D. (2018). *An Introduction to Mathematical Economics*. New Delhi: Himalaya Publishing House.
3. Gupta, S.C. (2018). *Fundamentals of Applied Statistics*, New Delhi: S. Chand & Sons.
4. Gupta, S.P. (2002). *Introduction to Statistical Methods*. New Delhi: S. Chand & Sons.
5. Spiegel, M.R... (1999). *Theory and Problems of Statistics*. London: McGraw Hill Book Co.
6. के. एन. नागर : सांख्यिकी के मूलतत्व
7. डी. सी. गोखरू : अर्थशास्त्रीय गणित

E-Learning Material:

1. <http://www.jamesbrennan.org/algebra/>
2. <http://www.statsoft.com/Textbook>
3. <https://www.britannica.com/science/statistics>

Public Finance

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Conceptualise, explain and give examples of concepts of public goods and externality
- Understand and explain the role of government according to economic theory
- Identify and distinguish between various sources of Public Revenue and assess the impact and incidence of taxation
- Identify various features of Indian Tax system.
- Understand and explain concepts related to Public Expenditure, Public Debt and the Budget.

Unit 1 Nature and Scope of Public Finance. Concepts of Private, Public and Merit Goods. Role of government in the economy. Principle of maximum social advantage.

Unit 2 Sources of Public Revenue. Choices of Taxes: Proportional v/s Progressive taxes, Direct V/s Indirect taxes. Canons of Taxation. Incidence and Impact of a tax: Basic concepts, Theories of tax shifting. Various factors influencing the incidence and shifting of a tax.

Unit 3 Justice in Taxation: Benefit and Ability to Pay Approaches. Salient Features of Indian Tax System. Public Expenditure: Factors influencing Public expenditure, Wagner's Law and the Peacock Wiseman Hypothesis.

Unit 4 Public Borrowing: Sources, Burden of Internal and External Public debt. Methods of debt redemption. Budget Concepts: Revenue and Capital Budget, Concepts of Budget Deficits. Fiscal Policy: Objectives, Instruments and Limitations.

Unit 5 Fiscal Federalism: Principles of federal finance, constitutional provisions in India. Centre –State Financial Relations in India.

Recommended Books:

1. Misra, B. (1981). *Economics of Public Finance*. New Delhi: South Asia Books.
2. Bhatia, H. L. (1993). *Public Finance*. New Delhi: Vikas Publishing House.
3. Tyagi, B.P. (2016). *Public Finance*. Meerut: Jai Prakash Nath & Company.
4. Musgrave, Richard A. (1959). *Theory of Public Finance*. Kogakusha, Tokyo: McGraw Hill.
5. शर्मा, पी. पी. : सार्वजनिक वित्त के सिद्धान्त
6. हजेला, तिलक नारायण : राजस्व के सिद्धान्त सिन्हा वी.सी. एवं सिन्हा पुष्पा : राजस्व

E-Learning Material:

1. <https://www.indiabudget.gov.in/>
2. <https://www.nipfp.org.in/home-page/>
3. <https://dea.gov.in/indian-public-finance-statistics>
4. <http://www.publicfinance.in/site/indexandbook.html>

International Economics

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Discuss and explain trade policy issues such as protectionism and free trade.
- Understand and apply the principle of comparative advantage-
- Apply partial equilibrium models in analysing the economic effects of trade policy instruments such as tariffs and quotas.
- Understand the concept of BoP and its disequilibrium
- Critically analyse different theories of determination of exchange rate.
- Appreciate the role of international organizations such as IMF, World Bank, WTO, UNCTAD

Unit 1 The Nature of International Trade, Free Trade Vs Protection. Theories of International trade: classical and opportunity cost theories.

Unit 2 Terms of Trade – meaning and types. Tariffs – effects of tariffs under partial equilibrium conditions, Types and Effects of Import Quota.

Unit 3 Balance of Payments - Meaning and Structure, Disequilibrium in Balance of Payments – Meaning, Types and causes, Measures to control disequilibrium in BOP.

Unit 4 Theories of determination of Exchange Rate – Mint Parity Theory, Purchasing Power Parity Theory, Balance of Payment Theory of Exchange Rate. Fixed vs. Flexible Exchange Rate.

Unit 5 Exchange Control – Meaning, Objectives and Methods, International Institutions: IMF, World Bank, WTO, UNCTAD.

Recommended Books:

1. Sodersten, Bo (1991). *International Economics*. London: The Macmillan Press Ltd.
2. Mithani, D.M. (2003). *International Economics*. New Delhi: Himalaya Publishing House.
3. Cherulinam, F. (2006). *International Economics*. New Delhi: McGraw Hill Education (India) Private Limited.
4. Salvatore, D. (1997). *International Economics*. S Upper Saddle. River, N.J: Prentice Hall.
5. Mannur, H.G. (1995). *International Economics*. New Delhi: Vikas Publishing House.
6. डॉ. टी. एल. जैन : अंतर्राष्ट्रीय अर्थशास्त्र (हिन्दी एवं अंग्रेजी) हरियाणा साहित्य अकादमी
7. सिन्हा, वी. सी. : अंतर्राष्ट्रीय अर्थशास्त्र
8. स्वामी, के. डी. : अंतर्राष्ट्रीय अर्थशास्त्र

E-Learning Material:

1. <http://ipindia.nic.in/ipr/patent/patents.htm>
2. <http://dgft.delhi.nic.in>
3. <http://dipp.nic.in/>
4. https://www.wto.org/english/thewto_e/thewto_e.htm
5. <https://unctad.org/en/Pages/aboutus.aspx>

Indian Economy – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Understand the historical background of colonial economy.
- Appreciate the nature and characteristics of Indian Economy.
- Understand the evolution of Indian Planning, its strategies, objectives and failures.
- Analyze the development of physical and social infrastructure in India.
- Analyze Institutional Reforms in Indian Agriculture.
- Analyze issues of agriculture finance and marketing in India

Unit 1 A brief historical background of colonial economy.

Basic features of Indian Economy – as an underdeveloped, developing and mixed economy.

Infrastructure Development in India - power and irrigation.

Unit 2 Planning in India: strategies, objectives, achievements and failures, latest five year plan details.

Unit 3 Agriculture sector in India: Land Reforms (institutional reforms) in India: abolition of intermediates, tenancy reforms and ceiling of land holdings, Causes of land, sub-division and their measures. The green revolution, productivity in agriculture sector.

Unit 4 Agriculture labour, food security, public distribution system, agriculture price policy in India. Agriculture finance and agriculture marketing.

Unit 5 Industrial sector in India. industrial progress during plans, recent industrial policy (after 1991), public enterprises and issues of privatisation.

Books Recommended:

1. RuddarDutt and K.P.M Sundaram (2000). *Indian Economy*. New Delhi: S. Chand & Co.
2. Dhingara, I.C (2018). *The Indian Economy: Environment and Policy*. New Delhi: Sultan Chand & Sons.
3. Misra, S.K. & V.K. Puri (2011). *Indian Economy*. New Delhi: Himalaya Publication House.
4. Verma J.D. and K. K.Dewett (2008). *Elementary Indian Economics*. New Delhi: S. Chand & Co Ltd.

E-Learning Material:

1. <http://personal.lse.ac.uk/ghatak/landref.pdf>
2. <http://re.indiaenvironmentportal.org.in/files/food%20security%20in%20india.pdf>
3. https://www.iisd.org/pdf/2006/climate_designing_policies_chap5.pdf

Indian Economy – II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Understand importance and problems of Industrial sector in India.
- Analyse composition and direction of foreign trade and foreign trade policy in India.
- Understand the concept of poverty and unemployment.
- Evaluate the policies related to poverty, unemployment and inflation in India.

Unit 1 Industrial sector in India: Characteristics, contribution and problems. Industrial policy (pre and post reforms period), public enterprises and issues of privatisation. Policy measures for SSI's.

Unit 2 Service Sector in India: Growth and Characteristics. Foreign trade composition and direction. Globalization and Foreign trade policy (EXIM) after 1991.

Unit 3 Balance of payment problem in India. Foreign capital: classification, need and problems. MNCs and their impact on Indian Economy.

Unit 4 Problem of poverty: concept causes and poverty eradication programmes.
Nature and causes of unemployment in India, some important schemes to reduce unemployment.

Unit 5 Problem of inflation in India and RBI's recent monetary policy. Population problem, policy measures and government programmes.

Books Recommended:

1. Dhingra, I.C. (2000). *The Indian Economy: Environment and Policy*. New Delhi: Sultan Chand & Sons.
2. Misra, S.K. & V.K. Puri (2011). *Indian Economy*. New Delhi: Himalaya Publication House.
3. Verma, J.D. and K. K. Dewett (2008). *Elementary Indian Economics*. New Delhi: S Chand & Co Ltd.
4. Ruddar, D. & K.P.M. Sundaram. (2000). *Indian Economy*. New Delhi, India: S. Chand & Co.
5. Kapila, U. (2005). *Indian Economy: Issues in Development and Planning & Sectoral Aspects*. New Delhi: Academic Foundation.

E-Learning Material:

1. <http://www.asercentre.org/Keywords/p/315.html>
2. <http://www.nuepa.org/new/Annual%20Reports.aspx>
3. http://rchiips.org/nfhs/factsheet_NFHS-4.shtml

Development Economics and Environment

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: On successful completion of the course, students will be able to:

- Acquire a basic understanding of the issues and on-going debates on development economics.
- Discuss the important theories in economic development and their policy implication.
- Demonstrate a basic knowledge of the role of market and market failure with regard to the allocation of natural resources and environmental amenities.
- Analyze and interpret the environmental implications of economic decisions
- Understand the nature and scope of contemporary environmental debates

Unit 1 Meaning of Economic Growth and Development.Measures of Economic Development.Characteristics of Underdeveloped Economies.Obstacles to Economic Development.

Unit 2 Factors helping Economic Development; Natural Resources, Population, Human Capital, Physical Capital and Technology.

Unit 3 Characteristics of Modern Economic Growth. Theories of Economic Growth: Rostow's Stage Theory, Balanced and Unbalanced Growth.

Unit 4 Theory of Big Push, Critical Minimum Effort Theory, Nelson's Low-level Equilibrium Trap Theory.

Unit 5 Interrelationship between environment and economic development.Sustainable development – Concepts, Indicators and Measurement. Global environmental issues - The Global concern, Policy options in developing and developed countries.

Recommended Books:

1. Goel, R.L. (1975). *Economics of Growth and Development*. New Delhi: MeenakshiPrakashan.
2. Jhingan, M. L. (1974). *Economics of Development and Planning*. New Delhi: Vikas Publishing House.
3. Todaro, M. P. (1969). *Economic Development in the Third World*. New York: Longman Inc.
4. Mishra, S. K., & V. K. Puri (2010). *Economics of Development and Planning-Theory and Practice*. New Delhi: Himalaya Publication House.
5. Thirlwall, A.P. (2005). *Growth and Developmen*. New York: Palgrave McMillan.
6. सिन्हा, बी. सी. एवं दुबे, आर.एन. : आर्थिक विकास एवं नियोजन

E- Learning Materials:

1. <https://www.iisd.org/library>
2. <http://projekty.osu.cz/igeography/docs/Euromodel%20ENVIRONMENT%20AND%20DEVELOPMENT.pdf>
3. <http://www.globalissues.org/issue/168/environmental-issues>

<https://www.ukessays.com/essays/economics/barriers-indias-economic-development-3066.php>

Micro Economic Theory- I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Analyze and appraise cardinal, ordinal and revealed preference approaches to consumer behaviour.
- Discuss various concepts of elasticity and its measurement.
- Apply the concept of elasticity in business decision making.
- Discuss the behaviour of production in short run and long run.
- Apply the theory of production in producer's decision making.
- Describe various revenue concepts and explain the behaviour of revenue under different market structures.
- Analyse short run and long run equilibriums of firms under perfect competition and monopoly.

Section-A

Theory of demand: Utility analysis – Assumptions and laws of utility analysis; The indifference curve theory: Characteristics of an indifference curve, Concept of Price line, Consumer's equilibrium; Price, income and substitution effects (Hicks and Slutsky's views), Breaking up the Price effect into income and substitution effects; Normal, inferior and giffen goods; Derivation of demand curve through price consumption curve (PCC); Violation of the premises about indifference curves; Satiation and Lexicographical orderings; Elasticity of demand: Price, income and cross elasticity of demand, Elasticity of substitution; The Revealed Preference Theory.

Section –B

Theory of Production: Concepts of production function, Product curves and Iso quants; Laws of production: Law of variable proportions, Symmetry between three stages of production. Degree of homogeneity and Laws of returns to scale, Ridge lines, Iso-cost line, Choice of optimal combination of factors, Expansion path; Types of production function: Linear homogeneous, Cobb Douglas, The CES and the Fixed coefficient production functions.

Section-C

Market Structure: Basic concepts of Revenue- Total Revenue (TR) Average Revenue (AR) and Marginal revenue (MR); Relationship between Average Revenue, Marginal Revenue and price elasticity of demand; Theory of cost in the short run and long run; Perfect Competition: Short run and long run equilibrium of a firm and industry. Monopoly: Short run and long run equilibrium of a monopolist; Price discrimination under monopoly: First degree, second degree and third degree discrimination.

Recommended Books:

1. Baumol, W.J. (2015). *Economic Theory and Operations Analysis*. Prentice Hall of India.
2. Da, Costa, G.C., (1980). *Production, Prices and Distribution*. New Delhi: Tata McGraw Hill,
3. Deaton, A.S. and J. Muellbauer. (2012). *Economics and Consumer Behavior*, Cambridge University Press, Cambridge.
4. Dobb, M., & Dobb, M. H. (1975). *Theories of value and distribution since Adam Smith: Ideology and economic theory*. Cambridge University Press.
5. Gould, J. P., & Ferguson, C. E. (1980). *Microeconomic theory* (No. 04; HB172, G6 1980.). RD Irwin.
6. Hirshleifer, J., & Glazer, A. (1992). *Price theory and applications*. Prentice Hall
7. Koutsoyiannis, A. (1975). *Modern microeconomics*. Springer. Macmillon Press, London.
8. Kreps, D. M. (1990). *A course in microeconomic theory* (Vol. 41). Princeton, NJ: Princeton university press.
9. Sen, A. (1976). *Micro Economics: Theory and Applications*, Oxford University Press, New Delhi
10. Varian, H. R. (1992). *Microeconomic Analysis* WW Norton & Co. New York.

E- Learning Material :

1. www.aeaweb.org

Micro Economic Theory - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Calculate equilibrium price and output of firms under monopolistic competition and oligopoly.
- Appraise various market structures in terms of their welfare implications.
- Discuss determination of factor prices.
- Analyse role of labour unions in determination of wages.
- Analyse efficiency of market outcomes under asymmetric information.
- Discuss the models of general equilibrium.
- Analyse the problems related to general equilibrium.
- Appraise various criteria for economic welfare.

Section-A

Market structure: Monopolistic competition: assumptions, product differentiation and the demand curve, The concepts of industry and group, Short run and long run equilibrium of a firm; Oligopoly: Non-collusive oligopoly: The Duopoly models of Cournot, Bertrand and Stackelberg, Chamberlin's oligopoly model; The kinked demand curve model; Collusive oligopoly: Theory of cartels and price leadership models; A 'Representative' model of average – Cost pricing.

Section-B

Distribution: The general theory of factor price determination under perfect competition, monopoly and monopsony; Concept of exploitation of labor and role of labor unions in wage determination. Information economics: Types of asymmetric information-Moral hazard, Adverse selection, Signalling; Market for lemons; Principal agent problem; Efficiency of market outcomes under asymmetric information.

Section-C

General Equilibrium: Meaning, Partial versus General equilibrium approach, Walrasian general equilibrium model, Tatonnement, Existence, Uniqueness and stability of equilibrium, A graphical treatment of the 2-factor, 2-commodity, 2-consumer general equilibrium system (2x2x2 model); Welfare economics: Criteria of social welfare-Value judgments in welfare economics, Basic theorems of new welfare economics- Pareto optimality and necessary conditions to achieve it; Market forms and welfare; Compensation principle: Kaldor-Hicks criterion; The Bergson criterion: Social welfare functions.

Recommended Books:

1. Baumol, W.J. (2015). *Economic Theory and Operations Analysis*. Prentice Hall of India.
2. DaCosta, G.C., (1980). *Production, Prices and Distribution*. Tata McGraw Hill, New Delhi.
3. Deaton, A.S. and J. Muellbauer. (2012). *Economics and Consumer Behavior*, Cambridge University Press, Cambridge.
4. Dobb, M., & Dobb, M. H. (1975). *Theories of value and distribution since Adam Smith: Ideology and economic theory*. Cambridge University Press.
5. Gould, J. P., & Ferguson, C. E. (1980). *Microeconomic theory* (No. 04; HB172, G6 1980.). RD Irwin.
6. Hirshleifer, J., & Glazer, A. (1992). *Price theory and applications*. Prentice Hall
7. Koutsoyiannis, A. (1975). *Modern microeconomics*. Springer Macmillan Press, London.
8. Kreps, D. M. (1990). *A course in microeconomic theory* (Vol. 41). Princeton, NJ: Princeton university press.
9. Sen, A. (1976). *Micro Economics: Theory and Applications*. Oxford University Press, New Delhi
10. Varian, H. R. (1992). *Microeconomic Analysis* WW Norton & Co. New York.

E- Learning Material

1. www.aeaweb.org
2. <https://www.economicsnetwork.ac.uk>

Macro Economic Theory - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Describe Circular flow of income and expenditure and analyse the effect of leakages and injections in various sector of the economy.
- Calculate National Income and its related aggregates and analyse the problems and limitation of National income estimation
- Describe basic Classical Model of output and employment and estimate the effect of money market and labour market changes on the level of output and employment.
- Analyse Keynesian Model of output and employment and evaluate the level and process of National Income determination
- Explain the process and importance of Multiplier
- Analyse and Elaborate Income-Consumption Relationship
- Explain Absolute Income, Relative Income and Permanent Income Hypothesis

Section – A

Circular flow of income in two, three and four sector economy; National income: concepts, components and measurement of national income.

Section- B

Basic classical model: Classical theory of output and employment; Say's law of market and Quantity theory of money, Classical model without saving and investment – Effects of a change in money supply, Demand for labour and Supply of labour, Effects of rigid money wage, Classical theory with saving and investment.

National income determination (two, three, and four sector economies): The Keynesian model – The aggregate demand & supply approach; saving and investment approach.

Section-C

Theory of multiplier: Static and dynamic multipliers, Super multiplier, Paradox of thrift; Government purchases, Transfer payments and Tax multipliers, Balanced budget multiplier, Foreign trade multiplier.

Consumption demand: Income – Consumption relationship – Absolute income, Relative income, Permanent income and Life cycle hypotheses.

Recommended Books:

1. Branson, W.H. (2005). *Macro Economic Theory and Policy*. Harper and Row, New York.
2. Dernberg, T. (1980). *Macro Economics*. McGraw Hill, Koga Kusha, Tokyo.
3. Dornbusch, R and S. Fischer. (1978). *Macro Economics*. McGraw Hill. Koga Kusha, Tokyo.
4. Edgmand, M.R. (1987). *Macro Economics – Theory and Policy*. Prentice – Hall of India, New Delhi.
5. Shapiro, E. (2015). *Macro Economic Analysis*, 5thed, Galgotia Publications (p) Ltd., New Delhi.
6. Jha, R. (2008). *Contemporary Macro Economic Theory and Policy*. Willey Eastern Ltd., India.

E- Learning Material

- 1 <http://sites.northwestern.edu/newresources/2009/03/11/american-economic-journal-macroeconomics/>

2. <http://www2.econ.iastate.edu/tesfatsi/sources.html>
3. <https://www.oecd-ilibrary.org/economics>
4. <https://www.imf.org/external/index.html>
5. <http://epwrfits.in/index.aspx>
6. <https://www.ft.com/>
7. <http://www.delnet.in/>
8. <https://www.elgaronline.com/browse?access=user&level=parent>

Macro Economic Theory - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Analyse the Samuelson, Hicks and Kaldor models of business cycles.
- Describe the investment behaviour through various theories of investment.
- Evaluate the tradeoff between inflation and unemployment and analyse the relation under adaptive expectations and rational expectations
- Examine the validity and applicability of the classical and Keynesian model of income and employment in recent years.
- Analyse the New Classical Model and New Keynesian Model.
- Describe the money market equilibrium and analyse the simultaneous equilibrium in money market and product market through IS-LM Model.
- Analyse the relative effectiveness of monetary policies and fiscal policies

Section –A

Investment demand: Stock market and Tobin's q-ratio, Accelerator theory of investment (simple and flexible acceleration models); Theories of business cycle: Samuelson, Hicks and Kaldor models.

Phillips curve: Tradeoff between inflation and unemployment, Keynesian explanation of Phillips curve; Natural unemployment hypothesis and Adaptive expectation (Friedman's view); Long-Run Phillips curve-Rational expectations; Relationship between short run and long run Phillips curve.

Section-B

The new classical model (Lucas view); The new Keynesian model; Real business cycle school : Real business and inter temporal substitution of labor- Real business cycle theory- technology shocks- neutrality of money and flexibility of wages and prices- Real business cycle view on great depression.

Section-C

Equilibrium in money market: The Keynesian model, Liquidity trap; Simultaneous equilibrium in money and product market- IS-LM model; Relative effectiveness of monetary and fiscal policies; Fiscal policy and crowding-out; Lags in the effect of macroeconomic policy, Rules versus Discretion.

Recommended Books:

1. Branson, W.H. (2005). *Macro Economic Theory and Policy*, Harper and Row, New York.
2. Dernberg, T. (1980). *Macro Economics*, McGraw Hill, Koga Kusha, Tokyo.
3. Dornbusch, R and S. Fischer. (1978). *Macro Economics*, McGraw Hill. Koga Kusha, Tokyo.
4. Edgmand, M.R. (1987). *Macro Economics – Theory and Policy*. Prentice – Hall of India, New Delhi.
5. Shapiro, E. (2015). *Macro Economic Analysis*, 5thed, Galgotia Publications (p) Ltd., New Delhi.
6. Jha, R. (2008). *Contemporary Macro Economic Theory and Policy*. Willey Eastern Ltd., India.
7. Mishkin, F. S(2008). *The Economics of Money, Banking and Financial market*, Addison, Wisely.
8. Froyen, T. R(2010), *Macroeconomics: Theories and Policies*, Pearson Prentice Hall.

E- Learning Material

- 1 <http://sites.northwestern.edu/newresources/2009/03/11/american-economic-journal-macroeconomics/>
- 2 <http://www2.econ.iastate.edu/tesfatsi/sources.htm>
- 3 <https://www.oecd-ilibrary.org/economics>
- 4 <https://www.imf.org/external/index.htm>
- 5 <http://epwrfits.in/index.aspx>
- 6 <https://www.ft.com/>
- 7 <http://www.delnet.in/>
- 8 <https://www.elgaronline.com/browse?access=user&level=parent>

International Trade and Commercial Policy

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Discuss various theories of international trade.
- Appraise and compare the theories of international trade.
- Identify the direction, composition of trade and gains from trade.
- Discuss the partial and general equilibrium effects of tariffs and quota.
- Calculate the economic effects of tariffs and quota.
- Appraise and compare the welfare effects of Tariff and Non Tariff Barriers to Trade.
- Discuss the various forms and effects of economic integration.
- Appraise the welfare effects of economic integration.

Section -A

Theories of International Trade – Absolute and Comparative advantage theory; Heberler's Opportunity Cost Theory; Mill's Reciprocal Demand Theory; Heckscher Ohlin Theorem – Factor Abundance in terms of price and physical; criteria Factor Intensity Factor Price Equalization Theorems. Leontief Paradox. Recent explanations of the basis of trade in terms of technological lead, domestic market size: Product Cycle approach, Linder's Hypothesis

Section- B

Intra-industry trade; Effects of trade under monopolistic competition. Neo-Chamberlinian models (Krugman model), Oligopolistic models (Brander-Krugman model); Trade and growth – export led or outward looking industrialization; Effects of growth on trade- Production and Consumption effects: Increase in Factor Endowment- The Rybczynski Theorem: Growth and terms of trade – Concept of immiserising growth.

Section- C

Partial and General equilibrium analysis of tariff and quota; The optimum tariff; Effective rate of protection; Non-tariff barriers and the new protectionism; The theory of economic integration – Trade creation and Trade diversion effects.

Recommended Books:

1. Kindleberger C.P. (1958) International Economics, Revised Edition. R.D. Irwin. Homewood.
2. Sodersten. Bo. (1994). International Economics, Macmillan, London.
3. Salvatore, D. (2001). International Economics, John Willey & Sons. Inc., New York.
4. Mannur, H.G. 2e. International Economics, Vikas Publishing House.

E- Learning Material

1. American Economic Association: www.aeaweb.org
2. www.economist.com
<https://www.oswego.edu/economics/resources>

International Money and Finance

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Describe the structure of the Balance of Payment of a country.
- Identify the presence and nature of disequilibrium in Balance of Payment of a country.
- Discuss the various mechanisms of adjustment in Balance of Payment of a country.
- Appraise and compare the various mechanisms of adjustment in Balance of Payment of a country.
- Discuss various approaches to determination of exchange rates.
- Appraise and compare various approaches to determination of exchange rates.
- Explain the trends in the movement of Indian Rupee against major currencies of the world.
- Appraise the welfare effects of international capital movements.
- Identify the causes of debt and financial crises

Section- A

Balance of payment: Meaning and structure; Disequilibrium in balance of payments: Meaning and Causes; Measures to correct BOP disequilibrium: Price adjustment mechanism under fixed and flexible exchange rate; Income adjustment mechanism and Synthesis of automatic adjustments; Fiscal and Monetary policies in BoP adjustment (under both fixed and flexible exchange rates).

Section- B

Theories of exchange rate determination: PPP theory, Monetary model of BOP under fixed and floating exchange rate – Portfolio balance model; Indian Rupee and its fluctuations in international currency markets; Essentials of international monetary order under Bretton Woods – Problem of international liquidity–Changing role of IMF – IMF conditionalities – World Bank and structural adjustment loan facility.

Section- C

International financial movements: Portfolio and direct investments and their impact on the economy. External debt – measuring the debt burden – Debt servicing – Third World debt problem; Debt and financial crisis; Important international financial crisis: East asian crisis, Brazil, Argentina and Mexico, The sub-prime crisis.

Recommended Books:

1. Kindleberger C.P. (1958) International Economics, Revised Edition. R.D. Irwin. Homewood.
2. Salvatore, D. (2001). International Economics, John Wiley & Sons. Inc., New York.
3. Mannur, H.G. 2e. International Economics, Vikas Publishing House.
4. Sodersten. Bo. (1994). International Economics, Macmillan, London.
5. Carbough, R.J., International Economics, Thomson South-Western.

E- Learning Material :

1. <https://hbsp.harvard.edu/economics>
2. www.aeaweb.org
3. www.economist.com

Mathematics for Economics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Solve problems related to equilibrium of national income, market equilibrium and input output modeling by applying the concepts of matrices and determinants.
- Demonstrate consumer and producer's equilibrium employing linear programming technique.
- Demonstrate optimum strategies of economic agents using Game Theory Approach.
- Solve optimization problems of consumers and firms using differential calculus

Section - A

Determinants and their basic properties; Solution of simultaneous equations by Cramer's rule; Concept and types of matrices; Addition, subtraction and multiplication of matrices; Inverse of a matrix and solution of simultaneous equations; Static input-output analysis- Open and closed models.

Section - B

Linear programming (LP): concept and formulation of LP problems, Solutions of LPP by Graphical and Simplex Methods. Straight line, Parabola and Hyperbola as used in economics; Game theory -Concept of a game; Strategies – Simple and Mixed; Value of a game; Saddle point solution.

Section - C

Differentiation of a function; Maxima and Minima - in Single and Multivariate functions- unconstrained and constrained, Partial differentiation. Applications of differential and integral calculus in Economics.

Recommended Books:

1. Chiang A. C. (1984). *Fundamental Methods of Mathematical Economics*. New York: McGraw hill.
2. Taro, Y. (1988). *Mathematics for Economists*. New Delhi: Prentice Hall of India.
3. Klein M.W. (2017). *Mathematical Methods for Economics*. 2nd edition, Addison-Wesley.
4. Dowling, E. (2001). *Introduction to Mathematical Economics*. McGraw Hill.

E- Learning Material

1. <http://link.springer.com/openurl?genre=book&isbn=978-94-6239-087-4>
2. <https://www.economicsnetwork.ac.uk>

Statistical Methods for Economics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Describe census and sample methods of data collection.
- Analyze relationship between economic variables using correlation and regression.
- Discuss various concepts related to theory of probability.
- Discuss various concepts related to hypothesis testing and their application in economic research.

Section-A

Sample v/s census methods; Types of sampling; Correlation – simple, partial and multiple; Association of attributes (case of two attributes only); Simple and multiple linear regressions; Coefficient of determination.

Section-B

Deterministic and non-deterministic experiments, Experiment and types of events, Classical and empirical definitions of probability, Laws of addition and multiplication, Conditional probability and concept of interdependence, Baye's theorem and its applications; Concept of random variable, Mean and variance of a random variable; Mathematical expectation; Binomial, Poisson and Normal probability distributions.

Section-C

Concept of parameter and statistic; Concept of an estimator and its sampling distribution, Desirable properties of an estimator; Basic concepts in hypothesis testing - null and alternative hypothesis, Confidence interval, Level of significance, Critical region, One and two tail test, Type I and Type II errors, Hypothesis testing based on Z, T, F(including one way and two way ANOVA) and Chi square tests.

Recommended Books:

1. Gupta, S.C., (2018) *Fundamentals of Applied Statistics*, S. Chand and Sons, New Delhi.
2. Gupta, S.P., (2011) *Statistical Methods*, S. Chand and Sons, New Delhi.
3. Speigal, M.R., (2003) *Theory and Problems of Statistics*, McGraw Hill Book Co., London.
4. Nagar, A.L. and Das, R.K. (1993). *Basic Statistics*, oxford University Press, New Delhi.
5. Chou, Y., (1975) *Statistical Analysis with Business and Economics Applications*, Reinhart and Winston, New York.

E- Learning Material :

- 1 http://letrunghieutvu.yolasite.com/resources/w-lawrence-neuman-social-research-methods_-qualitative-and-quantitative-approaches-pearson-education-limited-2013.pdf
- 2 <http://cache3.pdfdrive.com/dl.php?id=10442087&h=e90bd7771c3cf9674c6672e678aea224&u=cache>

Computer Applications

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning Outcome:

After completion of the course, the student will be able to:

- Basic knowledge of the computer system and its peripherals.
- Concept of operating system and their functions
- Understand databases and Network applications.
- Understand concept of Application software tools like MS- WORD, MS-EXCEL, MS-PowerPoint and SPSS.

Section- A

Introduction: What is Computer, Applications of computer, Elements of computer: Hardware & Software, Block Diagram of Computer System Functions of the computer components, Concept of Data and Information, Evolution and Classification of Computer Software: What is Software and Types of Software Operating System: Introduction and function of Operating System Programming languages: Generation of languages, Language Translators: Assembler, Compiler and Interpreter Database Management Systems: Concepts & Applications

Section- B

PC Software: Word Processing: Creating, opening and Saving Documents, Formatting, Inserting Tables and Pictures and Mail Merge Spreadsheets Package: Creating, Opening & Saving Worksheets, Use of Formulas & Functions, Charts: types, creation, editing. Sorting and Filtering of Data, What-if analysis: Scenarios & pivot table, Goal Seek. Presentation Packages: Introduction to Presentation Packages, Inserting Slides, Templates, Slide views, Graphics and Animation Introduction to Computer Network: What is Network, Advantages, types of Network: LAN, WAN, MAN Internet: Applications, Web browsers, Servers, Internet Services-WWW, E-mail, URL, Search Engines, Concept of Blogging

Section- C

Analysis through Statistical Packages (SPSS): Types of Variables, Classification and Tabulation of Data, Graphical presentation of Data: Histogram, Bar, and Pie Diagram. Import/Export of Data, Measures of Central tendency: Mean, Mode, and Median. Measure of Dispersion: Standard Deviation. Correlation analysis, Chi-Square Test.

Recommended Books:

1. Sinha, P. K. (2004). *Computer Fundamentals: Concept, Systems and Applications*. BPB Publications.
2. Goel, A. *Computer Fundamentals*. Pearson Education
3. Jaiswal, S., (1996) *P.C. Software Bible*. Galgotia, New Delhi.
4. Garg, P., Gupta, S. (2013). *Computer Fundamentals & Office Automation*. Shubham Publications.
5. Govil, M.C. *Computer Fundamentals and Programming in C*. Jaipur Publication House.
6. Forouzan, A. B. *Data Communications & Networking* (4th ed.). Tata McGraw-Hill.

E- Learning Material

- <https://nptel.ac.in/courses/106105082/>

Econometrics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Understand fundamental concepts of econometrics.
- Critically examine the theory of econometrics.
- Apply different techniques relating to treatment of three main types of data namely cross section, time series and panel.
- Learn to construct econometric models, estimate the parameters of these models and interpret the parameters estimates.
- Analyse data drawn from real-world and use econometric methods in solution of economic, business and financial problems.

Section A

Definition: scope, goals and division of econometrics. Methodology of econometric research. Linear regression model in two and more than two variables, OLS, Statistical properties of least square estimates; Concept and uses of dummy variables.

Section B

Violation of classical assumptions of regression model: Multicollinearity, Heteroscedasticity and Autocorrelation; Simultaneous equation bias, and Inconsistency of ordinary least squares estimators, Identification problem; Estimation of simultaneous equation system through indirect least squares.

Section C

Introduction to time series analysis: Stationarity, Test of stationarity, Dickey-Fuller and PP Unit root; Problem of spurious regression and concept of co-integration (Engle-Granger test), Error correction mechanism and Granger causality test; A basic introduction to panel data techniques: Fixed and Random effect model.

Recommended Books:

1. Wooldridge, J. (2012). *Introductory Econometrics: A Modern Approach*. US: South-Western.
2. Ramanathan, R. (2002). *Introductory Econometrics with Applications*. Stamford: Thomson Learning.
3. Gujarati, N.D. (2003). *Basic Econometrics*. US: McGraw Hill.
4. Koutsoyiannis, A. (2001). *Theory of Econometrics*. UK: Palgrave Macmillan.
5. Baltagi, B.H. (2005). *Econometric Analysis of Panel Data*. England: John Wiley and Sons.

E- Learning Material:

1. www.statsoft.com
2. www.statcounter.com
3. www.meandeviation.com
4. <https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics2006.pdf>
5. <https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics2006.pdf>

Monetary Economics and Modern Banking

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Understand Basic concepts of Financial Economics spot prices, discount factors, arbitrage, spot rates, forward rates and yield-to-maturity, Price sensitivity, Hedging.
- Understand Security Analysis return and risks, management, diversification, optimal portfolio choice and portfolio weights.
- Apply single index model and multi index models, capital asset pricing model; arbitrage pricing theory.
- Understand Derivatives and options, forward and futures contracts, options, other derivatives.

Section-A

Money: Meaning, functions and significance; Theories of money and price: Traditional quantity theory of money (Fisher's and Cambridge versions), Keynesian theory; Modern quantity theory (Friedman's approach); Demand for money: Classical approach, Keynesian approach and post-Keynesian: Tobin's approach.

Section-B

Supply of money: Components and measures of money supply; The 'H' theory of money supply, Money multiplier- process and determinants; RBI's analysis of money supply; Monetary policy: Functions of central bank, goals, indicators of monetary policy, Measures of credit control; Lags in monetary policy.

Section-C

Meaning and functions of commercial banks; Balance sheet of a bank- liabilities and assets; Process of credit creation- purpose and limitations; Investment policy of commercial banks; Commercial banks and economic development; Commercial banking in India: Structure, nationalization and reforms; Microfinance: Concept and progress in India; Use of ICT in banks.

Recommended Books:

1. Chandler, L.V., *An Introduction to Monetary Economics*, Manchester University Press.
2. Chick, V. (1977). *The Theory of Monetary Policy*, Basil Black Well, Oxford.
3. De Kock, M.H. (1938) *Central Banking*. Staples Press King and Sons, London.
4. Friedman, M. (Ed.). (1956). *Studies in the quantity theory of money* (Vol. 561). University of Chicago Press.
5. Gibson, W.E., and Kaufman, eds. (1996). *Monetary Economics: Readings on current issues*, 2ed, Tata McGraw Hill, New Delhi.
6. Gupta, S. B. (1982). *Monetary Economics (institutions, Theory And Policy)*. S. Chand & Company Ltd, New Delhi.
7. Harrias, L. (1981). *Monetary Theory*. McGraw Hill, Companies, New York.
8. Luckett, D.G. (1976). *Money and Banking*, McGraw-Hill Kogakusha, Ltd.,
9. McCallum, B.T. (1986). *Monetary Economics: Theory and Policy*, New York: Macmillan Publishing Company.
10. Rakhshit, M. (2011). *Money and Finance in the India*, Oxford University Press, India.
11. Mishkin, F. (2007). *Monetary Policy Strategy*, Prentice Hall of India, New Delhi.
12. Misra V.K. and S.K. Puri. (2012). *Indian Economy* (Chapters on Banking and Currency System), Himalaya Publishing House, New Delhi.
13. Mitra, S., ed. (1970). *Money and Banking*, Random house New York.

14. Reserve Bank of India. (1977). *Money Supply: Concepts, Compilation and analysis*, RBI Bulletin, January.
15. Sayers, R. S. (1936). *Modern banking*. Oxford University Press, London.
16. Sethi, T.T. (1999). *Monetary Economics*, S. Chand and Co., New Delhi.

E - Learning Material :

1. www.rbi.org.in
2. www.cpolicy.rbi.org.in
3. www.bulletin.rbi.org.in.
4. www.bankreport.rbi.org.in
5. <http://mospi.nic.in>
6. <http://www.indiastat.com>

Public Economics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Identify the role and functions of the government in a modern economy.
- Understand the concepts of public and private goods.
- Analyse the allocative and equity aspects of taxation.
- Critically examine different theories of public expenditure.
- Differentiate concepts of impact, incidence and Shifting of taxes in different market framework.
- Understand various sources of debts and methods redeeming it.
- Explain federal finance and centre-state financial relation in India.

Section- A

Role of government: Changing perspectives about role of government in organized society, Concept of pure public goods and pure private goods; Taxation: Allocative and equity aspect of tax; Theory and measurement of dead weight losses, Equity or justice in taxation; Benefit and Ability to pay approaches.

Section- B

Public expenditure: Hypothesis to explain the growth of public sector- Wagner's law of increasing state activities, The Peacock-Wiseman hypothesis; Theory of incidence and alternative concepts of incidence; The incidence and shifting of a tax under monopoly and perfect competition. Public debt: Meaning, sources effects, Debt redemption; Concepts of budget deficit, Fiscal consolidation in India.

Section- C

Federal finance in India: Principles of federal finance, Functions and sources of revenue of federal governments (Union, State and Local); Fiscal federalism in India: Vertical and Horizontal imbalances, Constitutional provision; Resource transfer from central government: Recommendation of latest finance commission; Criteria for transfer of resources; Centre-state financial relations in India.

Recommended Books:

1. Atkinson, A.B. and J.E. Stiglitz. (2000). *Lectures on Public Economics*. New York: Tata McGraw Hill.
2. Aurbach, A.J. and M. Feldstein (Eds) (1985). *Handbook of Public Economics*. Amsterdam: North Holland.
3. Dorfman R. (Ed.) (1970). *Measuring the Benefits of Government Investment* Brookings Institution. Washington: Brookings Institution.
4. Goode, R. (1986). *Government Finance in Developing Countries*. New Delhi: Tata McGraw Hill.
5. Jha, R. (1999). *Modern Public Economics*. London: Routledge.
6. Musgrave, R.A. (1959). *The Theory of Public Finance*. Tokyo: McGraw Hill.
7. Musgrave, R.A., and P.B. Musgrave (1970). *Public Finance in Theory and Practice*. Tokyo: McGraw Hill.
8. Stiglitz, J. E. (2005). *Economics of Public Sector*. New York: W.W. Norton and Company.
9. Tyagi, B.P and Singh, H.P. (2016). *Public Finance*. Meerut: Jai Prakash Nath & Co.
10. Bhatia, H.L. (2018). *Public Finance*. New Delhi: Vikas Publishing House.
11. Hajela, T.N. (2015). *Public Finance*. New Delhi: Ane Books Pvt. Ltd.
12. Bhargava, P.K. (1991). *India's Fiscal Crisis*. New Delhi: Ashish Publishing House.
13. Chelliah, R.J.et.al. (1981). *Trends and Issues in India's Federal Finance*. New Delhi: National Institute of Public Finance and Policy.
14. Mundle, S. (1999). *Public Finance Policy: Issues for India*. New Delhi: Oxford University Press.
15. Shrivastava, D.K. (ed.) (2000). *Fiscal Federalism in India*. New Delhi: Har-Anand Publications Ltd.

E- Learning Material

1. <http://indiabudget.nic.in>
2. <http://policies.gov.in>
3. <http://finmin.nic.in/revenuesummary/login.asp>;
4. <https://dea.gov.in>

Economics of Growth and Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Define basic analytical concepts required for study of Economics of Growth and Development
- Explain the role of major factors which affect the processes of Economic Growth and Development.
- Explain and distinguish between the working mechanisms of different types of theoretical approaches and Economic models of Economic Growth and development.
- Appreciate intuitive aspects of development.

Section -A

Economic growth and development; Measuring Development: Income Measures, Basic Needs approach, PQLI, HDI and Capability approach. Factors affecting economic growth- capital, labor and technical Progress.

Section- B

Theories of development: Classical, Big Push, Lewis, Dualism, Harris- Todaro, New (endogenous) growth theory and Macro determinants of growth; Models of economic growth: Harrod and Domar, Neoclassical growth models: Solow, Growth models of Joan Robinson, Kaldor and Pasinetti.

Section- C

Social and intuitional aspects of development: Poverty-concept and measurement, Disguised unemployment- types and measurement, incentives and cost for labour transfer, Inequality: inequality in Income distribution- Kuznets inverted U hypothesis, Lorenz curve and Gini- coefficient, Justice: Sen's concept and approach to justice.

Recommended Books:

1. Gillis, M., Perkins, D. H., Roemer, M., & Snodgrass, D. R. (1992). *Economics of Development* (Ed. 3). WW Norton & Company, Inc.
2. Kindleberger, C.P. (1977). *Economic Development*, (3rd Edition), McGraw Hill. New York.
3. Meier, G. M., & Rauch, J. E. (1995). *Leading Issues in Economic Development* (Vol. 6). New York: Oxford University Press.
4. Todaro, M.P. and S.C. Smith. (2015). *Economic Development* (12th Edition). Pearson Education, Delhi.
5. Thirwal, A.P. (1996). *Growth and Development*. (6th Edition). Macmillan, U.K.
6. Ray, D. (2008). *Development Economics*. Palgrave Macmillan UK.

E- Learning Material

1. <https://www.edx.org/professional-certificate/iimb-risk-management-in-banking-and-financial-markets>
2. <https://www.moneycontrol.com/>
3. <https://www.investopedia.com/>
4. <https://oyc.yale.edu/courses>
5. <https://www.core-econ.org/>

Economics of Environment

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Explain the meaning and scope of Environmental Economics.
- Conceptualize and explain ideas like externality and market failure
- Undertake Environmental Valuation using different techniques
- Explain the idea of Sustainable development
- Understand various practical environmental issues at national and global level
- Understand the role of global and national governments and organizations in resolving environmental issues.

Section- A

Meaning, importance and scope of environmental economics; The evolution and growth of environmental economics; Linkages between environment and economics; The concept of externalities, Environment as a public good and market failure; Environmental Kuznets's curve; Environmental valuation: Meaning and types of environmental valuation, Market valuation, Contingent Valuation Method (CVM), Hedonic pricing technique; Environmental accounting.

Section- B

Sustainable development: Concept, indicators, measurement and Strategies for sustainable development; Economics of natural resources: A resource taxonomy; Managing exhaustible and renewable resources; Methods of abatement of externalities: The Pigouvian tax – Subsidy approach; Cost-Benefits analysis to environmental analysis.

Section- C

Global environmental issues: Negative international externalities and their implications; Major environmental organization and events: Green peace movement, The World conservation union, the nature conservancy. Sierra club, UNEP, UNCED. The Vision, goals, objectives and instruments of environmental policy; A critique of India's environmental policy.

Recommended Books:

1. Bhattacharya, R.N. (ed.). (2001). *Environmental Economics: An Indian Perspective*, Oxford University Press, and New Delhi.
2. Bromely, D. W. (1995). *Handbook of Environmental Economics*. Blackwell.
3. Ch. Hanumantha Rao. (1994). *Agricultural Growth, Rural Poverty and Environmental Degradation in India*, Oxford University Press, New Delhi.
4. Dasgupta, P and Heal, G. M. (1979). *Economic Theory and Exhaustible Resources*, Cambridge University Press.
5. Dixon, J. (1994). *Economic Analysis of Environmental Impacts*, Earthscan Publications, London.
6. Field, B. C., (1994). *Environmental Economics: An Introduction*. McGraw Hill, New York.
7. Government of India. (1992). *Policy Statement for Abatement of Pollution, Ministry of Environment and Forests*. New Delhi.
8. Hanley, N, J. F. Shogren and B. White. (1997). *Environmental Economics in Theory and Practice*, MacMillan, New York.
9. Hardin, G. "The Tragedy of Commons", in Markandya, A. and Richardson, J. (eds.). (1993). *Earthscan Reader in Environmental Economics*. Earthscan Publications, London.

10. Jemba, C. and Munasinghe, M. (1998). *Climate Change Policy: Facts, Issues and Analyses*, Cambridge University Press.
11. Karpagam M. (1992). *Environmental Economics: A Text Book*. Sterling Publishers Pvt. Ltd. Green Park Ext. New Delhi.
12. Kolstad, Charles (2000). *Environmental Economics*, Oxford University Press.
13. Mehta, S., Mundle, S., and Sankar, U. (1997). *Incentives and Regulation for Pollution Control*. Sage Publication, New Delhi.
14. Murty, M. N., A. James and S. Misra. (1999). *The Economics of Water Pollution in India*, Oxford University Press, New Delhi.
15. Oates, W. E. (1992). *Economics of the Environment*, Edward Elgar, Cheltenham, U.K.
16. Opschoor, J. B. and Vos, H. B. (1989). *Economic Instruments for Environmental Protection*. OECD and OCDE.
17. Sankar, U., Mythili, G. and Anuradha, R. (1996). *Environmental Problems in India's Energy Sector and Policies for Corrective Action* (Project Report), Madras School of Economics, Chennai.
18. Sankar, U. (ed.). (2000). *Environmental Economics*, Oxford University Press.
19. United Nations ESCAP. (1997). *Accounting and Valuation of Environment, Vol. I and II: A Primer for Developing Countries*, New York.
20. World Bank. (1992) *Development and the Environment: World Development Report Series*, Washington, D. C.

E - Learning Material :

1. <https://www.nature.com/subjects/environmental-economics>
2. <https://www.cseindia.org/>
3. <https://www.niti.gov.in/>
4. <https://www.indiabudget.gov.in/index.as>
5. <https://www.epw.in/>

Indian Economic Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome:

After completion of the course, the student will be able to:

- Explain different development strategies in pre and post liberalization era.
- Analyse contribution of different sectors to output and employment.
- Analyse problem like “jobless growth”.
- Examine policy initiatives for sustainable agriculture.
- Analyse opportunities and problems with service sector led growth

Section –A

Development strategy and economic growth in India in pre and post reforms era; Emerging structure of Indian economy – Contribution of different sectors to output, employment and income; Economic reforms; Inclusive growth; Recent policy initiatives under latest five year plans.

Section- B

Review of agricultural performance since independence, Land reforms, Green revolution and Agricultural research, Policy initiatives for sustainable agriculture; WTO agreement and its impact on agriculture; Socio-economic developmental issues: Poverty- measurement extent of reduction in poverty since independence; Unemployment- nature and trends; Recent policy initiatives for these issues.

Section- C

Industrial, services and infrastructure sector: Review of India’s industrial growth since economic reforms, Policy initiatives for industrial growth; Growth of services industry; State of infrastructure, Promoting investment in infrastructure development, public-private partnership.

Recommended Books:

1. Kapila, U. (Ed.). (2009). *Indian Economy since independence*. Academic Foundation.
2. Jalan, B. (1997). *India's economic policy: preparing for the twenty-first century*. Penguin Books India.
3. Rangarajan, C., and Kannan, R. (2004). *Select essays on Indian economy* (Vol. 1). Academic Foundation.
4. Misra, S. K. and Puri, V.K. (2018). *IndianEconomy*. New Delhi: Himalaya publishing House.
5. Ruddar, D. & Sundharam, K. P. M. (1990). *Indian Economy*. S. Chand Limited.
6. Dhingra, C. Ishwar (2007). *The Indian Economy Environment and Policy*. Finance India, 21(3), 1073.

E- Learning Material

1. <http://mofapp.nic.in:8080/economicsurvey/>
2. http://planningcommission.nic.in/plans/planrel/fiveyr/11th/11_v2/11th_vol2.pdf
3. http://www.undp.org/content/dam/india/docs/how_inclusive_is_the_eleventh_five_year_plan_a_sectoral_review.pdf
4. http://www.igidr.ac.in/newspdf/17%20Chap_R.%20Nagaraj_IDR-2011.pdf
<http://agricoop.nic.in/sites/default/files/National%20Mission%20For%20Sustainable%20Agriculture-DRAFT-Sept-2010.pdf>

Economics of Social Sector

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective;

This course is meant to provide some insights into the application of economic theory in the design and implementation of public policy related to the management of social sectors. Paper deals with issues of social services and the problem of valuation of these services and designing of instruments and institutions for the management of social sector.

Section- A

Economics of education: definition, nature and scope; Education and labor force participation, Technological change and economic development; Social and private returns on education: Important issues in primary, secondary and higher education.

Section- B

Financing of education: public-private partnership; Linkages between education, skills and jobs; Wastages in education- Non- participations, Dropouts and Brain- Drain; Need and scope for external participation in education. Economics of health: meaning and scope; Peculiar characteristics of health care; Health output-input indicators and their correlation with the level of economic development; Public expenditure on health.

Section- C

Economic determinants of health care; Institutional issues in health care- role of government and market; Measurement of health state utilities, QALY's (**Quality-Adjusted Life-Year**) and its alternatives- Different approaches of valuing health, multi-attribute utility instruments and their development.

References:

1. Haq, M., Reflections on Human Development, Oxford University Press. New Delhi.
2. Dreze Jean and Amartya Sen, Indian Economic Development and Social Opportunity. Oxford University Press. New Delhi.
3. Mukherjee, A., Implications for Education, Economic & Political Weekly, Volume XLII No. 14 April 2007, PP 1273-1276.
4. Folland, S., A.C. Goodman and M. Stano, Economics of Health and Health Care, fifth edition, Pearson Prentice Hall, 2006.
5. Culyer, A.J. and J.P. Newhouse (eds.), Handbook of Health Economics, Volumes IA & B, North- Holland, 2000.
6. Zweifel, P., Health Economics, Oxford University Press, 1997.
7. Jimenz E., Pricing Policy in the Social Sectors, the Johns Hopkins University Press, New Yorks, 1987.
8. Panchamukhi P.E. Economics of Health: A Trends Report, in ICSSR, A Survey of Research in Economics, Vol. VI, Infrastructure, Allied Publishers, Delhi.

Financial Economics

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective :

This course aims to enable the learners in developing and understanding of the financial system in the era of liberalization, privatization and globalization. It is expected that students will develop critical skills in assessing the relevance of the principles of finance and financial intermediation to real world situations, and to better understand the role that financial markets play in the business environment that they will face in the future. The focus will be on the description of Indian financial markets, institutions, instruments and policies.

Section-A

Meaning and growth of financial economics; Structure of financial systems; Money Market: Call money market, Treasury bill market, Commercial bill market, An introduction to new instruments in money market. Capital Market: Role and structure, Corporate securities and gilt-edge securities, SEBI and its functions, An introduction to reform in capital market (With special reference to India).

Section-B

Financial intermediaries and intermediation: Banking and non-banking financial institution; Banking structure in India; Banking regulations; Various forms of NBFIs; Functions and salient features of co-operative banks; Development banks-meaning structure and main features with evolution; Role and salient features of growth of the Mutual fund and Insurance.

Section-C

Security Analysis-Meaning and types of risk, concepts and types of returns, risk-return tradeoff; Characteristic and significance of risk management, Financial derivatives-meaning, types and uses; Futures and options-features and types; Derivatives in India-prospects, policies and shortcomings.

References:

1. Avadhani, V.A, Financial Economics, Theory and Practice, Himalayan Publication, Bombay.
2. Bhole, L.M., Financial Institutions and Markets, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Chandra, P., Financial Management, Theory and Practice, Tata McGraw Hill, New Delhi.
4. David, A. Dubofsky and Thomas W. Miller. JR., Derivatives Valuation and Risk.
5. Gupta, S.B., Monetary economics, S. Chand and Company, New Delhi.
6. Hampton, John, Financial Decision Making; Prentice-Hall, Delhi.
7. Khan, M.Y., Financial Management, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
8. Mishkin, Fredrick. S. and S.G. Eakins, Financial Markets and Institutions, 6ed. Pearson, India.
9. Mishkin, Fredrick. S., The Economics of Money, Banking and Financial Market, 5ed, Wesley, India
10. Stoneir and Shapiro, Money and Banking: An Introduction to the Financial System, Henry Holt, New York

Research Methodology in Social Sciences

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course, the student will be able to:

- Understand the conceptual aspects of research approaches and techniques in social sciences.
- Critically analyse the methods of data collection in social sciences.
- Identify, explain, and apply the various research techniques in conducting research.
- Prepare a coherent research proposal and report.

Course Content:

Research in social sciences: Objectives and Types, Process of Research.

Scientific Method; Problem of theory building; Fact and Theory.

Formulation of Research Problem; Research Design, Hypothesis: Characteristics and Importance.

Sampling; Methods of Data collection: Observation, Interview, Questionnaire, Schedule, Ethnography and Case Study.

Data Analysis for Quantitative research- Measures of Central Tendency: Mean, Median and Mode; Measures of Dispersion: Range and Standard Deviation; Simple Correlation: Karl Pearson's co-efficient of correlation, Simple Regression.

Data Analysis for Qualitative research- Thematic and Narrative Analysis.

Report Writing and Styles of Referencing.

Recommended Books:

1. Ackoff, R. (1953). *Design of Social Research*. Chicago: Chicago University Press.
2. Bailey, K. (1978). *Methods of Social Research*. New York: Free Press.
3. Mueller, J. and Schuessler, K. (1961). *Statistical Reasoning in Sociology*. Boston: Houghton Mifflin.
4. Festinger, L. and Katz, D. (1953). *Research Methods in Behavioural Sciences*. New York: Rinehart, Winston.
5. Henry, M. (1977). *Sociological Research Philosophy and Methods*. Illinois: Dorsey Press.
6. Blalock, H. M. and Blalock, A. B. (1968). *Methodology in Social Research*. New York: McGraw-Hill Book Company.
7. Goode, W. J. and Hatt, P. K. (1952). *Methods in Social Research*. New York: McGraw-Hill Book Co.
8. Kothari, C.R. (1997). *Research Methodology: Methods and Techniques*. Delhi: New Age International Pvt Ltd Publishers.
9. Kumar, R. (2011). *Research Methodology*. Los Angeles: Sage Publications.
10. Dobbart, M.L. (1982). *Ethnographic Research: Theory and Application for Modern Schools and Societies*. New York: Praeger.
11. Miles, M. & Huberman, A. (1994). *Qualitative Data Analysis: A Sourcebook of New Methods*, 2nd Edition. Thousand Oaks: Sage Publications.
12. Denzin, N. & Lincoln, Y. (1994). *Handbook of Qualitative Research*. Thousand Oaks: Sage Publications.

13. Taylor, G. R. (2000). *Integrating Quantitative and Qualitative Methods in Research*. Maryland: University Press of America.

E- Learning Material

1. Research Methodology
http://www.sociology.kpi.ua/wp-content/uploads/2014/06/Ranjit_Kumar-Research_Methodology_A_Step-by-Step_G.pdf
2. Relationship between Positivism, Interpretivism, and Sociological Research Methods
<http://www.sociology.org.uk/notes/revgrm5.pdf>
3. What is ethnography?
<http://www.cusag.umd.edu/documents/workingpapers/epionattrib.pdf>
4. Ethnography : Definition and Method
https://www.researchgate.net/publication/221927953_Ethnography_An_Introduction_to_Definition_and_Method
5. Qualitative and Quantitative Research
6. <https://www.lancaster.ac.uk/media/lancaster-university/content-assets/documents/learning-skills/quantitativevqualitative-research-answers.pdf>

Teaching, Learning and Higher Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course, the student will be able to:

- Understand the reciprocity of teaching and learning processes
- Make use of various aids to enhance their teaching skills.
- Familiarize themselves with Academic Bodies of Higher Education
- Analyze the current situation of higher education in India.
- Understanding Education and its role in Holistic development

Course Content:

- Teaching and Learning: Meaning and Importance
- Role and Prerequisites of Teacher in Higher Education
- Overview of Higher Education in India
- Structure and Functions of Academic Bodies- UGC, ICSSR, ICHR, ICCR
- Methods for Teaching-Lecture, Discussion, Role Play, Workshop, Seminar and Audio-Visual
- Making of Effective Handouts and Lesson Plans
- Innovative Pedagogy and Critical Pedagogy for Classroom teaching
- Current Challenges before the Higher Education

Recommended Books:

1. Aggarwal, J.C. (2012). *Principles, Methods & Techniques of Teaching*. New Delhi: Vikas Publishing.
2. Association of Indian Universities. (2003). *Globalization of Indian Higher Education*.
3. Mangal. S.K. & Manga. U. (2014). *Essentials of Educational Technology*. Delhi: PHI Learning.

Suggested E-Resources

- **Innovative Pedagogy**
<https://res.mdpi.com/societies/societies-07-00030/.../societies-07-00030.pdf?>
- **Critical Pedagogy**
https://www.researchgate.net/.../240724612_Critical_Pedagogy_in_the_Sociology_Class..
<https://www.tandfonline.com/doi/full/10.11120/elss.2008.01010008>

Indian Economic Problems and Issues

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective : Indian economy is a unique amalgam of alternative competing and often conflicting theories and a proper understanding of its working is imperative if the student is to comprehend the ramifications that underlie most of the observed phenomena in the Indian economic set-up. By the end of the course, students are expected to have an in-depth understanding of Indian economy. The course intends to enable them to evaluate the pre and post reform progress of India.

1. A detailed study of the following problems and issues with emphasis on current economic situation: Problems of poverty in Indian economy, Inequality, Unemployment, Inflation and Balance of Payments; Black money: Definition, estimates and remedial measures.
2. Structural reforms: their desirability, limitations and functioning in Indian economy; Recent banking and financial reforms, Recent trade policies and their impact on Indian economy.
3. Flow of foreign investment and growth of Indian economy in the long run. Convertibility of rupee, Globalization and consumerism, Globalization and Swadeshi v/s Globalization a Critique.

References:

1. Misra, S.K. and V.K. Puri, Indian Economy, Himalaya Publishing House, 29th Edition.
2. Kapila U., Indian Economy since independence, Academic Foundation, New Delhi
3. Datt, R. and K.P.M. Sundharam, Indian Economy, S. Chand and Company Ltd., New Delhi
4. Dhingra, I.C., The Indian Economy, Environment and Policy, Sultan Chand and Sons, Educational Publishers, New Delhi
5. Agarwal, A.N., Indian Economy, Wishwa Prakashan, New Delhi, 37th Edition
6. Government of India, Economic Survey (Latest)

Urbanisation and Public Policy

L T P C

2 2 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective : The course aims at giving a thorough grounding to the students regarding the process of urbanisation and government policies. Urban areas have emerged as engine of growth in the national and global scenario as well. To sustain urban development through flexible and innovative policy measures is one of the biggest challenges of the twenty first century. Urbanisation policy to lend competitive edge to urban areas while safeguarding the quality of environment and life needs critical attention. It will cover a wide range of theoretical approaches and policy options such as the existence and growth of cities, urban transportation, pollution, poverty, crime, and housing.

1. Concepts and definitions of urban; Evolution of urban settlements - a historical perspective; Trends and patterns of urbanisation; structure of urban economy; rural urban relation in India; Urban labour market - rural-urban migration - urban informal sector - slums and poverty; Urban infrastructure and services- specific sectors: housing, water supply and drainage, waste management and sanitation; Urban land use and land market.
2. Urban planning framework: Institutions; Urban transport: Intra-city and inter-city problems; Issues relating to port, Urban environment: Problems of pollutions and its management; Cumulative causation theory for urban and regional growth; The urban centre within the region: urban hierarchy, urban size distribution and optimum city size debate; Locational aspects of various urban functions: Weberian location theory.
3. Market effects of housing policies- causes of homelessness; Urban concentration: policies for dispersal and decentralization; Role of the government of India, States and Urban local bodies; Recent policies for educational and health achievement in urban localities; Economics of crime (effectiveness of punishment etc). Infrastructure financing; Real-estate regulation and development; Determinants of urban expenditure (sports, culture).

References:

1. Ahluwalia, Isher Judge, and Kanbur, Ravi, Urbanisation in India: Challenges, Opportunities and the Way Forward, Sage India, New Delhi, 2014.
2. Ahmed, Waquar, and Kundu, Amitabh, India's New Economic Policy, A Critical Analysis, Routledge, New York, 2011.
3. Coelho, Karen, Kamath, Lalitha, and Vijayabaskar, M. (Eds.), Participopolis: Consent and Contention in Neoliberal Urban India, Routledge, New Delhi, 2013.
4. Evans, A.W., Urban Economics, Basil Blackwell, London.
5. Kulshrestha, S.K., Urban and Regional Planning in India: A Handbook for Professional Practice, Sage India, Delhi, 2012.
6. Ministry of Housing and Urban Poverty Alleviation, Government of India, Inclusive Urban Planning: State of the Urban Poor Report-2013, Oxford University Press, New Delhi, 2014.
7. Mohanty, K. Prasanna, Cities and Public Policy: An Urban Agenda for India, Sage India, New Delhi, 2014.
8. Ramachandran, D., India's Urban Confusion: Challenges and Strategies, COPAL Publishing Group, Ghaziabad, 2014.
9. Ramesh, G., Nagadevara, Vishnu Prasad, Naik, Gopal, and Suraj, Anil, Urban Infrastructure and Governance, Routledge India, New Delhi, 2010.
10. Ruet, Joel, and LamaRewal, Stephanie Tawa, Governing India's Metropolis: Case Studies of Four Cities, Routledge, New Delhi, 2009.
11. Shaw, Annapurna, Indian Cities, Oxford University Press, New Delhi, 2012.
12. Sen, Joy, Sustainable Urban Planning, The Energy and Resources Institute, New Delhi, 2012.
13. Sivaramakrishnan, K.C., Kundu, Amitabh and Singh, B.N., Handbook of Urbanization in India, Oxford University Press, New Delhi, 2007.

14. Sivaramakrishnan, K.C., *Re Visioning Indian Cities: The Urban Renewal Mission*, Sage India, New Delhi, 2011.
15. Sivaramakrishnan, K.C., *Governance of Megacities: Fractured Thinking, Fragmented Setup*, Oxford University Press, Oxford, 2014.
16. Sridhar, Kala Seetharam, and Reddy, Venugopal, *State of Urban Services in India's Cities: Spending and Financing*, Oxford University Press, New Delhi, 2010.
17. Sridhar, Kala Seetharam, and Wan, Guanghua, *Urbanization in Asia: Governance, Infrastructure and the Environment*, Springer, New Delhi, 2014.
18. Vinod, T.M., *Geographic Information Systems for Smart Cities*, COPAL Publishing Group, Ghaziabad, 2014.
19. World Bank, *Urbanization Beyond Municipal Boundaries: Nurturing Metropolitan Economies and Connecting PeriUrban Areas in India*, World Bank Publications, Washington DC., 2013]

Gender and Development

L T P C

2 2 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective : Gender biases in societal practices and development policies have resulted in persistent gender inequalities. It is increasingly being realized that mitigating such inequalities and enhancing women's capabilities and entitlements are crucial to the overall development of the country. This course would provide students an understanding of the nature of economic role of women and their contribution to the national economy. The course will also develop understanding to use gender perspectives in analysing issues and problems of development.

1. Gender and development as a separate area of study, issues in gender and development; Gender Development Index (GDI), Gender action plan and Sustainable Development Goals (SDGs): sex ratio, health, extreme poverty, primary education.
2. Concept and analysis of women's work: Valuation of productive and unproductive work, paid and unpaid work, economically and socially productive work; Female contribution to national income; Limitation of national income statistics.
Women and labor market in India; Supply and demand for female labor in developed and developing countries with special reference to India; Female work participation in organized and unorganized sector; Wage differentials and determinants of wage differentials: gender, education, skill, productivity, efficiency, opportunity.
3. Mainstreaming gender into developmental policies- Gender and development planning; Gender sensitive governance; Gender budgeting; Paradigm shifts from women's well being to women's empowerment; Microfinance and gender, Democratic decentralization and empowerment of women in India.

References:

1. Agarwal, B., Humphries, J. & Robeyns, I. (eds.), Capabilities, Freedom and Equality - Amartya Sen's Work from a Gender Perspective, OUP, New Delhi, India, 2010.
2. Agnihotri, S.B., Sex Ratio in Indian Population: A Fresh Exploration, Sage publications, New Delhi, 2000.
3. Banerjee Nirmala, M Krishnaraj, Sieving Budgets for Women, Economic and Political Weekly, Vol 39 (44), pp.4788 -4791, 2004.
4. Boserup, E., Women's Role in Economic Development, St. Martin's Press, USA, 1970.
5. Chen. Martha, Counting the Invisible Workforce: The Case of Home based Workers, World Development Report, Vol 27 (3), pp 603 - 610, 2009.
6. Dasgupta Monica et al. 'Evidence of an Incipient Decline in the Number of Missing Girls in China and India', Population and Development Review, Vol. 35 (2), pp 401 - 416, 2009.
7. Goodman, J. (Ed.), Global Perspectives on Gender and Work, Rowman & Littlefield Publishers, Inc., U.K, 2012.
8. Government of India: Towards Equality: Report of the Committee on the Status of Women in India, Department of Social Welfare, Ministry of Education and Social Welfare, New Delhi.
9. Hirway, I., Mainstreaming Time Use Surveys in National Statistical System in India, Economic and Political Weekly, Vol. XLIV (49), pp 56 - 65, 2009.
10. ILO: Women's Participation in the Economic Activity of Asian Countries, ILO.
11. Jacobson, J.P., The Economics of Gender, Blackwell Publishing, USA, 2007.
12. John, Mary, Women in Power: Gender, Caste and the Politics of Local Urban Governance, Economic and Political Weekly, Sept 29, 2007.
13. Krishna Raj, M., R.M. Sudarshan and A. Shariff: Gender, Population and Development, 1998.

14. Lourdes, B., Accounting for Women's Work: The Progress of Two Decades. World Development, Vol. 20, No. 11, 1547-1560, 1992.
15. Momsen, J., Gender and Development. Routledge, USA, 2010.
16. Papola, T. S. and A. N. Sharma (Eds.), Gender and Employment in India, 1999.
17. Seth, M., Women and Development: The Indian Experience, Sage Publications, New Delhi, 2000.
18. Sinha, N., Raju, D. & Morrison, A., Gender Equality, Poverty and Economic Growth. World Bank Policy Research Working Paper, 4349, 2007.
19. Srinivansan K. and A. Shroff, India: Towards Population, Development Goals, Oxford University Press, New Delhi, 1998.
20. Winter-Ebmer, R., Gender Wage Inequality and Economic Growth: Is there really a puzzle? - A comment, World Development, Vol. 39, No. 8, pp. 1476-1484, 2011.

Websites for Reference

- www.undp.org/hdr UNDP Human Development Report (various years)
- <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTGENDER/0,,contentMDK:20619560~menuPK:1570210~pagePK:148956~piPK:216618~theSitePK:336868,00.html>
- <https://info.worldbank.org/etools/docs/library/192862/Module1/Module1c.html>
- <http://www.fao.org/docrep/005/y3969e/y3969e02.htm>
- <http://www.bridge.ids.ac.uk/sites/bridge.ids.ac.uk/files/reports/re55.pdf>
- <http://www.un.org/millenniumgoals>.

Selected Topics in Indian Agriculture and Rural Development

L T P C
2 2 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Objective : The objective of the course is to provide an understanding of selected issues relating to rural economy and agriculture in India in the context of their development and barriers to transformation. It is intended that students would be able to appreciate the role of market, technology and institutions in explaining the growth and structure of rural and agriculture sector.

1. Rural economy of India: size and structure; Measures of level of rural development; Rural poverty in India: structure and determinants; A critical review of policies for rural development in post-independence period.
2. Indian agriculture: pace and pattern of agricultural growth; Agricultural growth and rural poverty; Agriculture and globalization: Uncertainty due to Trade Liberalizations; WTO issues: advantages and disadvantages with respect to Indian agriculture; Agrarian distress and farmers' suicides.
3. Food security: access to food-caloric consumption; Public distribution system and other food based programs; Self sufficiency in food production and availability; Agricultural marketing and pricing: problems and remedies; Marketing Model Act 2007; Pricing concepts; price support programs in India; Pricing policy and buffer stock policies; Contract farming: Advantages and Experiences E-marketing.

References:

1. Acharya, S.S. and Agarwal, N.L., Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd. (Ch. 5, 7).
2. Balakrishnan, Pulapre, Agriculture and Economic Reforms: Growth and Welfare, Economic and Political Weekly, 35 (12): 999-1004, 2000.
3. Chand, Ramesh, "India's Agro Export Performance and Competitiveness in Changed International Scenerio" in Essays in Honour of Prof. A.M. Khusro edited by CH Hanumantha Rao, B B Bhattacharya, M.S. Siddharthan.
4. Hanumantha Rao, C. H., "Agricultural Policy and Performance" in "The Indian Economy: Problems and Prospects edited by Bimal Jalan, Panguin Books.
5. Hanumantha Rao, C. H., "Agricultural Policy and Performance in "The Indian Economy: Problems and Prospects edited by Bimal Jalan, Panguin Books.
6. Jha, R., "Rural Poverty in India: Structure and Determinants and Suggestions for Policy Reforms" in Indian Economic Reforms edited by Raghavendra Jha, Palgrave Macmillan.
7. Mishra, S., "Risks, Farmers' Suicides and Agrarian Crisis in India: Is There A Way Out?" Indira Gandhi Institute of Development Research, Mumbai WP-2007-14.
8. Saini, S. and Gulati, A., The National Food Security Act 2013-Challenges, Buffer Stocking and Way Forward" ICRIER, Working Paper 297, 2015.
9. Saini, S. and Gulati, A., "Leakages from Public Distribution System and the Way Forward" ICRIER, Working Paper 294, 2014.
10. Singh, K., "Rural Development: Principles, Policies and Management" Sage Publications (Ch. 2,3)

Modern Economic Thought

L T P C
2 2 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Objective: This course will introduce the students to economic thought by tracing its history. It will help students to develop a chronological understanding of the development of economic thought. The study of economic ideas of the past is not only challenging but also enlightening. The paper attempts to make the students of economics acquainted with the evolution of economic ideas as a response to immediate economic problems and policy issues, refining earlier analysis by correcting mistakes and filling in the gaps in the analysis.

1. Pre-classical economic thought: Mercantilism, Physiocracy; Classical economic thought: Adam Smith- Theory of value and Theory of division of labour, Ricardo- Theory of value and Theory of distribution, Malthus- Theory of population, John Stuart Mill - Principles of political economy.
2. Karl Marx: Historical materialism, Theory of value, Theory of capital accumulation, Analysis of distribution, Theory of crisis; Essential features of Marginalism, Jevons theory of value, Bohm Bawerk: Theory of capital.
3. Features of Neo-Classical economics; A. Marshall and his contribution, Walras' Theory of general equilibrium; Economics of welfare: A.C. Pigou, V. Pareto; J. M. Keynes and his policies; Post-Keynesian approaches; Economic thought in modern India: Naoroji, Mahatma Gandhi, B. R. Ambedkar and Amartya Sen.

References:

1. Backhouse, A., History of Modern Economic Analysis, Oxford University Press, 1985.
2. Bhatia, H. L., History of Economic Thought, Vikas Publishing House Pvt. Ltd, 2009.
3. Blaug, M., Economic Theory in retrospect, Cambridge University Press, Cambridge, 1997.
4. Eaton, John, Political Economy, International Publisher, 1949 and revised (1966).
5. Eaton, John., Political Economy, The Indian Economic Journal, Vol. 41, No. 2 Oct- Dec., 1993, Pp. 153-171.
6. Ekelund, R.B. and Hebert, R.F., A History of Economic Theory and Method, McGraw-Hill, 1975.
7. Eric Roll., A History of Economic Thought, Faber & Faber Publisher, 1961 (Latest edition).
8. Ganguli, B.N., Indian Economic Thought: A Nineteenth Century Perspective, Tata McGraw-Hill Publishing Co., New Delhi, 1977.
9. Gide, C. and G Rist., A History of Economic Doctrines, Academic Foundation, New Delhi, 1956.
10. Gray, A. and Thompson A., The Development of Economic Doctrines, Longman, London, 1980.
11. Hajela, T.N., History of Economic Thought, Ane Books Pvt. Ltd, 2008.
12. Haney, L.H., A History of Economic Thought: A Critical Account of the Origin and Development of the Economic Theories of the Leading Thinkers in the Leading Nations, Macmillan, 1922.
13. Hunt, E.K., History of Economic Thought: A Critical Lautzenheiser, M. Perspective, M.E. Sharpe, 2011.
14. Landreth, H. and Colander, D.C., History of Economic Thought, Houghton Mifflin; 4th Revised edition (17 November 2001).
15. Medema, S.G. and Samuels, W.J., The History of Economic Thought: A Reader, Rout ledge, (2003).
16. Robbins, L., A History of Economic Thought, The LSE Lectures, ed. Medema S.G. and W.J. Samuels, Princeton University Press, 2001.
17. Roncaglia, A., The Wealth of Ideas: A History of Economic Thought, Cambridge University Press, 2005.
18. Schumpeter, J. A., A History of Economic Analysis, Oxford University Press, New York, 1954.
19. Spiegel, H.W., The Growth of Economic Thought, Duke University Press, 1991.
20. Steven, G. M., History of Economic Thought, Oxford University Press.

Websites:

www.policonomics.com/lp-classical-economics-mercantilism

- en.citizendium.org/wiki/History_of_pre-classical_economic_thought
- <https://www.marxists.org/archive/marx/works/.../theories...value>
- [ublishing.cdlib.org/ucpressebooks/view?docId=ft367nb2h4](http://publishing.cdlib.org/ucpressebooks/view?docId=ft367nb2h4)
- economics.illinoisstate.edu/ntskaggs/eco372/.../alfred_marshall.htm
- www.academia.edu/3836527/Walrasian_General_Equilibrium_Theory

Principles of Public Administration

L T P C

5 0 0 5

Max. Marks : 100

(CA:40+ESA:60)

Objectives :

This paper provides an introduction of Public Administration to the students. Its meaning, nature, scope and various approaches to its study are discussed in detail. Besides this, Organization; its theories and Personnel Administration of Government Organizations are also a part of this paper. Good Governance and its concepts of Right to information, Transparency, Citizen charter are also under review.

Section – I

Public Administration: Meaning, Nature, Scope, Public and Private Administration. New Public Management, Good Governance, Evolution of the study of Public Administration. Approaches to the study of Public Administration; Classical, Human relations, Behavioural Approaches.

Section – II

Principles of Organization: Formal and Informal Organization. Hierarchy. Unity of Command, Span of Control, Authority, Delegation, Co-ordination.

Administrative Behaviour: Leadership, Communication, Motivation and Decision Making.

Section – III

Personnel Administration : Meaning, Nature and Types of Bureaucracy, Contribution of Max Weber, Classification, Recruitment, Training and Promotion.

References Books :Core Books :

1. अवस्थी एवं माहेश्वरी : प्रशासनिक सिद्धान्त, लक्ष्मीनारायण अग्रवाल, आगरा
2. अवस्थी एवं माहेश्वरी : लोक प्रशासन, लक्ष्मीनारायण अग्रवाल, आगरा
3. चन्द्रा पाटनी, प्रभुदत्त शर्मा : प्रशासनिक सिद्धान्त एवं प्रबन्ध, कालेज बुक डिपो, जयपुर
4. बी.एल. फड़िया : लोक प्रशासन, साहित्य भवन पब्लिकेशन, आगरा
5. रविन्द्र शर्मा : लोक प्रशासन के तत्व, कालेज बुक हाउस, जयपुर
6. S.L. Goel : Public Administration Theory and Practice, Deep & Deep Publications, New Delhi
7. R.K. Saprue : Theories of Administration, S. Chand Company Ltd., New Delhi
8. Ramesh K. Arora : Public Administration : Fresh Perspectives, Aalikh Publishers, Jaipur
9. Mohit Bhattacharya : New Horizons of Public Administration, Jawahar Publishers & Distributors, New Delhi.
10. R.D. Agarwal : Organization & Management, Lata M.C. Graw, Hill Publishing Company Limited, New Delhi

International Politics : Issues and Challenges

L T P C

5 0 0 5

Max. Marks : 100

(CA:40+ESA:60)

Objectives:

The objectives of the paper are to give knowledge about various dimensions of international Politics and highlights major issues and debates in the international Politics with special reference to Post Cold War era.

Section I

Management of National Power : Balance of Power, Collective Security to Cooperative Security and Changing Concept of National Security and challenges to Nation State. Disarmament and Arms Control, World Public Opinion, U.N. and International Politics.

Section II

Bipolarity to Unipolarity, Polycentrism, Contemporary issues in Post Cold War era, Peace and Conflict Resolution Emergence of Developing Countries, Changes and Challenges, NAM : its role and relevance.

Section III

Liberalization, Globalization, Terrorism, and Fundamentalism Regionalism in International Politics, Human Rights, Gender and Environment in International Politics.

Core Books:

1. H.J. Morgenthau : Politics Among Nations, 6th ed. Revised by K.W. Thompson New York Alfred Knopf 1985.
2. Burchill Et.al. : Theories of International Relations Macmillan 2001.
3. M.P. Sullivan : Theories of International Politics : Enduring Paradigm in a changing World. Hampshire Macmillan 2001.
4. C.W. Kegley and E.R. Wittkopf : World Politics : Trends and Transformation, New York Martin Press 1995.
5. A.M. Hoogvelt : Globalization and the post colonial world : The New Political Economy of Development (Macmillan 1997)
6. Cox, Robert and T.J. Sinclair : Approaches to world order, (Cambridge University Press 1996)
7. Jayant Bandhopadhyaya and Amitav Mukherjee : International Relations Theory : From Anarchy to World Government Howrah Manuscript 2001
8. James Lee Ray : Global Politics Charles Hartford, 2002
9. डॉ. हरीश कुमार वैश्य : अन्तर्राष्ट्रीय राजनीति, आर्या पब्लिकेशन्स, दिल्ली, 2013
10. N.J. Papelford & Lincoln : International Politics the Macmillan Company Yark, 1954
11. Robert Jackson Georg Sorensen : Introduction to International Relations : Theories and Approaches (Second Ed Oxford Univ Press 2003.
12. P Aghen and J. Williamson : Growth Inequality and Globanization Cambridge Univ Press 1998.
13. D Hettne : Globalism and the New Regionism Macmillan 1999
14. A. Gamble and A Payne (ed.) : Regionalism Macmillan 1996
15. F Fratochwil and E Mansfied (ed), International organization : A Reader New York Harper Collins 1994.
16. M. Waters : Globanization 2nd ed. : Routledge 2000.

Additional Readings :

1. F.S. Northedge : The International Political System Faber and Faber Limited, 1976
2. Peter Calvocoressi : World Politics Pearson, 2006

Selected Journals :

1. Current History
2. Foreign Affairs
3. World Politics
4. South Asian Survey
5. International Affairs
6. International Studies
7. World Today
8. Current History

Public Administration in India

L T P C

5 0 0 5

Max. Marks : 100

(CA:40+ESA:60)

Objectives:

The main object of this paper to acquaint the students with development of central administrative system in India as well as to make them familiar with present systems and processes. Besides develop a deeper understanding of administrative problems and major reform efforts in context of gradually changing scenario.

Section I

Evaluation of Indian Administration with special reference to the influence of British Rule. Salient Features of Indian Administration since independence. Organization and functions of Central Secretariat, Cabinet Secretariat, Prime Minister's office (PMO) and Ministry of Home and Finance.

Section - II

Financial Administration : Budget Formulation, Budget approval and Budget execution. Financial Control over Administration : Comptroller and Auditor General, Public Accounts Committee and Estimate Committee. Major forms of Public Enterprises: Department, Corporation and Companies.

Section – III

Control Over Administration: Legislative, Executive and Judicial. Administrative Ethics and Problem of corruption. Administrative Reforms in India with special reference to first & second A.R.C.

Reference Books/Core Books :

1. बी.एल. फडिया : भारत में लोक प्रशासन, साहित्य भवन पब्लिकेशन, आगरा
2. हरिश्चन्द्र शर्मा : भारत में लोक प्रशासन, कालेज बुक डिपो, जयपुर
3. अवस्थी एवं अवस्थी : भारत में लोक प्रशासन, लक्ष्मी नारायण अग्रवाल, आगरा
4. रमेश अरोड़ा व गीता चतुर्वेदी : भारत में राज्य प्रशासन, आर.बी.एस.ए. पब्लिशर, एस.एम.एस. हाईवे, जयपुर
5. Ramesh K. Arora & Rajni Goyal : Indian Public Administration, Wishwa Prakashan, New Delhi.
6. B.L. Fadia & Kuldeep Fadia : Indian Public Administration, Sahitya Bhawan, Agra.
7. Hoshiar Singh : Local Governance Concepts & Networks, RBSA Publishers, SMS Highway, Jaipur.
8. R.P. Saprui : Development Administration, Sterling Publishers Pvt. Ltd., New Delhi.
9. M.V. Pylee : Introduction to the Constitution of India, New Delhi, Vikas, 1998.
10. J.K. Ray : India in a Search of Good Governance, K.P. Bagchi, Calcutta.

Research Techniques in Social Sciences

L T P C

5 0 0 5

Max. Marks : 100
(CA:40+ESA:60)

Rationale :

The Social investigation of a social phenomenon requires certain procedures and techniques used in survey research methods which may cut across various disciplines. Research Methodology, thus, is not disciplines specific, but may be used by the students of various disciplines, especially in social sciences, are exposed and made aware of the various procedures and techniques of research methods. The present syllabus, which will be common for the students of various social science disciplines, has been designed to achieve dual goals. The emphasis in this paper is more on the procedure and techniques of survey research requires for social investigation.

Section- I

Formulation of Research Problem. Research Design, Formation and types of hypothesis. Sampling.

Section- II

Source of Primary and Secondary data including library and e-resources. Techniques of Quantitative & Qualitative Data Collection: interview, Schedule, Questionnaire, Observation & Oral history. Case Study & Content Analysis.

Section- III

Classification & Tabulation. Graphic Presentation- Histogram, Bar & Pie diagram. Analysis of Quantitative data: Measures of Central tendency (Mean, Median, Mode), Standard deviation, correlation coefficient. An Overview of Hypothesis Testing (A detailed discussion of t, F, Z, X^2 tests and their applications are not required). Analysis of Qualitative data: Successive Approximation and The Illustrative Method. Report writing and the writing of research papers.

References:

1. Sellitz, G., Jahoda M., Cook Stuart W. Holt Rinehart & Winston, Research Methods in Social Relations, New York, 2003.
2. Goode W.J. and P.K. Hatt, Methods of Social Research, New York, Free Press, 1987.
3. Babbie, E.R., Survey Research Methods, Wadsworth Publishing Company, Belmont California, 2005.
4. Shah, Vimal P., Reporting Research, Rachana Prakashan, Ahmedabad, 2001.
5. Sijoberg Gideon and Nett Roger, A Methodology for Social Research, Rawat Publication, Jaipur 2002.
6. Kothari, C.R., Research Methodology- Methods and Techniques, Wiley and Eastern Limited New Delhi, 2008.
7. Rosenberg Kenneth, Statistics for Behavioural Sciences, W. C. Brown Publishers, 1990.
8. Black Thomas, Understanding Social Sciences Research, Sage Publication, New Delhi, 2001
9. Mariampolski H., Quantitative Market Research- A comprehensive Guide Sage Publication, New Delhi, 2001

Indian Polity - I

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives: To give an overview of the political system of India at the centre and generate ability to critically analyze various issues therein.

Section I

Framing of the Indian Constitution: Composition and Working of Constituent Assembly. Sources of the Indian Constitution, Characteristics of the Indian Political System. Ideological Contents: Preamble of the Indian Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy. Amendment Process in the Indian Constitution.

Section II

Union Executive : President, Prime Minister, Cabinet, Theory and Practice of Parliamentary System and the Working of the Coalition Government in India. Parliament : Composition, Powers, Functions, Relationship between Rajya Sabha and Lok-Sabha, Issue of Supremacy and Decline of Indian Parliament.

Section III

Judiciary : Composition and Jurisdiction of Supreme Court, Judicial Review and Judicial Activism, Need of Independence and Reforms in the Structure of Judiciary. Indian Democracy – A Critical Assessment.

Core Books :

1. C.H. Alexandrowiz : Constitutional Development in India.
2. Granville Austin : The Indian Constitution : Cornerstone of a Nation (Clarendon Press, Oxford, 1966).
3. A.B. Keith : Constitutional History of India (1900-1935).
4. N.D. Palmer : The Indian Political System.
5. M.V. Pylee : Constitutional Government in India.
6. W.H. Morris Jones : Government and Politics of India.
7. सुभाष कश्यप : भारत का संवैधानिक विकास और स्वाधीनता संघर्ष
8. रजनी कोठारी : भारतीय राजनीति
9. Reddy and Sheshadri : Politics and Society.
10. डॉ. एम.पी. राय : भारतीय सरकार एवं राजनीति : कॉलेज बक डिपो. त्रिपोलिया बाजार. जयपुर
11. Singhvi, L.M. : Indian Parties & Politics (in Hindi & English)

Additional Readings :

1. Sir Ivor Jennings : Some Characteristics of the Indian Constitution.
2. W.H. Morris - Jones : Parliament in India. 1957.
3. Richard L. Park and Irene Tinker (ed) : Leadership and Political Institutions in India.
4. Myron Weiner : Party Politics in India - The development of Multi Party System.
5. Myron Weiner : Politics of Scarcity : Public Pressure and Political Response in India.
6. Bayley D.H. : Police and Political Development in India.
7. S.L. Shukla : Parliamentary Practices in India.
8. Justice Hegde : Bhartiya Samvidhan Men Rajya ke Neeti Nirdeshak Tatva.
9. L.K. Singhvi (ed) : विदेशों में निर्वाचन. भारत में निर्वाचन
10. Bhawani Singh : The Council of States in India, Meenakshi Prakashan, Meerut.
11. Sharma, P.D., Pant, H.G. (ed.), Constitutional System in India, New Delhi, 1983.

12. Singhvi L.M. Indian Political Parties (in Hindi & English)
13. सिंघवी, एल.एम. : भारत का संविधान : चुनौतियां और उत्तर।
14. P.R. Brass, Politics of India since Independence 2ed. Cambridge.
15. P. Chatterjee (ed) State and Politics in India Delhi Oxford Press 1997.
16. P. Chatterjee and B. Chakraborty - Social Movements in Contemporary India (Calcutta, K.P. Bagchi and Co. 1999.)
17. M.V. Pylee, A Introduction to the Constitution of India New Delhi Vikas 1998.
18. G. Austin : Working of a Democratic Constitution : The Indian Experience Delhi Oxford Univ. Press, 2000.
19. M. Weiner, The Indian Paradox : Essays in Indian Politics Sage, 1999.
20. S. Kaviraj, Politics in India, Delhi Univ., Press 1998.

Selected Journals :

1. Pacific Affairs.
2. Asian Survey.
3. Journal of Commonwealth Political Studies.
4. Journal of Asian Studies.
5. Indian Journal of Political Science.
6. Political Science Review.

Public Policy in India

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives: This course aims to provide an understanding to students with the broader theoretical and practical context in which public policies are discussed, justified, designed and sought to be implemented. It also attempts to help students to understand and analyze Public policy in India.

Section I

Public Policy : Meaning, Nature and Significance. Approaches to the Study of Public Policy: Political Economy-**Western, Marxist and Non-Western Traditions**; Post Behavioral Approach; System Approach; Public Choice Theory; Public Management Theory

Section II

Public Policy Process: Policy Context- Political, Constitutional, Legal, Administrative, Socio-Cultural, Economic, Environmental and Scientific; Interfaces of the Policy Process- Institutions, Actors and role of Public Policy, Planning and Analysis, Resource mobilization, Formulation, Policy implementation, Policy monitoring and evaluation.

Section III

Public Policy in India: Policy Making, Structure and Process, Policy implementation, Feedback and problems of Policy implementation. Public Policy in the age of Globalization and Liberalization.

Books Recommended :

1. Anderson J.E., 2006, Public Policy making: an introduction, Boston, Houghton
2. Birkland Thomas A., 2005, An Introduction to The Policy Process: Theories, Concepts, And Models of Public Policy Making, 2nd Edition, Armonk; M.E. Sharpe
3. Dye Thomas, 2008, Understanding Public Policy, Singapore, Pearson Education
4. Gerston Larry N., 2004, Public Policy Making: process and principles, Armonk, M.E. Sharpe
5. Hill Michael, 2005, The Public Policy Process, Harlow, UK; Pearson Education, 5th Edition.
6. Parsons Wayne, 1995, Public Policy: An Introduction to the Theory of Policy Analysis, Aldershot, U.K.; Edward Elgar
7. Rathod P.B., 2005, Framework of Public Policy: The Discipline and its Dimensions, New Delhi; Commonwealth.
8. Stone Deborah, 2001, The Policy Paradox, N.Y., Norton
9. Dreze Jean and Amartya Sen, 2002, India: Development and Participation, New Delhi; Oxford University Press
10. Prabir Kumar De, Public Policy and Systems, Pearson Education India, New Delhi, 2012
11. RK Saprú, Public Policy – Formulation, Implementation and Evaluation, Sterling Publishers Pvt. Limited., New Delhi, 2010
12. RV Vaidyanatha Ayyar, Public Policy Making in India, Pearson Education India, New Delhi, 2009
13. William N Dunn, Public Policy Analysis – An Introduction, Prentice Hall, New Jersey, 1994.
14. Thomas Dye, Understanding Public Policy, Prentice Hall, New Jersey, 1995.
15. James Anderson, Public Policy Making: An Introduction, Houghton Mifflin, 2003.
16. Michael Hill and Peter Hupe, Implementing Public Policy, Sage, 2002

Major Governments of South Asia

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: This course is designed to acquaint the students with the political system of South Asian countries focusing on historical, cultural, social, political determinants of the political system. The Paper also highlights common geopolitical legacy of the region.

Course Contents:

- Unit 1** Pakistan: Determinants and Characteristics of the Political System. Role of Army and struggle for democracy in Pakistan, Federalism: Characteristics of the federal system. Composition, Powers and functions of Executive: President and Prime minister and Judiciary
- Unit 2** Bangladesh: Emergence, Determinants and Characteristics of the Political System, Power and functions of President (Executive), Composition and Powers of Legislature,
- Unit 3** Srilanka: Determinants and Characteristics of the Political System, Powers and Functions of the President, Composition and Powers of the Legislature, Role of Judiciary.
- Unit 4** Nepal: Determinants and Characteristics of the Political System, Genesis of Democratic Republic and end of Monarchy. Election and Powers of the President and Prime Minister. Composition and Powers of the Legislature, Emerging issues and Challenges.
- Unit 5** Bhutan: Characteristics of the Political System, Organization and Powers of Parliament, Executive and Judiciary
Maldives: Characteristics of the Political System, Organization and Powers of People's Majlis (Legislature), President and Judiciary

Books Recommended :

1. Khalid Bin Sayeed : The Political System of Pakistan, Houghton Muffin Co. Boston, 1967.
2. Howard Wriggings : Ceylon - Dilemmas of a New Nation.
3. Anirudh Gupta : Politics in Nepal, Allied Publishers, New Delhi, 1974.
4. J.C. Johari : Government and Politics of South Asia.
5. P.C. Mathur : Governments and Politics of South Asia (2 Vol.)
6. Karl Von Vorys : Political Development in Pakistan.
7. S.U. Kodikara : Indo - Ceylon Relations Since Independence. Colombo, 1965.
8. Saul Rose : Politics in Southern Asia.
9. M. Chadda, Building democracy in South Asia : India, Nepal, Pakistan, Boulder Colorado, Lynne Rienner, 2000.

Human Rights

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives: This course seeks to provide a systematic survey of existing international, regional, and national human rights instruments, standards, and enforcement mechanisms, and to encourage students to acquire an empirical knowledge of human rights from a political science perspective. The course aims at enabling the students to understand the issues concerning the rights of citizens in general and the marginalized groups in particular, and assess the institutional and policy measures which have been taken in response to the demands of various movements. Conceptual dimensions, international trends and the Indian experience form the contents of the course.

Section - I

Human Rights : Meaning, Nature and Perspectives (Liberal and Marxian), Origin and Evolution of Human Rights, Human Rights of Women and child.

Brief introduction of Philosophical Foundations: Liberty, Equality, Justice and Civil Society.

Section - II

United Nations and Human Rights : Universal Declaration of Human Rights, International Conventions on Civil and Political Rights, Social Economic and Cultural Rights and Responsibilities.

Section - III

Indian Perspective of Human Rights, Fundamental Rights.

Human Rights Enforcement Institutions : National Human Rights Commission, National Commission for Women, SC and ST Commission,

Books. Recommended:

1. Alston Philip : The United Nations and Human Rights, Clarondon Press, Oxford, 1995
2. एम.ए. अन्सारी, राष्ट्रीय महिला आयोग और भारतीय नारी, ज्योती प्रकाशन, जयपुर, 2000
3. अरुण कुमार पलेई, भारत का राष्ट्रीय मानवाधिकार आयोग : गठन कार्य और भावी परिदृश्य, राधा पब्लिकेशन, नई दिल्ली
4. अरुण चतुर्वेदी एवं संजय लोढ़ा (संपा.) भारत में मानवाधिकार, पंचशील प्रकाशन, जयपुर
5. आशा कौशिक (संपा.) मानवाधिकार और राज्य : बदलते सन्दर्भ, उभरते आयाम, पोईन्टर पब्लिकेशर्स, जयपुर
6. D.D. Basu : Human Rights in Constitutional Law, Prentice Hall New Delhi.
7. डी.डी बसु, भारत का संविधान : एक परिचय, वाधवा पब्लिकेशन्स, नागपुर 2003
8. Gokulesh Sharma : Human Rights and Legal Remedies, Deep and Deep New Delhi.
9. कृष्ण मोहन माथुर, स्वातंत्र्योत्तर भारत में मानवाधिकार, ज्ञान पब्लिशिंग हाउस, नई दिल्ली
10. M.P.Dube and Neeta Bora (ed.) Perspectives on Human Rights, Anmika Publishers, New Delhi.
11. Manoj K. Sinha : Implementation of Basic Human Rights, Manak Publication, New Delhi.
12. Parveen Vadkar : Concepts Theories and Practice of Human Rights rajat Publication, New Delhi.
13. Prakash Talwer (ed.) Human rights, Isha Books, Delhi, 2006
14. Rachana Kaushal : Women, and Human Rights and Lugal Remedies Deep and Deep, New Delhi
15. Sadhana Arya : Women, and Human Gender, Equality and State, Deep and Deep, Publication, New Delhi.
16. Sudhir Kapoor : Human Rights in 21st Century, Mangal Deep Publication, Jaipur

National Movement and Constitutional Development in India

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: The aim of this course is to make students acquainted with the history of different streams of the National Movement and Constitutional Development in India. The paper also deals with the participation of women in Indian National Movement

Course contents:

Unit 1 Indian Nationalism : Genesis of the Indian National Congress: Moderates and Extremists
Revolutionary Perspective of National Movement.

Unit 2 Home Rule Movement ,Non-Cooperation Movement, Swaraj Party,
Nehru Report, Civil Disobedience Movement

Unit 3 Emergence of Communal Politics : Muslim League, Fourteen Points of Jinnah, Two nation Theory,
Communal Award, Poona Pact, Hindu Revivalism.

Unit 4 Towards Freedom: Cripps Mission, Quit India movement, Cabinet Mission, Mount Batten Plan, Partition of
India.

Role of Women in National movement in India

Unit 5 An introduction to the constitutional development in India.

Main features and provisions of the Acts of 1909, 1919, 1935 and 1947.

Books Recommended :

1. Nehru, Jawahar Lal : The Discovery of India
2. Agarwal, R.C., Indian Government and Politics, New Delhi: S. Chand & Company Ltd., 2001
3. Chandra, B. and et. Al., India's Struggle for Independence, New Delhi: penguin, 1981
4. Deenanath Singh, Bharatiya Rashtriya Andolan aur Samvaidhanik Vikas, Varanasi
5. Kamla Devi Chattopadhyaya, Indian's Women's struggle for freedom, Abhinav Publications New Delhi, 1983.
6. Lala Kasturi & Vina Majumdar, Women and Indian Nationalism, Vikas Publishing House, New Delhi, 1994.
7. Manmohan Kaur (1968) Role of Women in the Freedom Movement, 1859-1947, Starly, New Delhi.
8. Radha Krishna Sharma (1981) – Nationalism, Social Reform and Indian Women, Janki Prakashan, New Delhi.
9. Chandra, B. and et. Al., India's Struggle for Independence, penguin, New Delhi, 1989 (In Hindi also)
10. Chandra, B., Indian National Movement: The Long Term Dynamics, Vikash Publishing, New delhi.

Principles of Political Science

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: The objective of this course is to provide students familiarize themselves with key ideas and concepts of Political Science inquiry and to critically explained various concepts and theories with the purpose of highlighting the differences in their perspectives and in order to understand other continuity and change and to emphasize relevance of these concepts, Ideas and theories of Political Science in contemporary perspectives.

Course contents:

Unit 1 Dictatorship and Democracy: Meaning, types, Merits and Demerits and conditions for successful working of Democracy.

Unit 2 Organization of Government: Legislature, Executive and Judiciary Patterns and relationship.

Unit 3 Forms of Government: Unitary Government; Meaning, Main Fetures, Merits and Demerits, Fedarl Government; Meaning, Main Fetures, Essential Conditions, Merits and Demerits.

Unit 4 Parliamentary Government; Meaning, Main Fetures, Merits and Demerits.
Presidential Government: Meaning, Main Fetures, Merits and Demerits.

Unit 5 Party System: Meaning and Importance of Political Parties, basic characteristics and types of Party System.
Role of Political Parties in the Political System.

Pressure Groups: Meaning, classification and methods, Importance of Pressure Groups in Democracy.

Books Recommended :

1. Asirvatham : Political Theory (Hindi and English Ed.)
2. Appadoraj : Substance of Politics (Hindi and English edition)
3. Pennock and smith : Political Science-An Introduction
4. S. N. Dubey : Rajniti Shastra Ke Siddhant, Shivlal Agrawal and Co., Agra.
5. Roy, Das Gupta and Ray : Principles of Political Science.
6. Pukhraj Jain : Rajniti Shastra Ke Siddhant.
7. A.D. Pant : Rajniti Shastra Ke Mool Adhar (Marg I Kitab Mahal, Allahabad)
8. Kapoor : Principles of Political Science.
9. D. Held, Models of Democracy, Cambridge, Polity Press 1987

Indian Political System - I

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: The objective of the paper is to give students the knowledge and understanding of Indian Political System. The content of the paper include: sources, salient features of constitution, Fundamental rights, Directive Principles and Executive, Legislature and Judiciary of Union Government of India etc.

Course Content:

Unit 1 Constitution of India: Sources and Salient features, Philosophical Foundations, Preamble.

Unit 2 Fundamental Rights, Fundamental Duties and Directive Principles of state policy in India.

Unit 3 Union Executive: President, Prime Minister and Council of Ministers.

Unit 4 Union Legislature: Organization and functions of Lok Sabha and Rajya Sabha, Speaker of Lok Sabha, Relationship between Lok Sabha and Rajya Sabha, Amendment Process of the Indian Constitution.

Unit 5 Union Judiciary: Composition and Jurisdiction of Supreme Court, Judicial Review and Judicial activism.

Books Recommended :-

1. N. D. Palmer: The Indian Political System (Houghton Mifflin Boston, 1971)
2. Rajni Kothari: Bharat Mein Rajniti (Orient Longmans, New Delhi, 1972.)
3. R. L. Hardgrave, JR : Indian government and politics in a developing Nation (Harcourt Brace and World, INC. New York, 1970)
4. Siwach : Dynamics of Indian Government and politics.
5. गोविन्द राम वर्मा : भारतीय राज, शासन और राजनीति
6. बाबुलाल फडिया : भारतीय राज व्यवस्था

International Relations Since 1945

L T P C

4 0 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: Objective of the paper is to give student the knowledge understanding and overview of various dimensions of international relations since 1945. The paper highlights various aspects of conflict, conflict resolution, cooperation and issues of cold war and post-cold war era.

Course Content:

Unit 1 International Relations: Meaning, Evolution and significance. Major approaches of International relations: Idealist, Realist, Systems and Marxist.

Unit 2 UNO: Objectives, Organization with special reference to General Assembly and Security Council. Achievements, Limitations and prospects of UN in 21st century.

Unit 3 Cold War: factors leading to Post Cold War Era, emerging Trends in post-cold war era, Uni-Polarity and Polycentrism

Unit 4 North South Dialogue, South-South cooperation, New International Economic Order.

Unit 5 Emerging Trends in Post-War Era: Human Rights, Gender, Conflict Resolution, Environment Protection.

Books Recommended :

1. Vinay Kumar Malhotra, "International Relations", Anmol Publication, 2008
2. Paimer and Perkins, "International Relations", 3rd ed., CBS Publication, 2001
3. V.N. Khanna, "International Relations", S. Chand Company Ltd., 2013
4. Paul Wilkison, "International Relations: A Very Short Introduction", OUP, 2007
5. Roop Singh Bareth and Damyanti Gupta, "State and Globalization", Rawat Publication, 2010
6. Surjeet Singh and S. Mohenkumar, "Climate Change: An Asian Perspective", Rawat Publication, 2012
7. Ganesh Datta Poddar, "Globalization, Liberalization and Environmentalism", Rawat Publication, 20091-
8. बी. एल. फडिया : अन्तर्राष्ट्रीय सम्बन्ध
9. जैन एवं मण्डोत : अन्तर्राष्ट्रीय सम्बन्ध
10. दीनानाथ वर्मा : अन्तर्राष्ट्रीय सम्बन्ध
11. प्रमदत्त शर्मा : अन्तर्राष्ट्रीय राजनीति
12. तपन बिस्वाल . अन्तर्राष्ट्रीय सम्बन्ध . 2009
13. पी. आर. भाटिया : अन्तर्राष्ट्रीय सम्बन्ध एवं विश्व राजनीति
14. Srivastava J. Joshi : International Relations.

India's Foreign Policy

L T P C

4 0 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: The course seeks to acquaint students with India's foreign policy with emphasis on the foundation aspects of foreign policy and India's interface with global and regional players and multilateral organizations and forums shall also be dealt with.

Unit 1 Foreign Policy: Meaning, Approaches and Significance, India's Foreign Policy: Evolution, Features and Determinants , Continuity and Change in 21st Century

Unit 2 India's Foreign Relations with Major Powers Since 1991 : USA, Russia and China

Unit 3 India's Relations with neighbours: Pakistan, Bangladesh, Sri Lanka and Nepal

Unit 4 India's Interaction with Global and Regional Institutions: UN, EU, BRICS, SAARC and ASEAN

Unit 5 Contemporary Issues and Trends of India's Foreign Policy: Globalization, Neo-Colonialism, Terrorism and Climate Change

Books Recommended:

1. Sharma, R.R. **India and Emerging Asia**, New Delhi: Sage, 2005.
2. Chellaney, Brahma. **Securing India's Future in the New Millennium**, New Delhi: Orient Longman, 1999.
3. Perkovitch, George. **India's Nuclear Bomb - The Impact of Global Proliferation**, New Delhi: OUP, 2002.
4. Cohen, Stephen. P. **India: Emerging Power**, New Delhi: OUP, 2001.
5. Ghai, U.R. **Foreign Policy of India**, Jalandhar: New Academic Publishing, 2012.
6. Vinayak, Achin. India in a Changing World: Problems, Limited and successes of its Foreign Policy, 1995.
7. Karunakaran Gupta : India in world Politics
8. P. N. Hasker: India's F. P. and its Problems
9. Kachroo : India in the Commonwealth
10. S. R. Mehrotra : India and the Commonwealth
11. Roy C. Macridis: Foreign Policies in World Politics.
12. पण्डित पंत भारत की विदेश नीति . मेगाहिल पब्लिशकेशन . 2014
13. मथरालाल शर्मा एवं जैन : प्रमुख देशों की विदेश नीतियाँ

Journals:

1. Indian Foreign Affairs Journal
2. International Studies
3. Economic and Political Weekly
4. South Asian Survey

Indian Administration-I

Contact hrs.: 4

Note : The paper will contain ten questions having two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: The main object of this paper is to acquaint the students with development of central administrative system in India as well as to make them familiar with its present systems and processes. Besides, develop a deeper understanding of administrative problems and major reform efforts in context of gradually changing scenario.

Unit 1 Historical Background of Indian Administration with Special Reference to the Influence of British Rule, Salient features of Indian Administration since Independence.

Unit 2 The Union Executive : President, Prime Minister, Council of Ministers.

Unit 3 The Organization and Functions of Central Secretariat, Cabinet Secretariat, Prime Minister's Office.

Unit 4 The Organization and Functions of Ministry of Home, Finance and Ministry of Personnel, Pension and Public Grievances.

Unit 5 Major Forms of Public Enterprises in India : Department, Corporations, Companies. .

Books Recommended :

1. शर्मा एवं ग्रोवर एवं अन्य : भारत में लोक प्रशासन, जयपुर (1979) राज. हिन्दी ग्रंथ अकादमी।
2. माहेश्वरी, श्रीराम : भारतीय प्रशासन, नई दिल्ली
3. Sharma, P.: Public Administration in India, Delhi (1978), Meenakshi Publication.
4. Bhambhari, C. P.: Public Administration in India, Delhi (1973), Vikas Publication.
5. Jain R. B. : Contemporary Issues in Indian Administration.
6. Jain R. B. : ARC Report on Personnel Administration.
7. Appleby, P. H.: Public Administration in India Report of a Survey, GOI (1953).
8. पत्रिकाएँ : (i) लोक प्रशासन, भोपाल (ii) IJPA, IIPA, New Delhi.

**State Administration in India with Special
Reference to Rajasthan-I**

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: The purpose of this course is to acquaint the student with the basic constitutional, Political and Administrative setup of state government in its federal context and changing scenario.

Unit 1 General Background of the State Administration in India and Its growing Importance. Integration of Rajasthan state.

Unit 2 The office of Governor, Its Powers, Functions, Role and Relationship with Council of Ministers. Chief Minister's Role and Functions and its Relationship with Council of Minister.

Unit 3 Centre - State Relations : Legislative, Administrative and Financial.

Unit 4 Organization and Role of the State Secretariat, Secretariat Directorate Relationship, Role and Significance of Chief Secretary in State Administration.

Unit 5 Organization and Functions of the Departments of Home, Finance and Planning in Rajasthan.

Books Recommended :-

1. S.R. Maheshwari : State Government in India.
2. S.S. Khera : District Administration in India.
3. M.V. Pylee : Indian Constitution (Hindi Ed.)
4. A.R.C. Report on State Administration.
5. A. Zabier & Gupta : Organisation of Govt. of Uttar Pradesh.
6. एच.सी. शर्मा : भारत में राज्य प्रशासन
7. सी.एम. सिंह : राजस्थान में राज्य प्रशासन

Urban Local Self Government

L T P C

4 0 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: To acquaint the students with concept, background, and need of Local self Government in urban context. The purpose is to make them understand the present setup of urban local self government in the country and highlight the growing importance, challenges and future possibilities in this area of study.

Unit 1 Meaning, nature and significance of Local Government in India. Nature and Importance of Urban Local Government in India. Development of Urban Local Government.

Unit 2 Growing Urbanization – Its Causes and Problems. The Organizational structure of Urban Local Self Government in India with special reference to the 74th constitutional Amendment Acts.

Unit 3 The Composition functions, powers and Role of various kind of Local Bodies. Administrative system of metropolitan Towns, Municipal Corporations and municipal Council.

Unit 4 Municipal Personnel Administration: Classification, Recruitment and training.

Unit 5 Management of Financial Resources in Urban Local Bodies, System and Nature of State Control Over Urban Local Bodies.

Books Recommended:

1. महेश्वरी, श्रीराम "भारत में स्थानीय सरकारें" (1984) दिल्ली, ओरिएण्ट ।
2. शर्मा रवीन्द्र "ग्रामीण स्थानीय प्रशासन"
3. Reddy, G.R. 'Panchayati Raj in India' (1997), Macmillan
4. राजस्थान जिला परिषद एवं पंचायत समिति अधिनियम, 1959
5. रिपोर्ट—सादिक अली (1964), गिरधारी लाल व्यास (1973), अशोक मेहता (1978), प्रशासन सुधार आयोग (1968), बलवन्तराय मेहता (1958)
6. Agarwal R. : Municipal Government in India.
7. Maheshwari S.R. : Local Government in India
8. Mathur M.V. : Panchayati Raj in Rajasthan
9. Khanna R.L. : Municipal Government and Adm. In India.
10. Bhoglee S.K. : Local Government in India

Rural Local Self Government

L T P C

4 0 0 4

Max. Marks : 60

(CA : 20 + ESA : 40)

Note : The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Objectives: To acquaint the student with, concept, background, and present setup of panchayati raj or Rural local Self Government in India. The purpose is to make them understand the need, growing importance, challenges and future possibilities in this area of study.

Unit 1 Meaning, nature and significance of Rural Local Government in India. The History of Panchayati Raj. in India.

Unit 2 Nature and problems of Rural India. Policies and Programmes of rural development, Panchayat patterns in India with special reference to 73rd Constitutional Amendment.

Unit 3 Panchayati Raj in India (with special reference to Rajasthan) Organisation. Structure, Powers and functions of Zila Parishad, Panchayat Samiti, Gram Panchayat, Gram Sabha.

Unit 4 Personnel Administration in Panchayat Raj: Classification, Recruitment and Training.

Unit 5 Management of Financial Resources in Panchayat Raj System and Nature of State Control Over Panchayati Raj.

Books Recommended:

1. महेश्वरी, श्रीराम "भारत में स्थानीय सरकारें" (1984) दिल्ली, ओरिएण्ट ।
2. शर्मा रवीन्द्र "ग्रामीण स्थानीय प्रशासन"
3. Reddy, G.R. 'Panchayati Raj in India' (1997), Macmillan
4. राजस्थान जिला परिषद एवं पंचायत समिति अधिनियम, 1959
5. रिपोर्ट—सादिक अली (1964), गिरधारी लाल व्यास (1973), अशोक मेहता (1978), प्रशासन सुधार आयोग (1968), बलवन्तराय मेहता (1958)
6. Agarwal R. : Municipal Government in India.
7. Maheshwari S.R. : Local Government in India
8. Mathur M.V. : Panchayati Raj in Rajasthan
9. Khanna R.L. : Municipal Government and Adm. In India.
10. Bhoglee S.K. : Local Government in India.

Business Law

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To enable students to know about Indian Contract Act, Sale of Goods Act, Indian Partnership Act, Negotiable Instruments Act and legal issues concerned with business activities.
2. To understand the legal regulations while entering into a contract.
3. To provide the knowledge about legal terminologies, basic concepts, practices in the field of Law.
4. To provide the students with practical legal knowledge of general business law issues.

Note: The paper will contain 10 questions having 2 questions from each unit; candidates will be required to attempt 5 questions taking 1 question from each unit.

Course Contents:

Unit I Indian Contract Act 1872: Meaning and essential of Contract, Valid contract and its essential elements, Offer and Acceptance, Capacity of Parties, Consideration: essential elements of valid consideration, Contract without consideration, Free Consent: Coercion, Undue Influence, Fraud, Misrepresentation, Legality of Object and consideration, and Agreement Opposed to Public Policy

Unit II Indian Contract Act 1872: Void Agreement and Contingent Contracts, Performance of a Contract, Discharge of a Contract, Remedies for Breach of Contract, Quasi- Contract: Kinds of Quasi Contract, Quantum Merit, Indemnity and Guarantee, Bailment and Pledge, Contract of Agency

Unit III The Sale of Goods Act, 1930: Meaning and Essential Elements of Contract of Sale, Distinction between Sale - Agreement, Sale - Hire Purchase Agreement, Sale- Contract for Work and Labor, Meaning, Type and destruction of Goods, Conditions and Warranties, Passing of Property: Meaning, Significance and Rules, Sale by non owner, Rights of an Unpaid Seller and Buyer and Delivery.

Unit IV Indian Partnership Act, 1932: Meaning, Nature and Essential Elements of Partnership, Partnership and Co-Ownership, Partnership and Hindu Undivided Family, Partnership Deed, Registration, Types, Duration, Property of the Firm, Mutual Rights And Duties, Reconstitution And Dissolution of a Company and Settlement of Accounts.

Unit V The Negotiable Instruments Act, 1881: Part 1 Meaning, Characteristics, Presumptions Maturity and Types of Negotiable Instruments, Promissory Notes, Bills of Exchange, Acceptance, Negotiation and Assignment, Rights and Obligation of Various Parties to an Instrument Obtained by Unlawful Means. The Negotiable Instruments Act, 1881: [Part 2] Presentation for acceptance and Payment, Acceptance for honor, Dishonor of a Bill, Notice of Dishonor, Noting and Protesting, Discharge of an instrument and a party, Hundis.

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand the basic strategies that can be used to solve legal problems.
- Apply their knowledge in solving realistic problems.
- Explain the legal system and various fundamental concepts.
- Apply the rules of contract law to real-life and theoretical issues that may arise in connection with contracts.

Suggested Readings:

1. Miller, R. L., & Cross, F. B. (2013). *Business Law: Alternate Edition* (12 ed.).Mason: Cengage.
2. Nolakha, R. L. (2004). *Business Regulatory Framework*.Jaipur: Ramesh Book Depot.
3. Tulsian, P. (2006). *Business & Industrial Law For B.Com Pass*.New Delhi: Tata McGraw-Hill Education.

4. Twomey, D. P., & Jennings, M. M. (2017). *Business Law: Principles for Today's Commercial Environment* (5ed.). United Kingdom: Cengage Learning.

Suggested E-Learning Materials :

1. Sachdeva, S. (2017, Dec 28). *Nature of Contract*. Retrieved from Youtube:
https://www.youtube.com/watch?v=jnNHtCODRFw&list=PLVE_dFhGA23xpZE8CMqm5rlZj5Pftnsli.
 2. Advocate Khoj (2012). *Partnership Act 1932*. Retrieved from:
<http://www.advocatekhoj.com/library/bareacts/partnership/index.php?Title=Indian%20Partnership%20Act,%201932>
 3. Khandelwal, P. (2015, Dec 3). *Sale of goods act 1930* . Retrieved from Youtube:
https://www.youtube.com/watch?v=fXK7F_W5yJl.
- Vyas, S. (2016, June 12). *Negotiable Instrument act*. Retrieved from Youtube:
https://www.youtube.com/watch?v=MqesNGviU_E.

Fundamental of Micro Economics – I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To develop the knowledge of and economic agent, namely, consumer and producer.
2. To understand the concepts of demand and elasticity of demand.
3. To understand the production function and cost function in manufacturing units.
4. Basic knowledge of different types of cost available in industries.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Course Content:

- Unit I** Concept of micro and macro economics- Nature and their scope. Consumer Equilibrium: Utility Approach- Assumptions and laws. Indifference curve approach- Concepts, properties, applications and Uses of indifference curves. Comparison between utility and indifference curve approach. Budget line.
- Unit II** Law of Demand and Its Elasticity- Price Elasticity and its Measurement and Determinants. Income and Cross Elasticity Of Demand. Consumer Surplus- Concept and Measurement.
- Unit III** Changes In Consumer Equilibrium- Price, Income and Substitution Effects: Derivation of Demand Curve from Price Consumption Curve for Normal and Giffen Goods. Substitute and Complementary Goods.
- Unit IV** Production function: Law of variable proportions Returns to scale- concepts of Isoquants and Iso-cost line, Least cost combinations, concept of ridge lines.
- Unit V** Concept of cost: Money, Opportunity and real. Shortrun cost curves: Total cost, Total fixed and variable cost, Average cost and Marginal cost. Long-run Total cost, average and marginal cost curves.

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand the utility approach and consumer equilibrium.
- Learn how the elasticity of the product affects the purchasing habits of the consumer.
- Determine consumption patterns of the consumer in relation to income effect and price effect.
- Understand the cost combinations in an industry.

Suggested Readings:

6. Ahuja, H. L.(2002).*Principles of Microeconomics*,(21ed), New Delhi, S. Chand.
7. Ahuja, H. L. (2007). *Advanced Economic Theory: Microeconomic Analysis* (20 ed), S. Chand.
8. Case & Fair (2007), *Principles of Economics*, (8ed) New Delhi, Pearson.
9. Hornby, W., Gammie, R .,&Wall.s, (2001), *Business Economics*, (2ed) ,Financlal Times Management.
10. [Dholakia R.H](#) & OZA, A.N. (2012), *Micro Economics for Management Students*, Oxford University Press.

Suggested E-Learning Materials :

4. Agrawal, D. (2017, Mar 8). *Indifference curve*. Retrieved from Youtube: https://www.youtube.com/watch?v=3l_rYca4eio.
5. Econ (2012). *Cost*. Retrieved from: Guide:<http://www2.econ.iastate.edu/classes/econ301/jintanakul/Notes/Ch7.pdf>
6. Khan, Y. (2014, Dec 18). *Production Function*. Retrieved from Youtube: <https://www.youtube.com/watch?v=MwuTt3L2hEQ>.
7. Bhogal, S. (2018, June 04). *Income and Cross Elasticity*. Retrieved from Youtube: <https://www.youtube.com/watch?v=i7O4CriwvY>.

Cost and Management Accounting

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

6. To understand the concept of management and cost accounting.
7. To understand the concept of material handling in manufacturing organization.
8. To understand the labor management in different organizations.
9. To understand the concept of allocation and apportionment of overheads.
10. To study the different strategic decision by using marginal costing.
11. To understand the new trends in management accounting.

Note: The paper will contain 10 questions having two questions from each unit; candidates will be required to attempt five questions taking one question from each unit.

Course Contents:

- Unit I** Introduction Nature and scope of Cost Accounting, Advantages and limitations of cost accounting, Installation of costing system. Cost concepts, Classification of cost, Preparation of cost sheet.
- Unit II** Elements of cost, Material cost, Direct and indirect material cost. Issue of materials of production, Pricing methods Labor cost, Direct and indirect labor cost, Methods of payment of wages, incentive plans, Over heads classification, Allocation and apportionment of over heads.
- Unit III** Marginal Costing: Concept, Relevance, Difference vis-a vis absorption costing, statement, CVP, BEP, P/V analysis. Introduction to standard costing and managerial applications
- Unit IV** Management Accounting: Concept, Interface & difference between Cost Accounting -Management Accounting - Financial Accounting, Different types of Financial Statements, Preparation and presentation of financial statements, Comparative balance sheets, Horizontal and vertical analysis, Common size balance sheet.
- Unit V** Relevance of Responsibility Accounting for managers, assumptions, limitations, controllable and non-controllable cost, New trends in management accounting and role in decision making.

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand how to use cost and management accounting.
- Understand the concept of material, labor and overheads used in manufacturing.
- Advice and guide on strategic decisions.

Suggested Readings:

1. Lal J. and Shrivastava, S. (2009) *Cost Accounting* (4 ed.), New Delhi: Tata Mcgraw Hill.
2. Khan M.Y. and Jain P.K. (2017), *Management Accounting* (7 ed.). New Delhi: Tata Mcgraw Hill.
3. Jain, S.P. and Narang, K. L. (2013), *Cost and Management Accounting*, Kalyani Publishers,

Suggested E-Learning Material

1. Agarwal, R. (2017, Oct 14), *Introduction to Cost and Management Accounting* Retrieved from Youtube: <https://www.youtube.com/watch?v=nAZhp69dPRM>.
2. Infliabate. *Absorption and marginal costing*. Retrieved from: http://content.inflibnet.ac.in/dataserver/eacharyadocuments/53e0c6cbe413016f234436f6_INFIEP_18/6/SA/18-6-SA-V1-S1__solved_problems_mc.pdf

3. Aggrwal, N. (2018, Nov 12), *FIFO Method of Store Ledger*. Retrieved from Youtube:
<https://www.youtube.com/watch?v=TxM9Z306Cb8>
4. Aggrwal, N. (2017, Oct 11). *Material Variance analysis*. Retrieved from Youtube:
<https://www.youtube.com/watch?v=Wi2Ud3IseJY>

Fundamentals of Micro Economics -II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To develop the knowledge about revenue curves under perfect market and imperfect markets
2. To understand the concepts of monopoly, duopoly oligopoly and monopolistic competition
3. To understand the classical theory and modern theory of wages and what is the role of trade unions in determining the wages for the labours
4. Basic knowledge of theories of profit, rent and interest.

Note: The paper will contain 10 questions having at least two questions from each unit, Candidates will be required to attempt five questions in all taking at least one question from each unit.

Course Contents:

Unit I Revenue concepts – Shape of Total Revenue, Average Revenue and Marginal Revenue curves under perfect and imperfect competition. Relationship between Average Revenue, Marginal Revenue and Price elasticity of demand.

Market structures – Short run and long run equilibrium of a firm and industry under perfect competition. Effect of an increase in demand on long run equilibrium price and output under perfect competition.

Unit II Determination of price and output in short run and long run under Monopoly. Third degree price discrimination under monopoly.

Determination of price and output in short run and long run under Monopolistic competition. Introduction to Oligopoly.

Unit III The nature of demand for factors of production. General theories of distribution: The Marginal Productivity theory and demand supply theory (Modern Theory). Wages: Real and money wages-Demand and supply theory of wages-Role of trade unions in the determination of wages.

Unit IV Profit: Normal and surplus Gross and Net Profit - Risk, uncertainty bearing, Innovation and marginal productivity theories. Rent: Ricardian and Modern Theories-Rent and Price-Quasi Rent-situation and ability rent.

Unit V Interest: Gross and net interest, real and money interest-bond prices and rate of interest, saving and investment, liquidity preference and modern theories of interest.

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand the market structures and the current market scenario.
- Get the knowledge of the different types of sellers available in the markets.
- Determine the prices for the product available in the different types of markets.
- Understand the factor payments and their determination.

Suggested Readings:

1. Ahuja, H. L.(2002). *Principles of Microeconomics*, (21 ed), New Delhi, S. Chand.
2. Ahuja, H. L. (2007). *Advanced Economic Theory: Microeconomic analysis* (20 ed), New Delhi S. Chand.

3. Case & Fair (2007), *Principles of Economics*, (8 ed) New Delhi, Pearson.
4. Hornby, W., Gammie, R., & Wall, S. (2001), *Business Economics*, (2 ed) New Delhi, Financial Times Management.
5. [Dholakia R. H](#) & OZA, A.N. (2012), *Micro Economics for Management Students*, (5 ed.) New Delhi, Oxford University Press.

Suggested E-Learning Materials:

1. Infotainment Arena. (2017, Sep 21). *Monopoly Market Structure*. Retrieved from Youtube: <https://www.youtube.com/watch?v=7zh1VsoG75U>.
2. Economicsdiscussion. *The Ricardian Rheory of Rent*. Retrieved from : <http://www.economicsdiscussion.net/rent/ricardian-theory-of-rent/the-ricardian-theory-of-rent-with-diagram/12612>.
3. Shrivastav, S. (2017, Nov 28). *IS-LM Model*, Retrieved from Youtube: <https://www.youtube.com/watch?v=OnJJbuswevE>
4. knowledgiate (2017, Sep 13). *Modern Theory of Interest in Economics*. Retrieved from : <http://www.knowledgiate.com/modern-theory-of-interest-in-economics/>

Business Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the basics of communication as a process.
2. To understand the implementation of business communication in professional settings.
3. To enhance the listening skills for better communication.
4. To develop upon the written and oral forms of communication with wise selection and usage of words.

Note: The paper will contain ten questions having two questions from each unit. Candidates will be required to attempt five questions taking at least one question from each unit.

Course Contents:

- Unit I** Communication: Process of Communication, Importance of Communication, Types and Techniques of Communication, Objectives of Communication, Barriers to Communication. How to overcome them.
- Unit II** Parts of speech. Subject and verb agreement, Punctuation, Adaptation and selection of words. Construction of sentences and paragraphs
- Unit III** Business Letters : Elements and Formats, E-mails: difference from paper pad letters. Report Writing : Structure of Report, Writing Bibliography
- Unit IV** Resume Writing: difference between Resume and CV, Precis Writing: Carrying important points along. Reading: Purpose and Rate of reading. Listening- Difference between Listening and Hearing, Active listening skills
- Unit V** Oral Communication: Essentials of Public-speaking, Presentations, gaining audience attention. Group discussions: do's and don'ts, Interviews

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand the essential of efficient communication mechanism.
- Get the knowledge about drafting resumes and business letters.
- Make mindful selection when it comes to listen and write for communication purposes.

Suggested Readings:

1. Lesikar, R. V., Pettit, J. D., & Flatley, M. E. (2014). Basic business communication (13 ed). Irwin.
2. Bovee, & Courtland. (2012). Business Communication Today, (10 ed) New Delhi. Pearson Education India.
3. Gimenez, J. C. (2000). Business e-mail communication: some emerging tendencies in register. English for Specific Purposes, 19(3), 237-251.
4. Bovée, C. L., Thill, J. V., & Schatzman, B. E. (2010). Business communication essentials (10 ed). New Delhi Pearson Prentice Hall.

Suggested E-Learning Materials:

1. Rout, N. R. (2018). *Business Communication*. Retrieved from youtube: <https://lecturenotes.in/notes/8051-notes-for-business-communication-bc-by-nihar-ranjan-rout>
2. Mulchandani, D. (2016, Sep 21). *Business Communication Introduction*. Retrieved from: <https://www.youtube.com/watch?v=nFqFQrCUBNc>.
3. Young Entrepreneur Forum (2018). *Business Communication Skills*. Retrieved from youtube: https://www.youtube.com/watch?v=bc0Z_n37Q3U

4.

Corporate Finance - I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the techniques of financial planning.
2. To understand the financial Position of company cash flow and fund flow analysis.
3. To understand the concept of Investment decision through capital budgeting method.
4. To enable students to get a deep insight about the structure and functioning of capital and money market

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in taking at least one question from each unit.

Course Contents:

Unit I Nature and scope of financial management, Techniques of Financial Analysis – Statement of change in financial position (Cash flow – Fund flow), Ratio Analysis.

Unit II Investment Decision-Capital budgeting principles & techniques – Traditional & Discounted cash flow methods, Projects selection under capital rationing, Measurement of cost of capital – Dividend Approach and CAPM.

Unit III Financing Decision – Operation leverage, Financial Leverage, EBIT – EPS analysis, combined leverage, capital structure theories – NI, NOI, Traditional, M&M, Approach, Determinants of capital structure.

Unit IV Working capital Management – Nature of working capital, concepts of working capital, Determination of financing mix, Need & determinants of working capital, Computation of working capital.

Unit V Structure & Functioning of Capital & Money Market: Primary vs. Secondary Market, Capital Market instruments, Stock market in India – Origin, growth, functions & role, Money Market, OTCEI, DFHI.

Learning Outcomes:

Upon Completion of the course student will be able to :

- Understand the financial planning.
- Analyze the financial position of company.
- Advice and guide in investment decision of firms.

Suggested Readings:

1. Agarwal, M.R., (2010), *Financial Management* (9 ed.). Jaipur: Garima Publication House.
2. Rustagi, R. P. (2009). *Financial Management* (3 ed.). New Delhi: Galgotia Publication.
3. Maheshwari, S. N. (2006) *Financial Management* (14 ed.). New Delhi: Sultan Chand & sons.
4. Khan, M. Y. and Jain P.K. (2011), *Financial Management: Text, Problems and Cases* (6 ed.). New Delhi: Tata Mc Graw Hill publishing company.

Suggested E-Learning Materials:

1. Kassi et al. (2019) *Market Risk and Financial Performance of Non-Financial Companies Listed on the Moroccan Stock Exchange*. Retrieved from http://www.academia.edu/38415024/Market_Risk_and_Financial_Performance_of_Non-Financial_Companies_Listed_on_the_Moroccan_Stock_Exchange
2. Tachalam V. Venlat (2016) *A Study on Working Capital Management on Mahindra Private Limited* Retrieved from https://www.worldwidejournals.com/paripex/recent_issues_pdf/2016/June/June_2016_1467285715_117.pdf.
3. Ahmad ,I. &Muqaddas,M.F(2016) *determinants of dividend payout policy: an empirical study of banking sector of pakistan*. Retrieved from https://ageconsearch.umn.edu/record/257113/files/Apstract_2016_04-05_vol10_13_fejezet.pdf

Principles and Practices of Banking

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

5. To understand the basics of banking system of India.
6. To understand the functionalities associated with banking which affect the normal individuals' life.
7. To understand the banking operations and various norms related to banking instruments and negotiable instruments.
8. To provide the knowledge about credits, deposits and other important aspects related to retail banking.

Note: The paper will contain nine questions having a compulsory case study in any one unit. Candidates are required to attempt five questions taking at least one question from each unit. Case Study will be compulsory.

Course Contents:

- Unit I** Introduction to Indian Banking Structure, Legal Aspects of Banking: Definition, Licensing requirement of banks, Permitted and Prohibited Business, Capital requirement of Banks, Qualification of Board of Directors. RBI act 1934 and functions of RBI, Banking Regulation Act 1949.
- Unit II** Rates fixed by RBI: CRR, SLR, MSFR, MCLR, Repo and Reverse Repo rate, Call Rate. KYC & AML policy, Banking Ombudsman, Introduction to Basel Accord, Various Ratios of latest Basel Accord
- Unit III** Retail Banking: Types of Deposits, Customers and accounts. Account Opening in name of limited companies, clubs, associations, government departments, trust and co-operative societies, types of NRI accounts. FD Return to Depositors and Taxation issues (numerical Problems)
- Unit IV** Banker Customer Relationship: legal Implications, types of relationship, obligation of banks, precautions. Rights of banks: type of lien, right to set off, concept-mandates, power of attorney, garnishee order and attachment order
- Unit V** Negotiable Instruments: Key features, Cheque v/s bill exchange, crossing –concept, type, endorsement-concept, type, CTS system of clearing and its importance, holder and payer in due course. Banker's duties and responsibilities as paying banker and as a receiving banker, Electronic fund transfer: NEFT, RTGS, IMPS, ECS.

Learning Outcomes:

Upon completion of the course student will be able to :

- To understand the banking operations.
- To advice and guide in basic banking operation.

Suggested Readings:

7. Gomez, C. (2011). *Banking and Finance Theory, Law and Practice* (1 ed.). New Delhi: PHI Learning.
8. Gopinath, M. N. (2017). *Banking Principles and Operations* (7 ed.). Mumbai: Snow White Publications.
9. IIBF. (2017). *Legal and Regulatory Aspects of Banking* (3 ed.). Mumbai: Macmillan.
10. IIBF. (2017). *Principles & Practices of Banking* (3 ed.). Mumbai: Macmillan.
11. IIBF. (2017). *Retail Banking* (3 ed.). Mumbai: Macmillan.
12. Vinay Dutta, K. S. (2013). *Commercial Bank Management* (1 ed.). Mumbai: Tata McGraw Hill.

Suggested E Learning Materials:

1. Verma, N. (2018, September 27). *History of Banking in India in Brief*. Retrieved from Gradeup: <https://gradeup.co/history-of-banking-in-india-i-e02deb86-f4ac-11e5-b410-2f0cca4d3c07>.
2. MSG. (2014). *Case Study of the Indian Banking and Financial Services Industry using Strategic Tools*. Retrieved from Managment Study Guide: <https://www.managementstudyguide.com/case-study-of-indian-banking-and-financial-services-industry.htm>.
1. Nishtha Pareek, M. D. (2018, Decemeber 1). *Emerging Trends in Banking*. Retrieved from <https://www.youtube.com/watch?v=gCBs313D46g>:
2. [IIBM Institute of Business Management](#), (2017, Oct 8). *Principle and Practice of Banking*. Retrieved from Youtube: <https://www.youtube.com/watch?v=eBXsl4Wz3C0>.

Income Tax

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To acquaint the students with the various basics of income tax.
2. To introduce the students to various heads of income as per tax norms.
3. To introduce various tax slabs and norms of taxation to the students.
4. To acquaint the students with various tax filing procedure and tax planning methods.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in taking at least one question from each unit.

Course Contents:

Unit I Introduction to Income Tax: Meaning and Features. Important Definitions: Gross Total Income, Total Income, Previous year, Assessment year, Assesses, Person, Casual Income, Agricultural income, Tax rates of Individuals, Exempted Incomes. Residential Status & Tax Liability.

Unit II Income under the head Salaries: Computation of Taxable Income from Salary head only, Numerical Problems on Salary

Income under the head House Property: Computation of Taxable Income from house property head, Numerical Problems on House Property

Unit III Income from Business and Profession: Computation of taxable Income from business or profession head. Numerical Problems on Business & Profession only.

Income from Capital gains: Introduction, Short term and long term capital gains, Security Transaction Tax, Numerical problems on capital gains only.

Unit IV Income from other sources, Important provisions related to deemed incomes and deductions from gross total income with emphasis on deductions related to business. Theoretical concepts only

Carry forward & set off losses, Clubbing of Income, Deductions in respect of Total Income

Unit V Computation of Total income of Individual & Tax Liability, TDS & Advance payment of Tax, Types of assessment, Rationalization of Indian Tax Structure and moving towards Direct Tax Code.

Learning Outcomes:

Upon Completion of the course student will be able to :

- Understand various intricacies associated with income tax.
- Plan and file income tax in a proper and legitimate way.
- Acquire knowledge of various legal formalities associated with Income Tax.

Suggested Readings:

7. Singhania, V.K., &Singhania, M.(2018). *Students' Guide To Income Tax including GST*. (58 Ed.). New Delhi: Taxman Publication.
8. Mehrotra, H.C.(2018). *Income Tax Law*. (59 Ed.).Agra: SahityaBhawan
9. Singhania, V.K., &Singhania, K. (2018). *Direct taxes law and practice*. (59 Ed.). New Delhi: Taxman Publication.

Suggested E-Learning Materials:

1. Arora. M. & Gupta. H.P. (2017) *The Changing Face of Indian Income Taxpayers in E-Filing Era: An Evaluation*. Retrieved from <http://samvad.sibmpune.edu.in/index.php/samvad/article/viewFile/120811/82946> .

2. Stylianoudis,A.(2015) *Tax avoidance :A Necessary Evil*. Retrieved from https://www.youtube.com/watch?v=kWt0WjlGX_I
3. Patel,A. (2013). *Basic Principles of Income Tax*. Retrieved from <https://www.slideshare.net/patelameet/basic-principles-of-income-tax>
4. Li, S., Sato, H., &Sicular, T. (Eds.). (2013). *Rising Inequality in China: Challenges to a Harmonious Society*. Cambridge University Press.

Advanced Accountancy

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the basics and working of partnership firm focusing on various accounts, adjustments and goodwill treatment.
2. To have an understanding of the effects of admission, retirement and death of a partner, including dissolution of the firm.
3. To foster an understanding of shares with respect to issue, redemption, underwriting and forfeiture. Also to understand issue and redemption of debentures.
4. To develop an understanding of amalgamation of companies focusing on valuation of shares. Also learning about the liquidation of companies

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in taking at least one question from each unit.

Course Content:

Unit I Accounting for partnership firms: Features, partnership deed, provisions of Indian Partnership Act, 1932 in absence of partnership deed, Fixed vs. Fluctuating Capital accounts, P&L appropriation account, Past adjustments (calculation of interest on capital and interest on drawings, profit sharing ratio), introduction to the concept of goodwill, Valuation of goodwill- nature, factors effecting and methods of valuation (average profit, super profit, capitalization)

Unit II Effect of changes in profit sharing ratio of existing partners, Admission of a new partner, Retirement and death of a partner. (treatment in accounts in all the cases) and dissolution of partnership firms

Unit III Issue of shares (at par, premium, discount), forfeiture and reissue of shares (Advanced problems on pro-rata allotment only), issue of debentures, redemption of preference shares, redemption of debentures, Overview of underwriting of shares & debentures

Unit IV Amalgamation of companies as per Accounting Standard - 14.valuation of shares

Unit V Liquidation of Company Accounts: Liquidator's Statement of receipt and payment, Receiver's statement

Learning Outcomes:

Upon completion of the course student will be able to:

- Learn the functionalities of a partnership firm.
- Learn about the various treatments and adjustments with respect to shares and debentures.
- Learn the process and working in case of amalgamation and liquidation of companies.

Suggested Readings:

1. K. Goel, Rajesh Goel & Shally Goel. (2017) Accounting (16 ed). New Delhi: Arya Publications
2. T.S. Grewal. (2017) Introduction to Accountancy (18 ed). New Delhi: Sultan Chand
3. M.C. Shukla, T.S. Grewal, S.C. Gupta. (2016) Advanced Accounts (19 ed) . New Delhi: Sultan Chand
4. Mukherjee and Mukherjee. (2016) Accounting (10 ed). New Delhi: Sultan Chand

Suggested E-Learning Materials:

1. [Chaudhry. S \(2010\) Limited Liability Partnership in India](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1708215) Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1708215

2. 2. Lee. P. (2016) *Advance Accounting-Part 1 Introduction to Consolidations*. Retrieved from <https://www.youtube.com/watch?v=UnsV2blZmc8>
3. [Somani. G.\(2017\) Basic concepts of Amalgamation and Accounting Standard 14Retrieved fromhttps://www.youtube.com/watch?v=ouSL6sRa4vs](https://www.youtube.com/watch?v=ouSL6sRa4vs)

Company Law and Secretarial Practice

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To impart expert knowledge of the various provisions of the Companies Act.
2. To understand the procedural requirement for appointment of directors.
3. To study the role and responsibilities of chief managerial persons in company.
4. To understand the related party transactions, loans and investment by companies.
5. To study the framework of strategic decision of merger, amalgamation, demerger.
6. To understand the procedures of winding up of company.

Note: The paper will contain ten questions having two questions from each unit. Candidates will be required to attempt five questions taking one question from each unit.

Course Contents:

Unit I Companies act 2013: History of Company Law in India, Nature and characteristics of a company, lifting of corporate veil, Different type of companies and their formation.

Unit II Share Capital; Meaning and types of Capital, Issue of securities, Procedure for allotment of Shares and Debentures, Private placement, Share capital, Rights and Privileges of Shareholders.

Unit III Board of Directors & Managerial Personnel; DIN, Appointment, Reappointment, Resignation, Removal. Company secretary as a key managerial personal, Meeting of Board and committees, Frequency, Convening, Proceedings, Kinds of meetings, Resolution

Unit IV Law Relating to making investments in granting loans to other bodies corporate and giving guarantee and providing security, Acceptance of deposits, Renewal, Repayment, Default and remedies, Accounts and Audits- Auditors, Appointment, Resignation, and removal, Qualification and disqualification, Rights, Duties and liabilities.

Unit V Dividend- Declaration and payment of dividend, Treatment of unpaid and unclaimed dividend to investor Education and protection fund. Board's report and disclosure, Contents and annexure to Board's report Director's responsibility statement- preparation and disclosure, corporate governance report, Merger- Demerger, Amalgamation, compromises and arrangements- An overview: Winding up of companies- An overview, An introduction to E governance -MCA-21 and XBRL. Insolvency And Bankruptcy Code, 2016: introduction, Corporate Insolvency Resolution Process, Liquidation of a Corporate Person.

Learning Outcomes:

Upon completion of the course student will be able to:

1. The students will be able to understand the various provisions of Company Law.
2. The students will be able to understand how appointment of directors takes place and legal matters associated with directors.
3. The students will be able to understand the procedural aspects in the merger and acquisition.
4. The students will be able to understand the procedures of winding up of company.
5. The students will be able to advice and guide the company law matters and will be job ready for legal department of any company.

Suggested Readings:

1. Kapoor, G.K. and Dhamija, (2018), Company Law and Practice (23 ed.), New Delhi: Taxman Publication
2. Kapoor N. D. (2015). Elements of company Law (30 ed.). New Delhi: Sultan Chand & Sons.

3. Module of ICSI: Company Law
4. Module of ICWAI: Corporate Law

Suggested E Learning Materials:

1. Philip, T. (2017, April). *Directors: Duties & Liabilities*. Retrieved from: <https://www.youtube.com/watch?v=b8y2vluTrP4>
2. Sachdeva, S. (2018 May 25). Retrieved from YouTube: <https://www.youtube.com/watch?v=f0aWlcl0EHU>
- Badlani, D. (2017, Jun 1,). Retrieved from YouTube: <https://www.youtube.com/watch?v=c9gWVP6w2bk>

Emerging Banking Services

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the global banking system and the emerging Indian scenario in banking industry.
2. To understand changing service dynamics of banks in India, alternative banking channels, smart apps, payment banks.
3. To study the concepts of banking, third party products, credit & Investment services etc.
4. To study Asset Reconstruction Companies (ARC's), its model and benefits to the parties involved, NPA Management, SARFESI Act and MSME.

Note: The paper will contain nine questions having a compulsory case study in any one unit. Candidates are required to attempt five questions in taking at least one question from each unit. Case Study will be compulsory.

Course Contents:

Unit I Overview of global banking system, Changing scenario of Indian banking, Direct banking channels, Smart apps. Changing service dynamics of banks in India CRM, Introduction to Payment banks, Small Finance Banks. case studies –growth of SBI, ICICI bank and other emerging banks

Unit II Fixed and Floating interest Rate, Principles of lending, Credit Scoring Models: Hybrid & Behavioral, Retail loan organization structure. Retail Loan products: Home loans, Home Equity Loans, Vehicle loans- Car and Two Wheelers, Consumer Loans, Education Loans, Personal Loans, LAS & LAP

Unit III Corporate Banking: Difference between Retail and Corporate Banking, RBI Guidelines for Regulation of lending, Features of credit, Term loan and its appraisal, Working Capital assessment & various Methods,

Unit IV Management of NPA's: Asset classification, Norms for NPA, Impact of NPA's on Banks, Credit rating & Pricing of Loans, Modes of creating charge in credit, Letter of Credit, pre shipment and post shipment financing. Travelers Cheque, prepaid Currency cards.

Unit V Introduction to third party products i.e. types of Life insurance, types of mutual funds, Types of General Insurance etc. Bancassurance: Principles and types, CAMELS rating.

Learning Outcomes:

Upon completion of the course student will be able to:

- Know about banking scenario in India as well as globally.
- Know about various banking products including third party products.
- Know about the recent financial reforms for NPA management.

Suggested Readings:

1. Gomez, C. (2011). *Banking and Finance Theory, Law and Practice* (1 ed.). New Delhi: PHI Learning.
2. Gopinath, M. N. (2017). *Banking Principles and Operations* (7 ed.). Mumbai: Snow White Publications.
3. IIBF. (2017). *Legal and Regulatory Aspects of Banking* (3 ed.). Mumbai: Macmillan.
4. IIBF. (2017). *Principles & Practices of Banking* (3 ed.). Mumbai: Macmillan.
5. IIBF. (2017). *Retail Banking* (3 ed.). Mumbai: Macmillan.
6. Vinay Dutta, K. S. (2013). *Commercial Bank Management* (1 ed.). Mumbai: Tata McGraw Hill.

Suggested E Learning Materials

1. Omarini, A. (2015) *Introduction: From Banking to Retail Banking* Introduction. Retrieved from https://link.springer.com/chapter/10.1057/9781137392558_1

2. Dedu.V, Duna, A.F, (2011). *The Importance of Banks in Foreign Exchange and the Implications of the Currency Risk Over the Bank Management*. Retrieved from: <https://ideas.repec.org/a/rom/rmcimn/v12y2011i6p291-295.html>.
3. [NCUAchannel](#) (2016, Jul 28). What is a CAMEL Rating? Retrieved from Youtube: https://www.youtube.com/watch?v=RWwsNG_9_uc
4. Bansal, A. (2017, Mar, 7). *SARFAESI*, Retrieved from Youtube: <https://www.youtube.com/watch?v=Wg1nRsXWcxg>

Application Software for Business

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

7. The main objective of this course is to provide students with the background to design, implement, and use database management systems
8. Provide an introduction of DBMS and their use;
9. Describe the main features and function of the DBMS;
10. Describe & Design of relational database and E-R diagrams;
11. To enable students to learn the concept of application software for business.
12. To work with basic application software tools like MS Excel, MS Access, Tally, Photoshop and its relevance in organizational functioning.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in taking at least one question from each unit.

Course Contents:

- Unit I** Organization of data in files, Introduction to Database and DBMS, Advantages and Disadvantages of Databases, Cases in Marketing, HR, Finance, Production etc.
- Unit II** Understanding Databases and its Environment, Understanding concept of Relational Model, Logical View of Data, Keys, Integrity Rules, Relationships, ER Model, Database Design, Normalization, SQL – DML & DDL.
- Unit III** Querying with QBE Grid, Creating and Customizing forms, Viewing data using forms, Exploring form Design Tools, Building forms, using Macros, Macro Window, Building Macros, Building Reports, Saving form as a report, Importing and Exporting Data.
- Unit IV** Features of Computerized Accounting, Company Creation, Alteration and Deletion of Company, Accounts Configuration: General Configuration, Accounts/Inventory Information Configuration, Classification of Accounts: Accounts group, Ledger Accounts, Hierarchy of Accounts, Reserved Accounts group, Contents of Reserved group, Account groups of balance sheet.
- Unit V** Graphics Environment : IDE, Creation of Files, Understanding Interface, Toolbox, Floating Palettes, Storing and Retrieving Files, Type Basics : Raster versus Vector Programs, Working with Types, Creating and Understanding Selection, Moving and Floating Selection, Flag Collage, Filling and Stroking Working in Layers, Clock Collage, Truck Collage.

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand the use and basic designing of a database system
- Understand the concept of relational databases and normalization
- Design a database and run queries using MS Access
- Create ledger accounts and balance sheets using Tally
- Use Photoshop for simple image editing and creating collages.

Suggested Readings :

4. Greenberg, A. D. (2000). *Fundamental Photoshop 5.5* (1 ed.). New Delhi: Mc Graw Hill.
5. Nadhani, A. N. (2007). *Implementing Tally ERP 9* (1 ed.). New Delhi: BPB Publications.
6. Saxena, S. (2000). *MS Office 2000 for Everyone* (1 ed.). New Delhi: Vikas Publication.

Suggested E-Learning Materials:

3. Studios, S. (2018, March 24). *Adobe Photoshop For Absolute Beginners*. Retrieved March 2019, from Youtube: <https://www.youtube.com/watch?v=KfXSt4XLedc>
4. World, G. L. (2017, December 30). *Tally ERP 9 Basic Course for Beginners - Free Tally*. Retrieved March 2019, from Youtube: <https://www.youtube.com/watch?v=1d2y7J0gESM>

Investment Management

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives

1. This course seeks to introduce the students to the field of inquiry that focuses on the security markets and its development globally.
2. To highlight the functioning of the financial markets and its role in resource allocation.
3. To introduce the students to the various asset classes traded in financial markets and its importance.
4. Introducing and acquainting students with different theories, valuation and pricing models.

Note: The paper will contain ten questions having two questions from each unit. Candidates will be required to attempt five questions taking one question from each unit.

Course Content:

Unit I Financial Markets, other form of Markets in Economy, and the role of Security markets in Economy. The Organization Pattern and Mechanics of Security Market in the Indian Security Markets, Types of Various Securities and their Characteristics and the role of market regulator SEBI and Market Intermediaries in smooth Functioning of Financial Markets.

Unit II Time value of money concepts and valuation of debt and equity instruments and introduction of the concepts of risk and return, and diversification

Unit III Portfolio theory, efficient frontier, discussion on Capital Asset Pricing Model (CAPM) and an Overview of Arbitrage Pricing theory (APT)

Unit IV Fundamental analysis: concept relevance, financial statements, Ratios and a brief overview on Valuation of Firm (Internal and External Valuation). Basics of technical analysis, Efficient Market theory and Behavioral Finance.

Unit V Introduction to Portfolio Management steps involved, significance and Strategies on Portfolio Management and overview of Futures and Options.

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand the dynamics of the markets and the role of the market participants bringing efficiency to the markets.
- Understand the concepts of valuation of financial securities.
- Understand portfolio allocation and how assets are priced in financial markets.

Suggested Readings:

1. Chandra, P. (2017). *Investment Analysis and Portfolio Management* (5 ed.). New Delhi: McGraw Hill.
2. Donald E Fischer, R. J. (2007). *Security Analysis and Portfolio Management* (6 ed.). Noida: Prentice Hall
3. William Sharpe, A. G. (2017). *Investments* (11 ed.). Noida: Prentice Hall.

Suggested E-Learning Materials:

1. Nickolas Steven (2019. March). *CAPM Vs. Arbitrage Pricing Theory: What's the Difference*. Retrieved from investopedia: <https://www.investopedia.com/articles/markets/080916/capm-vs-arbitrage-pricing-theory-how-they-differ.asp>
2. Karmele CA Pavan (2018, November). *Portfolio Management Class-1*. Retrieved from Youtube: <https://youtu.be/QRjy9e5xuuQ>
3. Walsh James (2018, April). *Present and Future Value: Calculating the Time Value of Money*. Retrieved from Study.com: <https://study.com/academy/lesson/present-and-future-value-calculating-the-time-value-of-money.html>

Corporate Finance - II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the concept of investment decisions.
2. To understand the concept of dividend for the market valuation.
3. To understand the concept of International Financial management.
4. To enable students to get a deep insight into emerging trends in mergers and takeovers

Note: The paper will contain 10 questions having 2 questions from each unit. Candidates will be required to attempt 5 questions taking 1 question from each unit.

Course Content:

Unit I Investment Decisions: Decision Making Techniques: Replacement Decisions, Capital Rationing, Decision Tree Analysis; Project Appraisal and Financing- Concept, Overview of Process, Financial Appraisal by Banks

Unit II Bonus Shares, Share Split, Share Buy Back; Dividend Decisions: Concepts, Dividend Theories - Water, Gordon, Modigliani & Miller, And Dividend Policies

Unit III Mergers and Takeovers: Regulatory Framework, Various Types, Computation of Costs and Benefits, Valuation Framework, Spin Off's and Divestitures

Unit IV International Financial Management: Concept, Forex Market Functioning, Factor Affecting Exchange Rate, Forex Exposure, ECB policy of government of India and various instruments of Long & short term financing

Unit V Financial Derivatives: Concept, Need, Types & salient features, Valuation of Forward and Future Contract, Derivatives in Indian Stock Market, Derivatives as double edged sword, Option Strategies- Straddle & Strangle'

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand the how to manage the capital with different investment opportunities.
- Understand the functioning of the Forex Market
- Advice and guide in valuation of stock/Shares listed in stock market
- Job ready as fundamental analysts.

Suggested Readings:

1. Rustagi, R. P. (2009). *Financial Management* (3 ed.). New Delhi: Galgotia Publication.
2. Hull, J. (2009). *Options, Futures, and Other Derivatives*, (7 ed). Dorling Kindersley India Pvt. Ltd.: Pearson Prentice Hall, 2009.
3. Chandra, P. (2006). *Projects* (6 ed.). New Delhi: Tata McGraw Hill publishing company.
4. Khan, M. Y. and Jain P.K. (2011), *Financial Management: Text, Problems and Cases* (6 ed.). New Delhi: Tata McGraw Hill publishing company.
5. Jeevnandanam, C. (2014). *Foreign Exchange & Risk Management* (15 ed.), New Delhi: Sultan Chand Publication.

Suggested E-Learning Material:

1. Edupristine (2015, June). *Mergers and Acquisitions*. Retrieved from EduPristine: <https://www.edupristine.com/blog/mergers-acquisitions>

2. Takota Asset Management (2015, September). *Financial Derivatives*. Retrieved from Youtube:
<https://youtu.be/nf9ByTdX0aY>
3. Aggarwal CA Naresh (2017, December). *Capital Budgeting Techniques*. Retrieved from Youtube:
https://youtu.be/QXoFB4-MV_I

Risk Management and Insurance

L T P C

4 0 0 4

Max. Marks : 60

(CA: 20 + ESA: 40)

Objective: The course seeks to provide a conceptual foundation for understanding the process of risk management using the insurance and relevance and the features of common forms of general insurance and life insurance.

Unit I: Risk management - introduction to risk in the society, relevance of managing risk, insurance as a tool of risk management, evolution of insurance in India and concepts from ancient literature, liberalization in Insurance, career in insurance and building entry level competencies.

Unit II: Introduction to prominent insurance players in India and the world, various types of insurance, introduction to working of life insurance and general insurance companies, legal aspects in insurance- principles, insurance contract- general concept, identification of risk exposures

Unit III: Life insurance- need, analysis, selection of life insurance policy, concept of annuities, types, taxation aspects related to life insurance and annuities. General insurance- types, motor insurance- types, nature, legal issues and selection.

Unit IV: Health insurance- types, nature, legal issues and selection. Types of fire insurance and marine insurance. Introduction to government regulations for insurance.

Unit V: Convincing the client about suitable insurance policy, ethical aspects, and comprehensive assessment of the insurance needs of the client, implementing and reviewing, introduction to pricing of insurance.

Suggested Readings:

- 1) Principles of Risk Management and Insurance, Rejda, Pearson Education
- 2) Risk Management and Insurance, IMS Proschool Book, Tata McGraw
- 3) Principles of Insurance Management, Gulati, Excel Books
- 4) Insurance Principles and Practices, Mishra, S.Chand
- 5) Life Insurance in India: Opportunities, Challenges And Strategic Perspective, Sadhak, Sage Publications
- 6) Principles and Practices Of Life Insurance In India, Imam, Anmol Publications
- 7) General Principles of Insurance Law, Chaudhary, Central Law Publications

Indirect Taxes

Duration: 3 Hrs

Max Marks: 40

Course Objective: The Course aims at introducing the Students to Concepts Goods and Sales Tax that form an Integral Part of the Taxation System of India.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction : Introduction to GST : Basics of Model, IGST, CGST, SGST, UGST Laws, Reverse Charge Mechanism GST : Definition of Supply, 8 Forms of Supply, Different Rates Under GST, Intra State Supply and Specific Exclusions like SEZ, and in bound Sales, Inter State Supply and Specific Exclusions, Export of Goods and Services.

Unit II GST Laws : Levy of CGST, SGST, IGST, UGST, Valuation of Imported and Exported goods, Provision of Places and times of supply of Goods and Services.

Unit III GST Registration : Single or Composition, Multi State Registration or Single State Registration, Input Tax Credit under SGST, CGST and UGST, Valuation of Goods & Services, Deemed Sales under GST, Transition Provision for Transfer of Existing Credit.

Unit IV Maintenance of Records & Books, Returns to files under GST, Payments Under GST, Refunds under GST, Inspection, Search Power and Penalties under GST.

Unit V Customs Laws : Levy of Customs Duties, Types of Customs Duty Levied, Tariff Classification & Exemptions, Valuation of Imported and Exported Goods Provision of Assessment, Payment of Duties, Recovery and Refund of Customs Duties, Procedure for Clearance of Imported and Exported Goods, Imposition of Penalties; Offences and Prosecution Provisions.

Suggested Readings:

1. Viswanathan B., Goods and Services Tax (GST) in India B. .
2. V S Datey, All about GST - A Complete Guide to Model GST Law
3. Jayaram Hiregange, India GST for Beginners
4. Jain Bimal and Bansal Isha GST Law & Analysis with Conceptual Procedures

Websites :

www.icmai.in/icmai/Taxation/upload/GST

www.finmin.nic.in/reports/ModelGSTLaw

E-Business

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the various concepts involved in e-Business & e-Commerce
2. To develop an understanding about the aspects like business models, advantages, payment system, legal issues of e-business
3. To gain insight into the concepts of e-CRM, e- SCM, ERP, e-Procurement in e- business.
4. To understand the meaning of concepts like online promotion-banking and crowd-sourcing.

Note: The paper will contain nine questions having a compulsory case study in any one unit. Candidates are required to attempt five questions in taking at least one question from each unit. Case Study will be compulsory.

Course Contents:

Unit I Advantage of Internet for various users, Concept of E-Commerce & E- Business, its advantages & history, forces fueling, Case study of ITC eChoupal, Channel Conflict-Evaluate if and how both offline and on-line Business Models can be Pursued Simultaneously. Effects of Internet & web on Business-Strategy, Structure & Process.

Unit II Business Models: advertising, brokerage, utility, mixed etc. Concept of Disintermediation, Horizontal & Vertical Market Places in E-Commerce, Impact of E-Business & Social Media on a single functional area Viz., Marketing - case study Branding in the Digital Age, website creation & Digital Marketing-Session Cum Workshop by industry Expert.

Unit III Concept & advantages: e-CRM, e-SCM, ERP, e-Procurement, direct marketing & customer service, introduction to online auction mechanism.

Unit IV Internet & Promotion: types of online promotions- banners, splash screens etc. strategies- push / pull, online catalogues, advantage & Challenges, Introduction to e-banking & advantages Crowd Sourcing- Concept & benefits.

Unit V Electronics Payment System: concept, advantages, security systems, cybercrimes, ethical issues in e-commerce, I.T. Act & implications, future of e-commerce

Learning Outcomes:

Upon completion of the course student will be able to:

- Comparatively evaluate both offline and on-line modes of shopping which they encounter on daily basis.
- Get the knowledge of Marketing & Branding in digital age, e-banking, e-CRM, e- SCM and ERP.

Suggested Readings:

4. Kalakota, R.,Whinston,A. (2013). *Frontiers of Electronic Commerce* (13 ed.). New Delhi: Pearson.
5. Turban, E.,Lee, J,King,D & Chung ,Michael H. (2003). *Electronic Commerce:A Managerial Perspective* (4 ed.). New Delhi: Pearson.
6. Mohammad, Rafi A (2003). *Internet marketing* (2 ed.). Mumbai: Tata McGraw Hill.
7. P.T.Joseph, S.J (2015). *E-Commerce - An Indian Perspective* (5 ed.) Delhi: PHI.

Suggested E-Learning Materials:

1. Brooke, J. (n.d.). *7 Types of Online Advertising*. Retrieved Jan 20, 2019, from [www.adskills.com: https://www.adskills.com/7-types-of-online-advertising/](https://www.adskills.com/7-types-of-online-advertising/)
2. Diaz, C. (n.d.). *What is E-Commerce? Definition, Differences with Other Terms and First Steps to Follow if You Want to Launch Your E-Commerce*. Retrieved Feb 23, 2019, from [www.doofinder.com: https://www.doofinder.com/en/blog/what-is-e-commerce](https://www.doofinder.com/en/blog/what-is-e-commerce)

3. Stevenson, M. (2015, Feb 15). *Electronic Payment Systems*. Retrieved March 1, 2019, from
www.youtube.com: <https://www.youtube.com/watch?v=I3RWfRmxDw>
- Study.com. (n.d.). *Enterprise Resource Planning: Using ERP to Integrate Business Processes*. Retrieved Feb 22,
2019, from study.com: <https://study.com/academy/lesson/enterprise-resource-planning-using-erp-to-integrate-business-processes.html>

Creativity and Soft Skills

L T P C

4 0 0 4

Max. Marks : 60

(CA: 20 + ESA: 40)

Course Objective: The objective of the paper is to generate creative thinking skills; to make students effective by honing their attitude and developing in them self management & inter-personal skills.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Course Contents:

Unit I Creativity: Definition, Objectives, importance. Creative Abilities, Study of Creative Individuals.

Unit II Creative Process, Techniques to enhance creativity, The 'Killing of Creativity', study of creative organizations.

Unit III Personal effectiveness, Johari Window as a tool for self analysis, efficiency & effectiveness. Attitude & its importance, Assertiveness - definition, importance, how to be assertive, difference from aggressiveness.

Unit IV Proxemics, Kinesics, Time as capital, attitude towards time, managing time effectively, Introduction to IQ, SQ, EQ. Dimensions of EQ. Importance of EQ for personal effectiveness.

Unit V Negotiation: Process, preparation for negotiation, bargaining. Dynamics of interpersonal skills: how to deal with people, giving & receiving feedback.

Suggested Readings:

1. Khadwala Pradeep : Fourth Eye. Wheeler Publication
2. Pareek Udai : Organizational Behaviour Process. Rawat Publication. Jaipur
3. Chandan Jit S.: Organization Behaviour. Vikas Publishing House
4. Rao Nageshwar, R.P. Das: Communication Skills
5. Varma Madhurendra K. : Managing More Effectively. Response Books.

Advanced Corporate Accounting

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the concepts of corporate accounting.
2. To understand the maintaining of accounts in holding, subsidiaries and internal reconstruction.
3. To understand the effect of inflation on accounts of business.
4. To understand the recent developments in accounting.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

The nature of holding companies - Legal requirements for a holding company -Accounts of holding companies - the consolidated balance sheet. Schedule VI of the Companies Act and subsidiary companies. Form of consolidated balance sheet. Cost of acquiring control or goodwill .preference share capital in subsidiary companies. Debentures in subsidiary companies. pre-acquisition profits/ reserves. Pre-acquisition losses. Inter-company transactions.

Internal Reconstruction: Meaning - Objective - Procedure - Form of Reduction -Passing of Journal Entries. Meaning of Amalgamation and Acquisition - Types of Amalgamation - Amalgamation in the nature of Merger - Amalgamation in the nature of Purchase - Methods of Purchase Consideration - Calculation of Purchase Consideration (Ind AS 103) (Old AS14), Net asset Method - Net Payment Method, Accounting for Amalgamation (Problems on both the methods) - Entries and Ledger Accounts in the Books of Transferor Company and Transferee Company - Preparation of new Balance sheet. (Vertical Format) (Excluding External Reconstruction)

Section B

Accounting for price level changes (Inflation Accounting): Introduction, history, limitations, profit measurement under different systems of accounting, methods of accounting for price level changes, current cost accounting (CCA) methods, different approaches, measurement of profits, merits and demerits, preparation of income statement, cost of sale of adjustment, depreciation procedure under CCA. Preparation of current cost balance sheet (CCB)

Liquidation of Companies-Scope, contributory preferential payments, preference dividend. Statement of affairs and deficiency surplus account. Liquidators final statement of account, liquidators remuneration, receiver for debenture holders.

Section C

Recent developments in Accounting: Human Resource Accounting: Definition, objectives, approaches, assumptions, advantages, objections of HRA. HRA in India. Human resource cost accounting, Human resource accounting (Theory Only). Social Responsibility Accounting: Meaning, Nature of social responsibility, need, objectives, accounting concept and objectives of social responsibility, indicators of social performance. Value added statement-Economic value added-Environmental Accounting-Brand Accounting (Theory only)

Learning Outcomes:

Upon completion of the course the students will be able to :

- Understand accounts of corporate with latest amendments.
- Price level changes and its maintenance
- Procure job in accounting field.

Suggested Reading:

1. Gupta, R.L. and Radhaswamy, M, (2003), *Advanced Accountancy* (14ed.). VolumeII, New Delhi: Sultan Chand & Sons.
2. Hanif. M and Mukherjee. A (2015), *Corporate Accounting* (2 ed.). New Delhi: McGraw Hill.
3. Mukherjee, A. and Hanif, M, (2015), *Corporate Accounting* (11 ed.). New Delhi: McGraw Hill.
4. Maheshwari, S N & Maheshwari, SK. (2014), *Corporate Accounting* (5 ed.). Vikas Publication.

Suggested E Learning Materials

1. Palkar A.,(2015) *Analyzing Contentious Issues in Holding-Subsidiary relationship*. Retrieved from <http://lawstreetindia.com/experts/column?sid=118>.
2. Welkins S.,(2017)*Liquidation of Companies Part-1*. Retrieved from Youtube <https://www.youtube.com/watch?v=-kyDI0TEr-0> .]
3. Ramana D.V.,(2016) *Human Resource Accounting*Retrieved from Youtube <https://www.youtube.com/watch?v=nL7yXTqhgWc>

Advanced Financial Management

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the methods and source of raising finance.
2. To understand the concept of project planning, financing and appraisal.
3. To understand the concept of valuation of share and evaluation of portfolio.
4. To enable students to get a deep insight into emerging trends of derivatives and option strategy formation.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there would be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content

Section A

Overview of Financial Management; Functions of finance manager-challenges in globalization era; Methods and sources of raising finance - Sources of short-term and long-Term finance- domestic - Critical appraisal of different securities as sources of finance. Objectives of finance function - financing decision - Investment decision - Management of surplus or dividend decisions; Financial Forecasting and Planning - Meaning, estimation of Capital requirements, fixed Capital, working Capital, importance of financial planning - Problems in financial forecasting.

Section B

Project Financing: Meaning - Definition - Features - Classification of projects - Stages in project cycle - Identification, Formulation and implementation. Appraisal of Projects - Market feasibility, technical feasibility, financial feasibility, Financial Appraisal of a Project - Evaluation Techniques - traditional and modern (theoretical aspects only) Risk analysis - meaning - importance and techniques - Sensitivity, Break Even, Decision Tree, simulation analysis.

Overview- IDBI, SIDBI, GIC, LIC, UTI, SFC, IFC - functions and schemes.

Section C

Valuation of Securities: Bond Valuation, Shares Valuation, Risk - Return Dimensions, Portfolio Management, Markowitz Model, Portfolio evaluation; Lease Financing: Meaning- Types- Accounting treatment- Tax treatment- Critical evaluation, Lease vs Hire purchase

Financial derivatives - Forwards and Futures, Options, Swaps; Pricing of futures, options strategies - Derivatives for financial risk management, Credit Derivatives. Mergers and Takeovers: Regulatory framework, Various types including spin off's and divestitures, Indian Scenario

Learning Outcomes:

Upon completion of the course student will be able to:

- Understand implementation of project evaluation techniques.
- Advice and guide in valuation of stock/Shares.
- Will be job ready as fundamental and technical analyst.

Suggested Readings:

7. Brigham, E. F. (1979). *Financial management: theory & practice*. (1 ed.). New York. Dryden Press.
8. Van Horne James, C. (2002). *Financial Management & Policy*. (12 ed.). New Delhi. Pearson Education India.
9. Pandey, I. M. (1995). *Essentials of Financial Management*, (4 ed.). New Delhi. Vikas Publishing House.
10. Jain, P. K., & Khan, M. Y. (2005). *Basic financial management*. (4 ed.). New Delhi. Tata McGraw-Hill.
11. Chandra, P. (2011). *Financial management*. (8 ed.) New Delhi. Tata McGraw-Hill Education.

12. Srivastava, R., & Misra, A. (2012). *Financial Management*. (1 ed.) New Delhi. Oxford University Press.

Suggested E Learning Material

1. Chou C.S. (2016) Financial Management (Overview of Finance) Retrieved from Youtube
<https://www.youtube.com/watch?v=yVaj2raL744>
2. Rajan,A.T.(2014) Overview and introduction to project finance Retrieved from Youtube
<https://www.youtube.com/watch?v=KCoytFTpHdk>
3. Petrov K.,(2014)*Financial Derivatives*Retrieved from Youtube
<https://www.youtube.com/watch?v=CQJVsfdCib4>

Entrepreneurship

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To contribute towards developing an entrepreneurial attitude amongst students.
2. To develop the ability of analyzing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities
3. To understand the basic concepts of venture creation.

Note: The paper will contain 3 questions from every section aggregating nine questions. In any one of the sections, there would be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content :

Section A

What is Innovation? What is Entrepreneurship? The Power of Entrepreneurship, Entrepreneurial traits and competencies, Entrepreneur vs intrapreneur, Social intelligence for entrepreneurs, Classification and types of entrepreneurship, Factors affecting entrepreneurial growth.

Motivation, Entrepreneurial Motivational training, Different Motivational theories, Grass-root ideas in entrepreneurship, Meaning of rural entrepreneurship and problems of rural entrepreneurship

Entrepreneurial support systems- Current government policies and measures towards promotion of entrepreneurship; Incubation cell

Section B

Social Entrepreneurship: Concept, Models of social entrepreneurship (Elkington & Hartigan 2008) and relevant case studies, Triple bottom line and role of social entrepreneurs

Women Entrepreneurs: Reasons for low women entrepreneurs in India, role, problems and prospects, stories of women entrepreneurs.

Why entrepreneurs fail, how they succeed? Case studies of start ups

Section C

MSME: Definition, role in India's economic development, Sources of information for entrepreneurs in India, Incentives and benefits available to MSME entrepreneurs. Creating Entrepreneurial Venture: Ideation - Sources of new ideas, Methods of generating ideas; Creative problem solving; opportunity recognition; Environmental scanning: SWOT, PESTLE; competitor and industry analysis

Feasibility study: Technical, Financial, Marketing, Personnel and Management, preparing business plan. Sources of capital: Debt or equity financing, Commercial banks, Venture capital; Financial institutions supporting entrepreneurs Legal issues: Brief overview of- Intellectual property rights, Patents, Trademarks, Copy rights, Trade secrets, Licensing. Business Crises

Learning Outcomes:

Upon completion of the course student will be able to :

- Familiarize with the basics of entrepreneurship.
- Learn about systematic process to select and screen a business idea.
- Developing a business plan using financial, operational, organizational, market, and sales knowledge.

Suggested Readings:

1. Desai, V. (2012). The Dynamics of Entrepreneurial Development & Management (5ed.). Mumbai: Himalaya Publishing House.

2. Drucker, P. F. (1985). *Innovation and Entrepreneurship* (1 ed.). Uttar Pradesh: Harper Collins.
3. Gupta, A. K. (2016). *Grassroots Innovations (Minds On the Margin Are Not Marginal Minds)* (1 ed.). New Delhi: Random House India.
4. Hisrich, R. D., Manimala, M. J., Peters, M. P. & Shepherd, D. A. (2014). *Entrepreneurship* (9 ed.). New Delhi: McGraw Hill.
5. Jain, P. C. (1999). *Hand Book for New Entrepreneurs* (1 ed.). New Delhi: Oxford University Press.
6. Roy, R. (2011). *Entrepreneurship* (2 ed.). New Delhi: Oxford University Press.

Suggested E-Learning Materials:

1. Barringer, B. R. (2009). *Preparing Effective Business Plans: An Entrepreneurial Approach*. Retrieved March 1, 2019, from [www.pearson.com: https://www.pearson.com/us/higher-education/product/Barringer-Preparing-Effective-Business-Plans-An-Entrepreneurial-Approach/9780132318327.html?tab=contents](https://www.pearson.com/us/higher-education/product/Barringer-Preparing-Effective-Business-Plans-An-Entrepreneurial-Approach/9780132318327.html?tab=contents)
2. Jose, T. (2019, Jan). *Micro, Small and Medium Enterprises (MSME): The Importance in Indian Economy*. Retrieved Feb 20, 2019, from www.clearias.com:
<https://www.clearias.com/micro-small-and-medium-enterprises-msme/>
3. Toppr. (n.d.). *Meaning and Concept of Social Entrepreneurship*. Retrieved Feb 23, 2019, from [www.toppr.com: https://www.toppr.com/guides/business-management-and-entrepreneurship/social-entrepreneurship/meaning-and-concept-social-entrepreneurship/](https://www.toppr.com/guides/business-management-and-entrepreneurship/social-entrepreneurship/meaning-and-concept-social-entrepreneurship/)
4. Women Entrepreneurs India. (n.d.). *Success Stories*. Retrieved Feb 22, 2019, from www.womenentrepreneursindia.com:
<https://www.womenentrepreneursindia.com/success-stories.php>

Organizational Communication

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To acquaint students with the importance of efficient and effective communication.
2. To make students understand the flow of communication and the various channels adopted herewith.
3. To familiarize the students with various forms of verbal and non-verbal communication.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction: Meaning, Importance of Communication, Purpose of Communication, Process of Communication, Communication Structure in Organizations, Barriers in Communication, Pre-requisites for Effective Communication, and Communication Network.

Verbal and Non-Verbal Communication: Meaning, Principles of successful Oral Communication, Barriers in Oral Communication, Conversation Control - Reflection and Empathy, Effective Principles of Oral Communication; Nonverbal Communication - Meaning, Characteristics, Classification, and Guidelines for developing Non-verbal Communication.

Section B

Written Communication: Meaning, Importance of skills in Written Communication, Purpose of Writing, Elements of Writing, and Principles of Effective Writing; Business Letters and Reports - Introduction, Meaning, Importance, Types of Business Letters and Report Writing, Writing of Business Letters and Reports, and Writing of Memos; Reading Comprehension - Discussion of Passages with questions to be answered.

Section C

Listening: Meaning, Significance, Types, Myths about Listening, Barriers and Overcoming Measures, Stages of Listening, and Body Language of an Active Listener. Presentation Skills: Meaning, Elements of Presentation, Designing a Presentation, Six great Helpers in Presentation, and Steps to a Successful Presentation; Group Communication - Meetings, Seminars, Conferences, Workshops and Business Etiquettes.

Employment Communication: Introduction, Writing CVs, Group Discussion, Interview Skills and Impact of Technological Advancement on Business Communication. Ethics in Group Discussion

Learning Outcomes:

Upon completion of the course student will be able to :

- Understand the specifications of formal communication process.
- Draft different forms of written communication.
- Learn to prepare and deliver presentations.
- Understand assimilation of verbal and non-verbal communication.

Suggested Readings:

5. Lesikar, R. V., Pettit, J. D., & Flatley, M. E. (2013). Basic Business Communication (4 ed) . Irwin, New Delhi
6. Bovee, & Courtland. (2012). Business Communication Today, (10 ed) Pearson Education, New Delhi India.

7. Gimenez, J. C. (2000). Business E-mail Communication: some emerging tendencies in register. *English for Specific Purposes*, (19 ed), 237-251.
8. Bovée, C. L., Thill, J. V., & Schatzman, B. E. (2010). *Business Communication Essentials*, (7 ed). Pearson Prentice Hall New Delhi.

Suggested E-Learning Materials:

1. Rout, N. R. (2018). Business Communication. Retrieved from Youtube:
<https://lecturenotes.in/notes/8051-notes-for-business-communication-bc-by-nihar-ranjan-rout>
2. Mulchandani, D. (2016, Sep 21). Business Communication Introduction.
Retrieved from: <https://www.youtube.com/watch?v=nFqFQtCUbNc>.
3. Young Entrepreneur Forum (2018). Business Communication Skills. Retrieved from Youtube:
https://www.youtube.com/watch?v=bc0Z_n37Q3U.

Application Software for Accounting

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the application of computers in the field of accounting.
2. To understand the application of Tally ERP 9 as accounting software package
3. To understand the preparation of books of accounts in MS Excel.
4. To understand calculation of TDS and file e-TDS return.

Note: The paper will contain three questions from every section aggregating nine questions. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content

Section A

Definition, Characteristics and limitations of computers - Elements of Computers - IT enabled services - BPO, KPO, Call centers. Computerized Accounting: Meaning and Features; An overview of Accounting Information System - AIS and Business organization, Production of Accounting Information - Accounting and System work, Information Concepts & Processing; Accounting procedures and controls in computer environment, Application of Information Technology, Business Applications, Security Measures. Company creation and set-up of accounts in Tally (8.1 or higher version) Startup Tally, Quitting Tally, Creation of a Company, Alteration, deleting, and shut a company - Concepts of Grouping of Accounts - Predefined account groups, display or alter groups.

Section B

Creating Ledger Accounts - Predefined ledger accounts, creation, display, alter and deleting ledger accounts - Inventory - Items, Groups, Units, Creating a single stock group, Creating a multiple stock groups. Preparation of Accounting vouchers and its advanced usages, Types of Vouchers used in Tally, Creation of Voucher type, Types of accounting Vouchers, Accounting Features, Maintaining Bill-wise Details, Cost centre and cost category, interest calculation, Reversing journals and optional voucher, Memorandum Voucher - Inventory vouchers - Delivery note, Physical stock voucher, Purchase order, Sales order, Receipt note, Rejection in, rejection out, stock journal, Stock category, Bill-wise details, Multiple Godowns, Different and actual bill quantity- Working with payroll info menu- payroll configuration and pay head creation- Pay roll vouchers- Payroll reports.

Section C

Preparation of Books of accounts with the help of windows based word processing and spreadsheet application software- Cash book, Bank book, Journal Register, Ledger, Purchase, Register, Sales Register, Display of Trial balance, Manufacturing account, Profit and loss accounts, Balance sheets, Consolidated statements companies/branches. Preparation of bank reconciliation Statement

Analysis of Financial statements in spreadsheet application software - calculating key financial ratios, Cash flow, Preparation of budgets and controlling through variance analysis. Calculation of Capital Budgeting techniques. Calculation of TDS in spreadsheet application software, Generation and Reconciliation of TDS Challans, Filing e-TDS return

Learning Outcomes:

Upon completion of the course student will be able to

- Learn usage of Tally ERP 9 for accounting purposes.
- Learn usage of MS Excel in maintaining books of accounting.
- Procure a job in the field of accounting.

Suggested Readings:

1. Nadhani, Asok K. (2015), *Implementing Tally. ERP 9*(2 ed.). New Delhi: BPB Publications.
2. Bodnar, G.H., & Hopwood, W.S. (2012), *Accounting Information Systems* (7ed.). Pearson.

3. Turner, L., & Weickgenannt, A.B. (2016), *Accounting Information Systems: The Processes and Controls* (3 ed.). John Wiley & Sons.
4. Smith, G (2011), *Excel Application for Accounting Principles* (4 ed.), Nelson Education.

Suggested E Learning Materials :

1. Income Tax Department, Govt. of India, E-filing of TDS, Retrieved from <https://www.incometaxindia.gov.in/Pages/tax-services/online-filing.aspx>
2. Parmar, Amir. (2013, Oct 14), Finance Functions in Excel, Retrieved from <https://www.youtube.com/watch?v=-6ERqkxlcFY>
3. GaddamSubramanyam (2014, March 15). How to Learn Tally ERP 9, Retrieved from <https://www.youtube.com/watch?v=wIFdDoYc6Zc>
4. Das, Mimmi. (2016, Sep 3). Cash Flow Statement in Excel, Retrieved from <https://www.youtube.com/watch?v=3I4s3Gq9US8>
5. My eSheet (2016, Oct 1). How to Prepare Trading and Profit & Loss Account in excel spread sheet, Retrieved from <https://www.youtube.com/watch?v=TgBULNacfGw>
6. Mangesh, B. (2017, March 26). How to Prepare Vouchers in Tally ERP9, Retrieved from <https://www.youtube.com/watch?v=PnzUiMLtQMk>

Personal Financial Management

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the meaning of financial planning Along with the details about the various areas of financial planning like Tax planning, Retirement planning, Estate planning, and Budgeting, Savings, Debt management and Investment planning.
2. To study in detail about tax refund, residency rules, procedure of assessment, taxation of interest income, taxation of capital gain, advance tax planning and instruments of tax planning.
3. To understand the meaning of financial planning, its different components, process, personal financial statements, budgeting, time value of money and along with this To understand about various investment avenues like mutual funds, insurance, basics of equity and debt markets.
4. To understand about the Regulatory bodies and ethical aspects of Personal finance.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section

Course Content

Section A

Personal Finance: Introduction, Goals, Need, Personal Financial Statements, Personal financial planning process, Life cycle approach to financial planning, Components of financial plan, developing financial plan. Budgeting: Principles of Successful Budgeting, Spending money wisely, Time value of Money, careers in personal finance advisory, Bharatiya Model of Financial Literacy. Introduction to various investment avenues: Mutual Fund, Types of Mutual Fund, Risk return ratio, performance evaluation, NAV Calculation (through excel). Insurance: Types of Insurance products Life and Non Life, Principle of insurance, Need for insurance, Requirement of Insurable risk, Role of insurance in portfolio diversification, Steps in Insurance Planning. Principles of Successful Investing.

Section B

Basics of Equity and Debt markets Other Investment avenues: Gold, PPF, Post office savings Scheme, Various Types of Bank Deposits. Retirement Planning: Introduction to retirement planning process, estimating retirement corpus, determine retirement corpus, retirement products. Retirement solutions and pension plan, choosing the right product, Reverse Mortgage as a retirement avenue. Estate planning: Relevance, consequences of dying intestate, Element of Estate Planning, Tools of Estate planning, Wills, Gifts, Joint holding and nomination, Family settlement and trusts, Power of Attorney and Mutation, Succession Act (Hindu & Indian).

Section C

Tax planning: Heads of income, Exemptions and Deductions, Types of Assesses, Rates of Taxation, Obligations for filling and reporting, Return filling procedure, Tax aspects of investment products and types of tax benefits, Taxation of dividends taxation of interest income, Taxation of capital gain, Set off and carry forward of losses, Advance Tax planning and instruments for tax planning. Regulatory Bodies and Ethical issues: Introduction to Regulatory bodies and various functions of the regulatory bodies RBI, SEBI, IRDA, redressal in banking, investor grievance redressal mechanism

Learning Outcomes:

Upon completion of the course student will be able to :

- Learn about components of financial planning.
- Understand Personal Tax Planning.
- Familiarize with regulatory bodies like SEBI, IRDA.

Suggested Readings:

1. Halan, M, (2018). *Let's Talk Money: You've Worked Hard for it, Now Make it Work for You* (1 ed.), New Delhi, Harper Business
2. Mitra S. et al. (2018), *Financial Planning* (1 ed.), Sage Publications New Delhi
3. Mirashi, S., (2012). *I Can Do-Financial Planning*. (4 ed.), New Delhi: Academic Foundation
4. Preschool, IMS, (2015). *Investment Planning* (1 ed.), New Delhi, Tata Mc-Graw Hill
5. Gopinath, M. N. (2011). *Banking Principles and Operations*. (3 ed.), Mumbai, Snow white Publications.

Suggested E-Learning Material:

1. Kotak Securities (2019), Knowledge Bank, Retrieved from <https://www.kotaksecurities.com/ksweb/Research/Knowledge-Bank/Investment-Knowledge-Bank>
2. Halan M. (2019), *Let's Talk Money With Monika Halan: Financial Planning Ideas*, Retrieved from <https://www.bloombergquint.com/bqportfolio-videos/let-s-talk-money-with-monika-halan-financial-planning-ideas>, Courtesy BloombergQuint
3. Pareek, N., et al. (2018, December 1). *Emerging Trends in Banking*. Under Banasthali-MHRD NRC, Retrieved from <https://www.youtube.com/watch?v=gCBs313D46g>:
4. Purohit, H. (2015, October 13), Banasthali Vidyapith Presents the Bhartiya Mode of Financial Literacy (BMFL), retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2673446
5. RBI. (n.d.). *Financial Education and RBI*. Retrieved March 1, 2019, from rbi.org.in: <https://rbi.org.in/fmancialeducation/home.aspx>
6. Sud, R. (2017, June 13). *Why India needs to work on financial literacy now more than ever*. Retrieved March 1, 2019, from <https://www.livemint.com/Opinion/f5xo11OSPqxGWUdaWKVb8J/Why-India-needs-to-work-on-financial-literacy-now-more-than.html>

Political Obligations

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course students will be able to

Understand the concept and theories of political obligation.

Aware about political obligation of individual towards state.

Analyze the political obligation in present scenario.

Unit 1 Introduction to Political Obligation, Meaning, nature and Scope of Political Obligation, Evolution of the concept of political obligation, contemporary developments, Political obligation and right, Political, obligation and Duties.

Unit 2 Theories of Political obligation, T.H. Green on Political obligation, Moral or Ethical foundations of Political obligation, Ancient Indian ideas and Institutions on Political obligation.

Unit 3 Dimensions of Political obligations in a modern State, Political, Membership and political obligation.

Unit 4 Political Obligation and the right to dissent, legal issues, social issues, political issues, Right to disobey the law, D.H. Thoreau and Gandhian Principles.

Unit 5 Political Obligation and Revolution, Role of State in balancing political obligations, Role of international society in political obligation of a State.

Suggested Readings:

Horton, J. (1992). *Political obligation*. London, U.K.: MacMillan.

Gilbert, M. (2006). *A Theory of political obligation: membership, commitment and the bonds of society*. London, U.K.: Clarendon Press.

Raphael, D.D., & Green, T.H. (2008). *Political obligation*.

Suggested E-Learning Material:

<https://epgp.inflibnet.ac.in/ahl.php?csrno=29> Annual Review of Political Science,
<http://www.annualreviews.org/journal/polisci>, Annual Reviews

Revista CIDOB d'Afers Internacionals,

Political Methodology, <http://www.jstor.org/action/showPublication?journalCode=polimethod>, Oxford University Press; Society for Political Methodology

Annual Review of Political Science <http://www.annualreviews.org/journal/polisci>

PS: Political Science and Politics <http://www.jstor.org/action/showPublication?journalCode=pspolisciepoli>

Legal English

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The Students will be able to Command the language which is an essential quality of a lawyer.

The Students will be able to understand writings of eminent jurists.

The Students will be able to develop skill of articulation and effective writing.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction: Language and the Law – Legal Language: meaning, scope and problems; Constitutional Provisions relating to Language; Language of Legislation of Union and States; Language problem in Drafting of the Documents/ Judgments; Language to be used in representations for redress of grievances etc.

Unit II Legal Vocabulary, Glossary: Act of God, Affidavit, Adverse possession, Anticipatory Bail, Amicus curiae, Benefit of doubt, Civil rights, Compounding of offence, Contempt of Court, Constitutionality of an Act, Rarest of Rare, Per incurium, FIR, Natural justice, Secularism, Uniform Civil Code, Locus standi, Laissez-faire, Moral turpitude, Parens patriae, etc. (*The list is illustrative only*); General principles governing Legal Drafting, Framing Issues, etc.

Unit III Legal Maxims:

1. Actus non facit reum nisi mens sit rea (The act itself does not constitute guilt unless done with a guilt intent).
2. Actio personalis moritur cum persona (A personal right of action dies with the person).
3. Audi Alteram Partem (Non man shall be condemned unheard).
4. Communis error facit jus (Common error sometimes makes law).
5. Delegatus non potest delegare (Delegate cannot further delegate).
6. Ex nudo pacto non oritur actio (No cause of action arises from a bare promise).
7. In pari delicto potior est condition defendentis (Where the parties are equally at guilt, the defendant is better placed).
8. Generalia specialibus non derogant (General things do not derogate from special things).
9. Ignorantia facti excusat, ignorantia juris non excusat (Ignorance of fact excuses, ignorance of law does not excuse).
10. Omnia praesumuntur contra spoliatores (All things are presumed against a wrong doer).
11. Qui facit per alium facit per se (He who does an act through another is deemed in Law to do it himself).
12. Respondeat superior (Let the principal be held responsible).
13. Res ipsa loquitur (The thing itself speaks).
14. Sic utere tuo ut alienum non laedas (Enjoy your property in such a manner as not to injure that of another person).
15. Ubi jus ibi remedium (Every right has a remedy).
16. Volenti non fit injuria (Damage suffered by consent is not a cause of action).

17. Salus populi est suprema lex (Regard for the public welfare is the highest law).
18. Rex non-potest peccare (The king can do no wrong).
19. Vigilantibus non dormientibus, jura Subveniunt (The laws give help to those who are vigilant and not to those who sleep over their rights).

(Note: *The list is illustrative only*)

Unit IV Selected Judgements for Case-Study:

1. **Rylands v. Fletcher**, (1868) L.R. 3 H.L. 330
2. **Mohori Bibee v. Dharmodas Ghose**, Privy Council, (1903) 30 IA 114
3. **In Re: Vinay Chandra Mishra**, Contempt petition (Criminal) No. 3 of 1994
4. **Keshavanand Bharati v. State of Kerala**, AIR 1973 SC 1461
5. **Reg v. Govinda** 1876 ILR 1Bom. 342
6. **Salomon v. Salomon & Co.** (1897)AC 22
7. **National Legal Services Authority v. UOI**, W. P. (Civil) No.400 of 2012, D/-15/04/2014
8. **Dr. Balram Prasad v. Dr. Kunal Saha & Ors** Civil Appeal No.2867 OF 2012, D/- 24/10/2013 (Note: *The list is illustrative only and may include other landmark judgments*)

Unit V Notices: Name change, Degree/Certificates lost, Removal of Agent /Representative/Partner, Company meeting etc; Legal Comprehension including Précis/letter/ essay writing.

Suggested Readings:

Ishitiae A. (1978). *Law and Language*. Aligarh; University Publishers.

Sengupta, Ajit K, Maumder's (2005) *Law Relating to Notices*, Kolkata: Eastern Law House Pvt. Ltd

Mogha G.C, Mogha's (2009). *Law of Pleadings in India with precedents*. (17th ed). Lucknow: Eastern Book Company.

Shrivastava J.M, Mogha's (2009) *Indian Conveyancer*. 14th ed. Lucknow: Eastern Book Company.

Broom's (2011) *Legal Maxims*, (11th ed.) New Delhi: Universal Publishing Ltd.

Trayner's (2010) *Legal Maxims*, New Delhi: Universal Publishing Ltd.

Sridhar, M. (2012). *Legal Language*. Hyderabad: Asia law House.

Prasad A. (2011). *Outlines of Legal Language in India*. Allahabad: Central Law Publications

Tripathi, S.C. (2005). *Legal Writing and General English*. New Delhi: Central Law Publications

Suggested E-Learning Material:

Smith, Y. (1943). Legal English. *The News Letter of the College English Association*, 5(7), 1-1. Retrieved from

<http://www.jstor.org/stable/44402591>

Morawski, L. (1999). Law, Fact and Legal Language. *Law and Philosophy*, 18(5), 461-473. Retrieved from

<http://www.jstor.org/stable/3505140>

International Relations

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course student will be able to:

Understand the concept of international relations and foreign policies.

Aware about India's relation with US, Pakistan and china.

Analyze the international relations and foreign policies.

Unit 1 International relations: Meaning, Nature and Scope, Theories in international relations: Idealism, Realism, National Interest: Meaning and Elements, Balance of Power: Meaning and Feature.

Unit 2 United Nations: Organs and functions Achievement and Limitations.

Unit 3 Foreign policy : Meaning and Determinants, Foreign Policy of India.

Unit 4 India's relations with US, Pakistan and China in new millennium.

Unit 5 Nuclear Issues and disarmament: NPT, CTBT and India's Nuclear Policy, Regional organizations: NATO, OPEC. SAARC

Suggested Readings:

Ghai,U.R.(2003). *International politics: theory & practice*. Jhalandhar, India: New Academic Publishing.

Chandra,P.,&Arora,P.(2015). *Comparative politics & international relations*. New Delhi, India: Bookhives.

Dutta,V.P.(1993). *India's foreign policy*. New Delhi, India: NBT.

Kumar,M.(1967). *Theoretical aspects of international politics*. Agra, India: Shiva LalAgarwal.

Palmer,&Parkins(2010). *International relations*. New Delhi, India: AITBS.

Suggested E-Learning Material:

<https://epgp.inflibnet.ac.in/ahl.php?csrno=29>

Presidential Studies Quarterly <http://www.jstor.org/action/showPublication?journalCode=presstudq>

Review of International Studies <http://www.jstor.org/action/showPublication?journalCode=revinterstud>

International Studies Quarterly <http://www.jstor.org/action/showPublication?journalCode=intestudquar>

Family Law – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able understand the vast discipline of Hindu Law and other Personal Laws.

The students will be able understand the significance of Hindu Law and other Personal Laws.

The students will be able get insight into various concepts of Hindu Law and other Personal Laws which will help in shaping their career as Judges, Lawyers, Academicians and Jurists.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction to Family law: Sources of Hindu Law, Application of Hindu Law, Nature and Origin of Hindu Law as Applied and Interpreted in India, Schools of Hindu Law, Migration and Change of Religion.

Marriage: Concept of marriage in Hindu Law – A sacrament or contract, Essentials of a Valid Marriage, Kinds of marriage and Effects of Void, Voidable and Valid Marriage, Forms of Marriage, Effects of Conversion.

Joint Hindu Family: Introduction, Coparcenaries, Karta-position and powers, Female may be a Karta or not, Religious and Charitable Endowment

Law of Partition: Concepts and Kinds, Who can Demand, Modes of Partition and Reunion, Deemed Partition.

Unit II Dowry: Concept of Dowry in Hindu Marriage, The Dowry Prohibition Act, 1961: Effects of Demand and Payment of Dowry

Matrimonial Reliefs: Concept and Meaning; Positive and Negative Remedies, Restitution of Conjugal Rights-Provisions in Hindu Law and other Personal Laws, Restitution of Conjugal Rights and Cruelty (Domestic Violence), Judicial Opinion regarding Constitutionality of the Remedy of Restitution of Conjugal Rights, Concept, Grounds and Effects of Judicial Separation, Theories of Divorce, Grounds of Divorce under Hindu Law, The Special Marriage Act, 1954, The Indian Divorce Act, 1869 and The Parsi Marriage and Divorce Act, 1936.

Unit III Maintenance: Provisions regarding Maintenance in Hindu Law and Christian Law, Implications of the Provisions in Cr. P.C. (Ss. 125-128) Judicial Approach.

Guardianship and Adoption: Laws of Guardianship, Types of Guardian, Requisites of a Valid Adoption, Adoption by Foreign Parents, Effects of Adoption, Adoption under Juvenile Justice (Care and Protection of Children) Act, 2000, Surrogacy

Unit IV Testamentary Succession & Intestate Succession: Will, Probate and Codicil, Execution, Attestation and Revival, Will under Hindu Law and Section 30 of Hindu Succession Act, 1956, General Principles of Succession under Hindu Law, Succession to Hindu Male, Succession to Hindu Female, Disqualified Heirs, Stridhan and Section 14 of Hindu Succession Act.

Parentage and Legitimacy: Brief Study of Section 112 of Indian Evidence Act, **Legitimacy-** Legal Status of Children Born of Void, Voidable Marriage under Hindu Law.

Unit V Family Courts: Object of the Family Courts Act, 1984, Powers, Functions, Jurisdiction and Critical Evaluation of Family Courts in India

Uniform Civil Code: Uniform Civil Code, Implications, Efforts of Judiciary and Indian Legislature.

Leading Cases:

Brang Gangadhar Revdekar v. Pooja Gangadhar Revdekar A.I.R. 2010 Bom.

Samar Ghosh v. Jaya Ghosh, A.I.R 2007 SC 1000

Srinivas Kango v. Narayan Kango, AIR 1954, SC 379.

Guru Nath v. Kamla Bai, AIR 1955, SC 280.

Gopal Rao v. Sitaramamma, AIR 1964, SC 1970.

Angurbala Mullick v. Debabrata Mullick, 1951 S.C.R. 1125.

Sawan Ram v. Kalawati, A.I.R. 1967 S.C. 1761.

Audh Bihari v. Gajadhar, A.I.R. 1954, S.C. 417

Dastane v. Dastane, AIR 1975 SC 1534

Constitutional Law – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The student will be able to understand the need for the constitution

The student will be able to explain the role of the constitution in a democratic society

The student will be able to list the key features of the constitution

The student will be able to appreciate the fundamental rights of the citizens of India.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction: - Making Of Indian Constitution, Salient features of the Indian Constitution, Nature of the Indian Constitution.

Unit II Preamble, Territory, Citizenship: - Preamble of Indian Constitution, Territory of India, Admission or Establishment of New States, Concept Of single Citizenship under Indian Constitution & Citizenship Act 1955 with latest amendments.

Unit III The Union Executive: - The President, Vice-President and Council of Ministers, The State Executive, The Parliament: - Composition, Legislative Procedure and Parliamentary Privileges, The State Legislature.

Unit IV The Union Judiciary: - The Supreme Court of India, the State Judiciary.

Unit V Relations between the Union & the States: - Legislative Relations, Administrative Relations & the Financial Relations; Emergency Provisions: - National Emergency, Failure of Constitutional Machinery in States, Financial Emergency

Leading Cases:

1. Keshavanand Bharti v. State of Kerala, AIR 1973 SC 1461
2. S.R. Bommai v. Union of India, AIR 1994 SC 918
3. Indra Sawhney v. Union of India, AIR 1993 SC 477
4. Menaka Gandhi v. Union of India, AIR 1978 SC 597
5. Bacchan Singh v. State of Punjab, AIR 1982 SC 1336
6. E.P. Royappa v. State of Tamil Nadu, AIR 1974 SC 555
7. M.Nagraj v. Union of India, AIR 2007 SC 71
8. Selvi v. State Karnataka, AIR 2010 SC 1974

9. Chairman, Rly. Board v. Chandrima Das, (2000) 25 SC 465
10. Minerva Mills v. Union of India, AIR 1980 SC 1789
11. Smt. Indra Nehru Gandhi v. Rajnarain, AIR SC 1951 SC 2299
12. A.D.M. Jabalpur v. A.K. Shukla, AIR 1976 SC 1207
13. I.R. Coleho v. State of T.N., 2007 (1) SC 137
14. Ajay Hasia v. Khalid Mujib, AIR 1981 DC 487

Suggested Readings:

Basu , D.D. (2008). *Constitutional Law of India*. Nagpur: Lexis Nexis.

Pandey , J.N. (2011). *Constitutional Law of India*. Allahabad: Central Law Agency.

Shukla, V.N. (1995). *Constitution of India*. Lucknow : Eastern Book Company.

Seervai, H.M. (2008). *Constitutional Law of India*. New Delhi: Universal Law Publication Company.

Kashyap, Subhash. (2008). *Constitution making since 1950*.

Dicey, A.V. (2008). *An Introduction to the Law of Constitution*, New Delhi: Universal Law Publication.

Suggested E- Learning Material:

Singh Dalal, Rajbir. (2009). Fundamental rights enshrined in Indian constitution Provisions and Practices. *Indian Political Science Association*. Retrieved from : <https://www.jstor.org/stable/42742760>

Ahmad, S. Waseem. & Ali, M. Ashraf.(2006). Social justice and the constitution of india. *Indian Political Science Association*. Retrieved from: <https://www.jstor.org/stable/41856262>

Meston, Lord. (1923).The New Constitution of India. *Cambridge University Press on behalf of the British Institute of International and Comparative Law*. Retrieved from : <https://www.jstor.org/stable/753122>

Sharan, P. (1978). Constitution of India and judicial review. *Indian Political Science Association*. Retrieved from : <https://www.jstor.org/stable/41854873>

Basavaraju, C. (2009). Reservation under the constitution of India: issues and perspectives. *Indian Law Institute*. Retrieved from : <https://www.jstor.org/stable/43953443>

Essentials of Sociology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of the course, the students will be able to

Trace the development of sociology as a discipline.

To explain the key concepts in sociology and its relationship with other social science disciplines.

Write about the role of various institutions such as religion, marriage, family and kinship.

Describe forms of stratification in society.

Unit 1 The emergence of sociology - Transition from social philosophy to sociology, Enlightenment-The Social, Economic and Political Forces: The French and Industrial Revolutions.

Unit 2 Nature and Scope of Sociology – Meaning and nature of Sociology, Concept of Society and Culture, Relationship with other social sciences; Social Anthropology, History, Political Science, Psychology and concept of groups; Institutions – Social structure and of social system.

Unit 4 Role of religion in sociology- Religious belief and rituals, religious groups, religion in social structure, Marriage and Family, forms of marriage, Unisexual and Bisexual marriage, Divorce, Kinship System.

Unit 5 Social stratification – Concept of class, Nature of Cast and Class, Family as the unit of class, Class Endogamy, functions and dysfunction of social stratification.

Suggested Readings:

Aron, Raymond. (1956) (1982 reprint), *Main currents in sociological thought (2 volumes)*. Harmondsworth, Middlesex: Penguin Books.

Barnes, H.E. (1959). *Introduction to the History of Sociology*. Chicago: The University of Chicago Press.

Coser, Lewis A. (1979). *Masters of sociological thought*. New York: Harcourt Brace Jovanovich.

Cotterell, Roger. (1992). *Sociology of law*. New Delhi, Oxford: University Press.

Fletcher, R. (1994). *The making of sociology (2 volumes)*. Jaipur: Rawat Publishing.

Freeman, M. (2006). *Law and Sociology*. New Delhi: Oxford University Press.

Lucy M. (1997). *An Introduction to Social Anthropology*. New Delhi: Oxford University Press.

Marrison, K. (1995). *Marx Durkheim, Weber: Formation of Modern Social Thought*. London: Sage.

Ritzer, G. (1996). *Sociological Theory*. New Delhi: Tata Me Graw Hill Singh,

Singh, Y. (1986). *Indian Sociology; conditioning and emerging trends*. New Delhi: Vistaar.

Zeitlin, I. (1998). (Indian edition); *Rethinking sociology: A Critique of Contemporary Theory*. Jaipur: Rawat Publishing.

Suggested E-Learning Material:

Classical Sociological Theory, Platform: Utkal University, Link:

http://ddceutkal.ac.in/Syllabus/MA_SOCIOLOGY/MA_PAPER-3_CLASSICAL_SOCIOLOGICAL_THEORY.pdf

Classical Theorists in Sociology, Platform: sesync.org, Link:

<https://www.sesync.org/sites/default/files/education/sociology-2.pdf>

Basics of Public Administration

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course student would be able to

Understand the foundation of subject in proper fashion.

Comprehend the concept and application of good governance.

Develop interdisciplinary insight about the subject.

- Unit 1** Public Administration: Meaning, Nature, Scope Importance of public Administration in Modern Society Evolution; Public and Private Administration; New Public Management and Good Governance.
- Unit 2** Theories of Organization: Scientific Management, Classical and Human Relations.
- Unit 3** Principles of Organization: Hierarchy, Span of Control, Unity of Command, Delegation and Co-ordination.
- Unit 4** Centralization, Decentralization, Line and Staff, Authority and Responsibility, Decision Making, Leadership.
- Unit 5** Personnel Administration: Meaning, Nature and Significance; Classification, Recruitment, Training and Promotion.

Suggested Readings:

- Avasthi, Amreshwar&Maheswari, Shriram, (2017). *Public Administration*. New Delhi: Lakshmi Narain Agarwal Educational Publishers.
- Fadia, B.L., (2017). *Public Administration (Administrative Theory and Concepts)*. Agra: Sahitya Bhawan Publication (Hindi & English)
- Goel S.L. & Rajneesh, Shalini, (2002). *Public Personnel Administration Theory & Practice*. New Delhi: Deep & Deep Publication.
- Chakrabarty, B. & Chand, Prakash, (2017). *Public Administration from Government to Governance*. Jaipur: Orient Black Swan
- Kataria, Surendra, (2000). *Element of Public Administration*. Jaipur: RBSA Publisher.
- वर्मा एस0 एल0, शर्मा बी0 एम0, (1990). प्रबन्धकीय लोक प्रशासन, राजस्थान हिन्दी ग्रंथ अकादमी, जयपुर
- भाँभरी चन्द्र प्रकाश, (1976). *लोकप्रशासन-सिद्धान्त एवं व्यवहार*, जयप्रकाश नाथ
- Goel, S.L., (2005). *Public Administration: Administrative Theory & Practice*. New Delhi: Deep & Deep Publication.

Suggested E-Learning Material:

<https://epgp.inflibnet.ac.in/ahl.php?csrno=30>

Indian journal of public administration- <https://us.sagepub.com/en-us/nam/indian-journal-of-public-administration/journal202581#description>

Journal of Public Administration Research and Theory: J-PART

<http://www.jstor.org/action/showPublication?journalCode=jpubladmiresethe>

Essentials of Sociology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of the course, the students will be able to

Trace the development of sociology as a discipline.

To explain the key concepts in sociology and its relationship with other social science disciplines.

Write about the role of various institutions such as religion, marriage, family and kinship.

Describe forms of stratification in society.

Unit 1 The emergence of sociology - Transition from social philosophy to sociology, Enlightenment-The Social, Economic and Political Forces: The French and Industrial Revolutions.

Unit 2 Nature and Scope of Sociology – Meaning and nature of Sociology, Concept of Society and Culture, Relationship with other social sciences; Social Anthropology, History, Political Science, Psychology and concept of groups; Institutions – Social structure and of social system.

Unit 4 Role of religion in sociology- Religious belief and rituals, religious groups, religion in social structure, Marriage and Family, forms of marriage, Unisexual and Bisexual marriage, Divorce, Kinship System.

Unit 5 Social stratification – Concept of class, Nature of Cast and Class, Family as the unit of class, Class Endogamy, functions and dysfunction of social stratification.

Suggested Readings:

Aron, Raymond. (1956) (1982 reprint), *Main currents in sociological thought (2 volumes)*. Harmondsworth, Middlesex: Penguin Books.

Barnes, H.E. (1959). *Introduction to the History of Sociology*. Chicago: The University of Chicago Press.

Coser, Lewis A. (1979). *Masters of sociological thought*. New York: Harcourt Brace Jovanovich.

Cotterell, Roger. (1992). *Sociology of law*. New Delhi, Oxford: University Press.

Fletcher, R. (1994). *The making of sociology (2 volumes)*. Jaipur: Rawat Publishing.

Freeman, M. (2006). *Law and Sociology*. New Delhi: Oxford University Press.

Lucy M. (1997). *An Introduction to Social Anthropology*. New Delhi: Oxford University Press.

Marrison, K. (1995). *Marx Durkheim, Weber: Formation of Modern Social Thought*. London: Sage.

Ritzer, G. (1996). *Sociological Theory*. New Delhi: Tata Me Graw Hill Singh,

Singh, Y. (1986). *Indian Sociology; conditioning and emerging trends*. New Delhi: Vistaar.

Zeitlin, I. (1998). (Indian edition); *Rethinking sociology: A Critique of Contemporary Theory*. Jaipur: Rawat Publishing.

Suggested E-Learning Material:

Classical Sociological Theory, Platform: Utkal University, Link:

http://ddceutkal.ac.in/Syllabus/MA_SOCIOLOGY/MA_PAPER-3_CLASSICAL_SOCIOLOGICAL_THEORY.pdf

Classical Theorists in Sociology, Platform: sesync.org, Link:

<https://www.sesync.org/sites/default/files/education/sociology-2.pdf>

Family Law – II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to understand the vast discipline of Muslim Law. Understanding the significance of Muslim Law.

The students will be able to understand the significance of Muslim Law.

The students will be able to get insight into various concepts of Muslim Law which will help in shaping their career as Judges, Lawyers, Academicians and Jurists.

Unit I Introduction to Family Law: Sources of Muslim Law, Application of Muslim Law, Nature and Origin of Muslim Law as Applied and Interpreted in India, Schools of Muslim Law, Migration and Change of Religion.

Marriage: Concept of Marriage in Muslim Law – A Sacrament or Contract, Essentials of a Valid Marriage, Kinds of Marriage and Effects of Void, Irregular and Valid Marriages, Effects of Conversion.

Unit II Dower: Concept of Dower in Muslim Law, Types of Dower, Nature of Dower -whether Inheritable and Transferable, Wife's Right of Retention of Property in lieu of Mahr, Effects of Non-Payment of Dower.

Maintenance: Provisions regarding maintenance for wife and other dependants in Muslim Law, Implications of the Muslim Women (Protection of Rights on Divorce) Act, 1986, Provisions in Cr. P.C. (Sec.125-128), Judicial Approach.

Unit III Matrimonial Reliefs: Theories of Divorce, Grounds & Kinds of Divorce under Muslim Law.

Guardianship, Parentage and Adoption: Laws of Guardianship, Type of Guardian, Legitimacy and Legitimation, Acknowledgement of Sonship under Muslim Law, Adoption under Muslim Law – Whether Recognized or Not?

Unit IV Gift/Hiba: Concept of Gift/Hiba under Muslim Law, Types of Gifts

Wakf: Concept of Wakf under Muslim Law; Object, Essentials and Kinds of Wakf; Doctrine of Mushaa; Mutawalli; Wakf and Sadaqah Distinguished.

Unit V Testamentary Succession & Intestate Succession: Will under Muslim Law, Will under Indian Succession Act, 1925, Law of Inheritance under Muslim Law, Intestate Succession under Indian Succession Act, 1925.

Law of Pre-Emption: Concept of Pre-Emption, Law of Pre-Emption or Shufaa under Muslim Law, Constitutional Validity of the Right of Pre-Emption.

Leading Cases:

1. Mohd. Ahmed Khan v. Shah Bano Begum & Ors, 1985 AIR 945 SCC (2) 556

2. Rosy Jacob v. Jacob A. Chakramakkal, 1973 AIR 2090, 1973 SCR (3) 918
3. Maina Bibi v. Chaudhary Vakil Ahmed, 2, I.A. 145
4. Immambandi v. Mutsaddi (1918) 45, I.A. 71
5. Amjad Khan v. Ashraf Khan, 56 I.A. 218
6. Audh Bihari v. Gajadhar, A.I.R. 1954, S.C. 417
7. Jafree Begum v. Amin Mohammed Khan, 7 All 822.
8. Mohd. Ahmed Khan v. Shah Bano Begum & Ors, 1985 AIR 945 SCC (2) 556
9. Sarla Mudgal v. UOI, AIR 1995 SC 1531
10. Danial Latifi v. Union of India, (2001) 7 SCC 740
11. John Vallamattom v. UOI, AIR 2003 SC 2902
12. Shayara Bano v. Union of India and others, Writ Petition (C) No. 118 of 2016

Suggested Readings:

- Kusum. (2015). *Family Law-I* (4th ed.). Gurgaon: LexisNexis.
- Saxena, Poonam. Pradhan. (2019). *Family Law-II* (4th ed.). Gurgaon: LexisNexis.
- Ahmad, Aqil. (2016). *Mohammedan Law* (26th ed.). Allahabad: Central Law Agency.
- Mahmod, Tahir. (2016). *The Muslim Law of India and Abroad* (2nd ed.). Gurgaon: Universal LexisNexis
- Pillai, K.N. Chandrashekharan. (2017). *R.V. Kelkar Lectures on Criminal Procedure Code* (6th ed.). Lucknow: Eastern Book Company.
- Thakker 'Takwani', C. K., Thakker, M.C. (2014). *Criminal Procedure* (4th ed.). Gurgaon: LexisNexis
- Mulla, D.F. (2017). *Mulla's Principles of Mohamedan Law* (22nd ed.). Gurgaon: LexisNexis.
- Saeed Manzar. (2015). *Commentary on Muslim Law in India* (2nd ed.). New Delhi: Orient Publishing Company.
- Siddiqui, Munir. Ahmad (2012). *Principles of Mohammedan Law* (2nd ed.). Allahabad : Dwivedi & Company.

Suggested E- Learning Material:

- Habib, I. (2006). Muslims in India: Some Issues for State Action. *Social Scientist*, 34(3/4), 82-89. Retrieved from <http://www.jstor.org/stable/27644129>.
- Subramanian, N. (2008). Legal Change and Gender Inequality: Changes in Muslim Family Law in India. *Law & Social Inquiry*, 33(3), 631-672. Retrieved from <http://www.jstor.org/stable/20108777>

Constitutional Law – II

Max. Marks : 100

L T P C

Learning Outcomes:

The student will develop an understanding of Fundamental rights, directive principles and fundamental duties.

The students will learn the reasonable restriction imposed on various organs so far as the rights are being concerned.

The students will be able to acquaint the scope and parameters of part III and part IV and part IV A of the Constitution.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Fundamental Rights in General: Origin & Development, Importance of Fundamental Rights; **State:** Definition and Judicial Interpretations; The power of Judicial Review, Doctrine of Eclipse, Severability & waiver.

Unit II Right to Equality (Art. 14 to 18); **Right to Freedom** (Art. 19 to 20): Six freedoms, Restrictions, Protection in respect of conviction for offences – Protection against ex-post facto Law, Double Jeopardy and prohibition against self incrimination

Unit III Protection of Life & Personal Liberty (Art. 21); Right to Education – (Art.21-A); Safeguards against Arbitrary Arrest & Detention (Art.22)

Unit IV Right against Exploitation - (Art. 23-24); **Right to Freedom of Religion** – (Art. 25-28); **Cultural & Educational Rights** – (Art. 29-30); **Right to Constitutional Remedies** - (Art. 32)

Unit V Directive Principles of State Policy: Importance & Relation with Fundamental Rights, Fundamental Duties; **Amendment of the Constitution:** Power & Procedure, Basic structure doctrine, **Right of Civil Servants.**

Leading Cases:

1. Hussain Ara Khatoon v. State of Bihar, AIR 1979
2. M.C. Mehta v. Union, AIR 1987 SC 1086
3. Menka Gandhi v. Union, (1978) 1 SCC 248
4. Peoples Union for Civil Liberties v. Union AIR 2005 SC 2419
5. State of Madras v. K.M. Raja Gopalan, AIR 1955 SC 817
6. Vineet Narain v. Union AIR 1998 SC 889
7. Vishakha v. State of Rajasthan (1997) 7 JT SC 384
8. Upendra Baxi v. State of UP, AIR 1987 SC 191
9. M/s Zee Tele Films v. Union, AIR 2005 SC 2677
10. Bandhuwa Mukti Morcha v. Union, AIR 1984 SC 802

Suggested Readings:

1. Basu, D.D. (2008). Constitutional Law of India, Nagpur: Lexis Nexis Butterworths Wadhwa.
2. Pandey, J.N. (2011). Constitutional Law of India, Allahabad: Central Law Agency.

3. Shukla, V.N. (2011). Constitution of India, Lucknow: Eastern Book Co.
4. Seervai, H.M. (2008). Constitutional Law of India, Ed. N.M. Tripathi
5. Dashyp, S. (Latest Edn.) Constitution Making, Since 1950, New Delhi: Universal Law Publishing Co. Ltd.
6. Dicey A.V. (2008). An Introduction to the Law of Constitution, Lighting Source inc.

Suggested E –Learning Material:

1. A David Ambrose. (2013). DPSP and Distribution of material resources with special reference to natural resources – Recent Trends. Journal of the Indian Law Institute.
2. British Institute of International and Comparative Law. (2006). Fundamental Rights. Cambridge University Press from https://www.jstor.org/stable/pdf/4092627.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3A4c4871be427d5b72379652454b97bed8
3. Udit Raj Rai. (1994). Reach of Fundamental Rights. Journal of the Indian Law Institute from https://www.jstor.org/stable/pdf/43952346.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3Aa45a4a55ec7f4bf09668cdad0c2843e
4. R. S. Gae. (1967). AMENDMENT OF FUNDAMENTAL RIGHTS. Journal of the Indian Law Institute from https://www.jstor.org/stable/pdf/43949952.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3Aa369d70065425cdc6dc9a0986bb7a880
5. Samirendra Nath Ray. (1968). THE CRISIS OF JUDICIAL REVIEW IN INDIA. The Indian Journal of Political Science from https://www.jstor.org/stable/pdf/41854244.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3A3193503e0e8cd81bcd69df518637ab5e
6. Vibhuti Singh Shekhawat. (1994). JUDICIAL REVIEW IN INDIA: MAXIMS AND LIMITATIONS. The Indian Journal of Political Science from <https://www.jstor.org/stable/pdf/41858807>
7. Janki Kutti Amma. (1952). RIGHT TO EQUALITY. The Indian Journal of Political Science from https://www.jstor.org/stable/pdf/42743401.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3Abf0c3afde2e1c694957927c7caa69245
8. Jack P. Greene. (2000). "A Plain and Natural Right to Life and Liberty": An Early Natural Rights Attack on the Excesses of the Slave System in Colonial British America. The William and Mary Quarterly from https://www.jstor.org/stable/pdf/2674156.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3A4c6c14cb6359c7535c9b8ac6d489c3ab
9. Rajeev Dhavan. (1987). Religious Freedom in India. The American Journal of Comparative Law from https://www.jstor.org/stable/pdf/840167.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3Aa6ffa0e23858d12adf27b105d40db514
10. Jasodhara Bagchi. (2013). Towards Equality. Social Scientist from https://www.jstor.org/stable/pdf/23610453.pdf?ab_segments=0%252Ftbsub-1%252Frelevance_config_with_defaults&refreqid=excelsior%3A837704933e56d6f45f0616f06b619399

Theoretical Perspective of Sociology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of the course, the students will be able to

Identify and explain classical sociological thought.

Interpret concepts and theory to understand societal problems.

Develop an understanding towards contemporary relevance of sociology.

Unit 1 August Comte: Intellectual Background, Theory of Law of Three Stages, Positivism, Hierarchy of Sciences.

Unit 2 Herbert Spencer: Intellectual Background, Theory of Social Darwinism and Evolution.

Unit 3 Emile Durkheim: Intellectual Background, Social Fact: Meaning, Characteristics, types, Rules For the Observation of Social Facts, Division of Labor: Mechanical and Organic Solidarities, Pathological Forms of Division of Labor, Religion: Meaning Concept of Sacred and Profane.

Unit 4 Karl Marx: Intellectual Background, Theory of Social Change, Dialectical Materialism, Class and Class Conflict, Surplus Value, Alienation.

Unit 5 Max Weber: Intellectual Background, Ideal Type, Bureaucracy, Concept of Class, Status and Power, Social Action, Authority.

Suggested Readings:

Abraham, F. (1982). *Modern Sociological Theory*. Delhi: Oxford University Press.

Bogardus, E.S. (1967). *Development of Sociological Thought Vol. I & II*. Harmondsworth, Middlesex: Penguin Books.

Bottomore, T. B. (1979). *Karl Marx: Selected Writings in Sociology and Social Philosophy*. Oxford: B.Blackwell, C.

Chouhan, B. R. *Samajshastra Ke Prerak Stotra*. Udaipur: A.B. Publications

Coser, L, A. (1996). *Masters of Sociological Thought*. Jaipur: Rawat Publication.

Doshi, S. L. (1997). *Samajik Vicharak*. Jaipur: Panchsheel Prakashan.

Ritzer G. (1996). *Sociological Theory*. Delhi: Tata McGraw Hill.

Sorokin, P.S. (1968). *Modern Social Theory*. London: Heinemann Education Books.

Suggested E-Learning Material:

1. Classical Sociological Theory, Platform: Utkal University, Link:
http://ddceutkal.ac.in/Syllabus/MA_SOCIOLOGY/MA_PAPER-3_CLASSICAL_SOCIOLOGICAL_THEORY.pdf
2. The Classical Theorists in Sociology, Platform: sesync.org, Link:
<https://www.sesync.org/sites/default/files/education/sociology-2.pdf>

Central, State and District Administration

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course student will be able to:

Discuss the administrative set-up of Indian Administration.

Evaluate the working of Indian administration since independence.

Explore the knowledge about the administrative set-up and functioning of various institutions.

Explore the knowledge about the administrative set-up and functioning of various institutions.

Unit 1 Historical Background of Indian Administration with special reference to the influence of British Rule, Salient features of Indian Administration since Independence.

Unit 2 The Union Executive: President, Prime Minister, Council of Ministers.

Unit 3 Civil Service in India: Role and Significance, Union Public Service Commission: Composition and Functions, Recruitment and Training of All India and Central Services.

Unit 4 Governor: Appointment, Powers, Functions and Actual Position; Chief Minister, Power, Role and Position, Council of Ministers

Unit 5 District Administration : Evaluation, Board of Revenue, Office of Divisional Commissioner, District Collector; Position, Role and Function of District Collector.

Suggested Readings:

Arora, Ramesh. (2012). *Indian Public Administration: Institutions and Issues*. New Delhi: New Age Publishers.

Bhambhari, C. P (1973). *Public Administration in India*. Delhi: Vikas Publication.

Fadia, B.L. (2017). *Public Administration :Administrative Theory and Concepts*. Agra: Sahitya Bhawan Publication.

Laxmikanth, M.(2014). *Governance in India*. India: McGraw Hill

Sharma, P.(1978). *Public Administration in India*. Delhi: Meenakshi Publication.

Suggested E-Learning Material:

<https://epgp.inflibnet.ac.in/ahl.php?csrno=30>

Indian journal of public administration <https://us.sagepub.com/en-us/nam/indian-journal-of-public-administration/journal202581#description>

Journal of Public Administration Research and Theory: J-PART

<http://www.jstor.org/action/showPublication?journalCode=jpubladmiresethe>

Labour Law – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to define the provisions of Constitutional Safeguards on Social Security & Labour Welfare.

The students will be aware about the Trade Unions Act, 1926, Industrial Disputes Act, 1947, Workmen's Compensation Act, 1923, The Employees' Provident Funds and Miscellaneous Provisions Act, 1952 and the Payment of Gratuity Act, 1972, Unorganised Workers' Social Security Act 2008.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Constitutional Safeguards on Social Security & Labour Welfare Article 14, 23, 24, 41, 42, 43, 39, 39A of Indian Constitution, **Trade Unions Act, 1926** : The Philosophy of Trade Unionism, History of Trade Union, Trade Union Movement in India – Aims and Objects – Extent and Commencement of the Indian Trade Unions Act, 1926 – Definition and Nature of Trade Union, **Registration of Trade Unions** – Right and Liabilities of Registered trade Unions, Recognition of Trade Unions, Regulations, Penalties and procedure, Dissolution, Collective Bargaining and Trade Disputes – Unfair Labour Practices.

Unit II Industrial Disputes Act, 1947: Historical Development of Industrial Disputes, Legislation in India, Various Modes of Settlement of Disputes, Object and Reasons, Scope Definition of Important terms – Authorities under this Act voluntary arbitration and Compulsory Adjudication, Reference of Disputes to Boards, Courts or Tribunals; Procedure, Powers and Duties of Authorities, Implementation of Awards, With-holdings of Awards.

Unit III Appeal to Supreme Court and High Court, Strikes and Lock-outs, Lay-off and Retrenchment, Special Provisions Relating to Lay-off, Retrenchment and closure in certain establishment, Compensation in transfer of undertakings, Section 33, 33-A, 33-B, 33-C and other miscellaneous provisions, Penalties, Unfair Labour Practice etc. **The Industrial Employment (Standing Orders) Act 1946:** Registration of standing orders, Legal status of standing order, Payment of Subsistence allowance, Grievance procedure.

Unit IV Workmen's Compensation Act, 1923: Salient features; **The Employees' Provident Funds and Miscellaneous Provisions Act, 1952:** Applicability, definitions, The Central Board, Executive Committee, Recovery of money from Employer, Transfer of Accounts, Protection against Attachment, Liability of Employer in Case of Transfer of Establishment, Inspectors, Schemes Covered Under The Act i.e., Employees Provident Fund Scheme, The Employees' Pension Scheme, Employee's Deposit Linked Insurance Scheme. **The Payment of Gratuity Act, 1972:** Salient features.

Unit V The Unorganised Workers' Social Security Act 2008: Introduction, Objectives, Definition, Preliminary, Social Security Benefits, National Social Security Board for Unorganised Workers, State Social Security Board for Unorganized Workers, Registration, Miscellaneous.

Leading Cases:

1. Rangaswami v. Registrar of Trade Unions, AIR 1962 Mad 231
2. Chairman, SBI v. All Orissa State Bank Officers Association, AIR 2002 SC 2279
3. Rohtas Industries v. Its Union, AIR 1976 SC 425
4. Bangalore Water Supply and Sewerage Board v. A. Rajappa, AIR 1978 SC 548
5. State of U.P. v. Jai Bir Singh, (2005) 5 SCC 1.
6. Workmen of Dimakuchi Tea Estate v. Management of Dimakuchi Tea Estate, AIR 1958 SC 353
7. Indian Banks Association v. Workmen of Syndicate Bank, AIR 2001 SC 946; (2001) 3 SCC 36

8. Gujarat Steel Tubes Ltd. v. Gujarat Steel Tubes Mazdoor Sabha, (1980) 2 SCC 593
9. State of Rajasthan v. Remeshwar Lal Gahlot, AIR 1996 SC 1001
10. U.P. State Brassware Corporation Ltd. v. Uday Narain Pandey, (2006) 1 SCC 479
11. M.C. Mehta v. State of Tamilnadu, AIR 1997 SC 699
12. Deena v. Union of India, (1983) 4 SCC 645
13. Bandhua Mukti Morcha v. Union of India, (1984) 3 SCC 161
14. Gaurav Jain v. Union of India, AIR 1990 SC 292
15. Workmen of Dimakuchi Tea Estate v. DimakuchiGopalPatwardhan, AIR 1957 SC
16. Central Province Transport Service v. Raghunath Gopal Patwardhan, AIR 1957 SC
17. Dharangdhan Chemical Works Ltd. v. State of Sourashtra, AIR 1957 SC 264
18. M. Unichogi v. State of Kerala, AIR 1962 SC 12 (1961) I LLJ 631.

Suggested Readings:

1. Singh Avtar & Kaur Harpreet.,(2008) *Introduction to Labour and Industrial laws*, 4th edition, New Delhi: LexisNexis
2. Mishra, S.N.,(2009)*Labour and Industrial Laws*, 28 edition, Allahabad: Central Law Publication.
3. Malik, P.L.,(2009) *Handbook of Labour and Industrial Law*. Lucknow: Eastern Book Company
4. Srivastava Prof. S.C. (2007) *Labour Law and Labour Relations: Cases and Material* 2002, New Delhi: Indian Law Institute

Suggested E-Learning Material:

Pandey Shubhi (2018) Authorities & Notice of Change under Industrial Dispute Act 1947 Retrieved from <https://www.legalbites.in/law-library-notes-study-material-llb-llm-judiciary-entrance/>

Pandey Shubhi (2018) Registration of Trade Union under Trade Union Act 1926 Retrived from <https://www.legalbites.in/law-notes-labour-law-registration-trade-union-act-1926/>

Deshmukh Hanumant (2018) Trade Union. Retrieved from <https://a19.in/law/llb-llm-law-notes/90-labour-laws/292-labour-laws-trade-union>

Company Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

Demonstrate comprehensive and accurate knowledge, understanding of those areas of company law identified in the indicative syllabus.

Critically analyse complex problems in relation to regulation of companies, apply the legal principles studied to these problems, evaluate competing arguments or solutions and present well supported conclusions both orally and in writing.

Form a critical judgment on areas of controversy within the topics studied

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction to Company Jurisprudence : Origin and development of Company Law in India and in other provinces; Major legislations applicable to companies; Meaning and nature of company with emphasis on its advantages and disadvantages over other forms of business organizations; Kinds of Companies; **Consequence of Incorporation:** Corporate Personalities, Lifting and Piercing of the Corporate Veil.

Unit II Promotion of Companies: Position of Promoters; Pre- Incorporation Contract; Registration of Companies

Formation of a Company: Statutory Requirements and Nomenclature; Memorandum of Association and Article of Association, Doctrine of ultra vires, Doctrine of Indoor Management and Rule of Constructive Notice; Prospectus

Unit III Members and Shareholders: Acquisition and termination of membership; Share Holder's role in the Management of the Company; **Shares**– meaning nature and kinds, various right and duties attached to these Shares, Allotment of Shares, Pre-emptive rights.

Company Management and Administration: Directors – Legal Position of Directors; qualification, type; appointment of Board of Directors; duties and liabilities of director; Removal and Resignation of the Director; Independent Directors; Company Secretary - Qualifications and disqualifications, appointment, position, duties.

Unit IV Capital Management: Borrowing powers, Charges, Dividends, Debentures.

Company Meetings: Types of meetings, essential conditions of valid meetings, procedure for calling company meetings; Resolutions – Kinds and procedures relating thereto.

The rule of Majority - Prevention of Oppression and Mismanagement; Investigation into the affairs of Companies

Unit V Corporate Restructuring - modes; A brief introduction to Corporate Insolvency.

Winding Up: Modes of Winding up of companies; Official Liquidator - Appointment and Powers.

Leading Cases:

1. Saloman v. Saloman & Co., (1895-99) All E.R. Rep 33.
2. State Trading Corporation of India v. CTO, AIR 1963 SC 1811.
3. Ashbury Railway Carriage & Iron Co. Ltd v. Riche, (1875) 44 L.J. Exch. 185.
4. Royal British Bank v. Turquand, (1856) 119 ER 886.
5. Shiromani Sugar Mills Ltd. v. Debi Prasad, AIR 1950 All 508.
6. LIC of India v/s Escorts Ltd., AIR 1986 SC 1370
7. Bamford v/s Bamford, (1968) 3 WLR 317

8. Shanti Prasad Jain v/s Kalinga Tubes, AIR (1965) SC 1535
9. Baji Rao v/s Bombay Docking Co., (1984) 56 Comp Cases 428 Bom
10. Davco Products Ltd. v/s Rameshwar Lal, AIR (1954) Cal 195
11. TM Mathew v/s Industrial Bank Ltd., (1972) 42 Comp Cases 55 Ker
12. Sajneev Kothari v/s Vasant Chordia, (2005) 66 CLA 45 CLB
13. Sikkim Bank Ltd. v/s RS Choudhary, (2000) Comp cases 187 Cal
14. Official Liquidator v Baroda Batteries v ROC, (1978) 48 Comp cases 120 Guj
15. Maharaja Exports v Appareals Export Council, (1986) 60 Comp Cases 353 Del

Suggested Readings:

Singh A. (2018). *Company Law*, Lucknow, EBC.

Kapoor G.K., Dhamija S. (2018). *Company Law and Practice*, New Delhi: Taxmann Publication Pvt. Ltd.

Paranjape N.V. (2017). *Company Law*, Allahabad: Central Law Agency (Latest Edition)

Gower, L.C.B., (2003). *Gower and Davies: The Principles of Modern Company Law*, Sweet and Maxwell
Company Cases (Law Journal)

Insolvency and Bankruptcy Code, 2016

Suggested E- Learning Material:

ICSI (2019, Feb 8). Retrieved from <https://www.icsi.edu/publication-icsi/>

Ministry of Corporate Affairs (2019, Feb 8). Retrieved from
<http://www.mca.gov.in/MinistryV2/companiesact2013.html>

Insolvency and Bankruptcy Board of India (2019, Feb 8). Retrieved from <https://ibbi.gov.in/resources/articles>

Forensic Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to know the importance of forensic science and medicine in resolving the legal matters, both civil as well as criminal.

The students will be able to impart knowledge of the relation between law and medicine.

The students will be able to understand the basic principles of crime scene investigation, including the recognition, collection, identification, preservation, and documentation of physical evidence from scene of crime

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Role of Forensic science in criminal and civil cases: Forensic science and its historical perspective, role in criminal investigation and civil matters, Basic question in investigation-Who bono, Scene of crime, Discovery of traces of physical evidences. **Principles governing forensic science:** Locard principle of exchange, Principle of individuality, Principle of analysis, Principle of comparison.

Unit II The establishment of identity of individual: Tattooing, mutilating, scars and moles, Anthropometric system, Photography, hair, Finger printing, poroscopy, DNA test, EEG (Through case study), brain mapping, lie detection test, Footprints and walking pattern. **Identification of fire arms and cartridges and related problems:** Types of fire arms and their use, Time of firing, Range of firing, Identification of fire arm with cartridge case and bullet.

Unit III Medical Jurisprudence: Definition and scope of medical jurisprudence, historical perspective, Examination of body fluid- blood, Blood grouping, semen, saliva, sweat etc.

Human Body and Injuries Sustained: Parts of human body, Human injuries, Mechanical: (blunt, sharp-edged, pointed sharp edged, firearm), Thermal: (heat, cold), Regional: injuries, Physical: (electric, lightening, radiation), Legal: (simple, grievous).

Unit IV Autopsy and related aspects: Death and its modes, medico:- legal aspects, Autopsy-aims and objectives.

Post mortem changes: Earliest changes, post mortem staining, rigor mortis, Cadaveric spasm, putrefaction, mummification, adipocere formation.

Death due to asphyxia: (Hanging, strangulation, Suffocation, drowning) Hunger, Heat and Cold.

Unit V a. Toxicology: Poison and its medico legal importance, Law of poisons, Nature of poisoning- homicidal, suicidal, accidental, Routes of administration and fate of administration, Kinds of Poisons & their actions, Diagnosis of Poisoning.

- b. Classification of poison & Duty of Medical Practitioner in case of suspected poisoning:** Corrosives - Sulphuric acid, hydro chloric acid, nitric acid, Aqua Regia, Irritants- Inorganic poison – non-metallic and metallic (Phosphorous, Chlorine, Arsenic, Antimony, Mercury), Organic poison – vegetable poison (castor oil seeds, madar, aloes), animal poison (snakes), Mechanical – diamond dust, powdered glass.
- c. Systemic poison:** Affecting brain-opium, barbiturates, alcohol, chloroform, dhatura, belladonna, affecting cardio vascular system- aconite, affecting respiratory system poisonous irrespirable gases (carbon monoxide, etc.).
- d. Diagnosis of poisoning in dead and living:** Modern identifying technique to identify the poisoning, Duty of medical practitioner in case of suspected poisoning.

Suggested Readings:

Modi,J.P.(2016).A Text-Book of Medical Jurisprudence and Toxicology. LexisNexis

Parikh.C.K.(2016).Parikh's Text Book of Medial Jurisprudence & Toxicology.CBS Publishers and distributors Pvt Ltd.

Sharma.B.R.(2016).Forensic Science in Criminal Investigation and Trials. Universal Law Publishing

Mahanta.P.(2014).Modern Textbook of Forensic Medicine and Toxicology. Jaypee publications.

Suggested E-Learning Material:

National Mission on Education through ICT , Forensic science- e-PG pathshala – infliibnet, Retrieved from

<http://epgp.inflitnet.ac.in>,

Notes by Renzitte, Marcia/Forensic Science Lecture-Caldwell-West Caldwell Retrieved from <http://www.cwcboe/page/1087>

Society in India

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After the completion of the course, the students will be able to

Understand the ethnic and cultural heritage of India.

Identify the tribal culture and traditions of Indian society.

Discuss the features of rural and urban society and their continuum.

Critically analyze social issues in rural, urban and tribal communities in India.

Unit 1 The textual and the field view of Indian society; the significance of the field view; the interface between the present and the past. Women, minorities and Dalits, issues.

Unit 2 Cultural and Ethnic Diversity: historically-embedded diversities in respect of language, caste, religious belief and practices and cultural patterns. Basic institutions of Indian society: Concept of caste, religion and class & changing dimensions.

Unit 3 Change and Transformation in Indian society; nation-building and national identity; Dimension of Social Change, urbanization, concept of subalterns, and social transformation.

Unit 4 The structure and composition of Indian Society, Rural Society and Urban Society, Agrarian unrest, changing rural society, Rural-Urban Continuum.

Unit 5 Movements of India - Peasant Movement, Environmental Movements, Students Movements, Dalit Movement and Women's Movement.

Suggested Readings:

Ahuja, R. (2002). *Society in India* (Hindi & English). Jaipur, Rawat Publication

Dube, S.C. (1990). *Indian Society* (Hindi & English). New Delhi, National Book Trust.

Mandelbaum, D. G. (1972). *Society in India*. Bombay, Popular Publication.

Sharma, R. (1981). *Indian Society*. Bombay, Media Promoters.

Sharma, R. (1981). *Indian Society*. Bombay, Media Promoters.

Shrirama, I. (1999). *Society and Culture in India*. New Delhi, Rawat Publication.

Suggested E-Learning Material:

Cultural and Social Anthropology, Platform: NVAO.net, Link:

https://search.nvao.net/files/51c0c2b94107c_rapport%20UvA%20wo-ma%20Cultural%20and%20Social%20Anthropology.pdf

2. Introduction to Rural Society, Platform: e-Gyankosh.in, Link:

<http://egyankosh.ac.in/bitstream/123456789/31744/1/Unit-1.pdf>

Rural-Urban Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course student will be able to:

Evaluate the status of administration in India.

Examine the working of the local bodies in their areas

Analyze the condition of agriculture in rural areas.

Evaluate the working of various institutions and commissions in India

Unit 1 Meaning and Scope of Development Administration, Welfare State: Meanings Objectives and functions.

Unit 2 Urban Local Bodies : Municipal Corporation, Municipal Council & their meaning, Features, Role and significance.

Panchyati Raj Institutions : Composition, Functions, Sources of Income of Gram Panchyats and ZilaParishads.

Unit 3 District Planning Committee, Composition and their Significance, State Finance Commission, State Election Commission, Urban-Rural, Local Leadership.

Unit 4 Agriculture Development, Problems and causes of the Backwardness of Agriculture development, Programme of the Centre and State Government for agriculture development.

Unit 5 Social Welfare Administration in India Institutional Framework and Programmes of Centre and State Governments for the Welfare of Scheduled Castes, Women and Children. Organisation of Planning Agencies: NITI AAYOG, National Development Council, State Planning Board.

Suggested Readings:

Sharma, P.D.& Sharma, B.M. (2009). *Indian Administration Retrospect and Prospec*. Jaipur: Rawat Publication.

Dhingra, I. C. (2014). *The Indian Economy Environmental and Policy*. NewDelh: Sultan Chand & Sons

Sapru, R.K. (2002). *Development Administration*. New Delhi: Sterling Publications.

Sharma, VirenderPrakash (2010). *GraminSamajShastra*. Jaipur: PanchheelPrakashan.

Maheswari, S.R.. (2008). *Local Governments in India*. New Delhi: Laxmi Narayan Publication.

Suggested E-Learning Material:

<https://epgp.inflibnet.ac.in/ahl.php?csrno=30>

State & Local Government Review <http://www.jstor.org/action/showPublication?journalCode=statlocagovervi>
Alternatives: Global, Local, Political- <http://www.jstor.org/action/showPublication?journalCode=alternatives>

Labour Law – II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to understand the provisions of the Factories Act, 1948.

The students will be able to know the provisions and procedure about the factory inspection.

The students will be able to understand the provisions and procedure of the Minimum Wage Act, 1948, Maternity Benefits Act, 1961, Employees' State Insurance Act, 1948.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I The Factories Act, 1948: History of Factory Legislation: Concept of Welfare, Objects and reasons – Scope and Applicability – Definition of some important terms.

Unit II The inspecting staff – Health, Safety, Welfare, Working House of Adults – Employment of young persons- Annual leave with wages. Special provisions – Penalties and Procedure – New Provisions inserted vide Factories (Amendment) Act of 1987.

Unit III The Minimum Wage Act, 1948 Concept of Wages, Particularly Minimum Fair, and Living Wages, Need base minimum wage – Aims and objects of Minimum Wages Act – Application, Exceptions and Exemptions – kind of wages; Fixation and revision of minimum rates of wage, Adjudication of claims relating to minimum wages and Miscellaneous provision

Unit IV Maternity Benefits Act, 1961.

Unit V The Employees' State Insurance Act, 1948: Introduction, Objectives, Definition. Administration of the Act Corporation, Standing Committee and Medical Benefits Council, Finance and Audit, Contributions, Benefits, General Provisions, Adjudication of Dispute and Claims, Penalties, Miscellaneous.

Leading Cases:

1. Uttaranchal Forest Development Corporation and Another v. Jabar Singh & others, 2006 INDLAW SC 1247
2. Rohtas Industries Ltd. v. Ramlakhan Singh, (1978) 2 SCC 140: 1978 SCC (L&S) 161
3. Ardeshir H. Bhuwandiwalla v. State of Bombay, 1961 INDLAW SC 354, AIR 1962 SC 29 (1962): 20 FJR 113
4. Express Newspapers v. Union of India, (AIR 1958, SC 576)
5. Sangam Press v. Its Workmen, AIR 1975, SC 2035
6. Bharat Bank Ltd. v. Employees, AIR 1950 SC 188
7. Karnal leather Karamchari Sangathan v. Liberty Footwear Co. AIR 1990 SC 247
8. The State of Madras v. C.P. Sarathy, AIR 1953 SC 53
9. J.K. Synthetics Ltd. v. K.P. Agarwal, (2007) 2 SCC 433
10. Delhi Cloth and General Mills Ltd. v. Kushal Bhan , AIR 1960 SC 806
11. Debotosh Pal Choudhary v. Punjab National Bank, AIR 2002 SC 3276

12. Neeta Kaplish v. Presiding Officer, Labour Court, AIR 1999 SC 698
13. The Management, Hotel Imperial v. Hotel Workers Union, AIR 1959 SC 1342
14. Crown Aluminum Works Ltd. v. Workmen, AIR 1958 SC 130
15. Jalan Trading Co. (P.) Ltd. v. Mill Mazdoor Sabha AIR 1967 SC 69
16. Vishakha v. State of Rajasthan, AIR 1997 SC 3110
17. B.P. Gopal Rao v. Public Prosecutor, AIR 1970 SC 66
18. Ardeshir H. Bhuwandiwalla v. State of Bombay, AIR 1962 SC 29

Suggested Readings:

1. Singh Avtar & Kaur Harpreet., (2008) Introduction to labour and industrial laws, 4th edition, New Delhi: LexisNexis
2. Mishra, S.N., (2009) Labour and Industrial Laws, 28 editions, Allahabad: Central Law Publication.
3. Malik, P.L., (2009) Handbook of Labour and Industrial Law. Lucknow: Eastern Book Company
4. Srivastava Prof. S.C. (2007) Labour Law and Labour Relations: Cases and Material 2002, New Delhi: Indian Law Institute

Suggested E-Learning Material:

1. Pandey Shubhi (2018) Registration of Trade Union under Trade Union Act 1926 Retrieved from <https://www.legalbites.in/law-library-notes-study-material-llb-llm-judiciary-entrance/>
2. Deshmukh Hanumant (2018) Labour Laws Industrial Disputes Act Retrieved from <https://a19.in/law/llb-llm-law-notes>
3. Tiwari Smriti (2018) The Factories Act, 1948 Retrieved from <http://www.legalserviceindia.com/legal/article-149-the-factories-act-1948.html>
4. Maternity Benefit Act., 1961 which was amended in 2017 with several major changes. (2017) retrieved from <http://www.indialawoffices.com/legal-articles/maternity-benefit-act-1961-with-latest-amendments-of-2017>

Interpretation of Statutes and Principles of Legislation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The student will be able to Locate, identify and critically analyse relevant statutes, statutory provisions and legislative instruments, as well as pertinent judicial authority;

The student will be able to interpret the appropriate provisions using the accepted tools and techniques of statutory interpretation;

The student will be able to apply statutory provisions to fact scenarios and communicate the interpretation, nature and effect of statutory provisions to relevant stakeholders, such as clients and courts.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction – Meaning, Purpose and Scope of Interpretation and construction of Statutes; Nature of Statutes and their Classifications, Rules of Construction under the General Clauses Act, 1897.

Unit II Basic and General Principles of Interpretation: Literal Rule, Golden Rule, Mischief Rule, Dworkin's Theory of Interpretation.

Unit III Subsidiary Rules of Interpretation: *Noscitur a sociis, Ejusdem Generis, Expresso Uno Est Exclusio Alterius, Ut Res Magis Valeat Quam Parae, Reddedo Singula Singulis, Generalia specialibus non derogant, Leges posterioris prioris contrarias abrogant.*

Internal Aids to Interpretation: Title, Preamble, Headings and Marginal Notes, Punctuation, Illustrations, Definitions, Proviso, Explanation, Schedule, etc.

External Aids to Interpretation: Parliamentary History, Historical facts and surrounding circumstances, Later social, political, scientific and economic developments, Dictionaries, Foreign decisions, Reference to other statutes (*Statutes in pari materia*), Effect of Usage and Practice; *Contemporanea Expositio*.

Unit IV Interpretation of Constitution: Power of Judicial Review, Judicial Activism, Harmonious Construction, Principle of Basic Structure, Principles of Plenary Powers, Principles of Implied Powers, Principles of Colorable Legislations, Principles of Territorial Nexus, Theory of Pith and Substance.

Unit V Interpretation with Reference to Subject Matter and Purpose of Statutes: Beneficial Statutes, Penal Statutes, Taxing Statutes or Fiscal Statutes, Subordinate Legislations, Repeal of Statutes.

Leading Cases:

1. Girija K. Phukan v. State of Assam, 1984 (2) LR 488
2. Bengal Immunity Co. Ltd. v. State of Bihar, 1955 2 SCR 603
3. Smti Charu Deka v. Umeswari Nath & other, AIR 1995 Gau 9
4. P. Ramchandra Rao v. State of Karnataka, (2002) 4 SCC 578
5. Bhatia International v. Bulk Trading S.A., (2002) 4 SCC 105
6. R.M.D.C. v. Union of India, AIR 1957 SC 628
7. Avtar Singh v. State of Punjab, AIR 1955 SC 1107

8. A.S. Sulochana v. C. Dharmalingam, AIR 1987 SC 242

Suggested Readings:

1. Kafaltiya, A.B. (2010). *Interpretation of Statutes*, Universal Law Publishing Co.
2. Sarathi, V. P. (2010), *Interpretation of Statutes*, (4th Ed.) Lucknow, EBC.
3. Tandon, M.P. *Interpretation of Statutes and Legislation*. Allahabad: ALA
4. Gandhi, B.M. *Interpretation of Statutes*, Lucknow: EBC 2006
5. Roy and Bawa., *Interpretation of Statutes*, Allahabad: ALA (Latest Edition)
6. Rao, M.N. and Dhanda, Amita.Bindra's *Interpretation of Statutes*, Allahabad ALA (Latest Edition)
7. Singh, G.P., *Principles of Statutory Interpretation*, Lexis Nexis Butterworths Wadhwa, 2011

Suggested E-Learning Material:

Robert R. Wilson. (1939). Some aspects of treaty Interpretation. The American Journal of International Law.

Jmaes Gould. (1983). the golden Rule. American Journal of Theology and Philosophy.

Geoffrey Marston.(1976). Statutory Interpretation. Cambridge Law Journal.

Civil Procedure Code – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

To analyze, outline and assess the structure and purpose of the civil courts system as it presently operates.

To assess the sources of procedural rules and practices in the Supreme Court. Assessment criteria.

To analyze and evaluate the steps prior to litigation, the process of preparation for trial and the enforcement of judgments or orders and costs.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit

Unit I Introduction: Historical Development, Scheme of the Code of Civil Procedure, Constitution of Civil Courts and their Hierarchy, Definition-Decree, Order, Mesne Profit; Place of Suing and Jurisdiction, Foreign Judgment, Meaning of Suits of Civil Nature.

Unit II Suits in General Res Sub-Judice and Res-Judicata , Cause of Action, Parties to Suit, Non-Joinder and Frame of Suits, Institution of Suits, Issuance of Summons and Service of Summons, Effect of Non-Appearance of the Parties, Setting aside ex-parte decree

Unit III Pleadings: Meaning and Content, Complaint, Written Statement, Set off & Counter Claim, Amendment of Pleading, Impounding or Return of Documents.

Unit IV Trial of Suits: Examination of Parties and Framing of issues, Disposal of Suit at the First Hearing, Summoning and Attendance of Witness, withdrawal, Adjustment and Compromise of a Suit, adjournment, Hearing of Suit / Examinations of Witnesses, Judgment and Decree, Death of parties.

Unit V Suits of Special Nature: Representative Suits by or against Government or Public Servant, Suit by Indigent Person, Suit by or Against Minors and Persons of Unsound mind, Interpleader Suits, Suit by or against Corporations or Firms, Suit Relating to Public Nuisance and Public Charities.

Leading Cases:-

1. Shakuntala Devi v/s Kuntal Kumara, AIR 1969 SC 575
2. Vidyacharan v/s Khal Chan, AIR 1964 SC 1099
3. Dhulabhai v/s State of M.P., AIR 1969 SC 78
4. RSDV Finance Pvt. Ltd. v/s Shree Ballabh Glanworks Ltd., AIR 1993 SC 2094
5. Raja Bhagwati Baksh Singh v/s Civil Judge, AIR 1961 ACC 556
6. Amarnath Dogra v/s Union of India, AIR 1963 SC 424
7. N.P. Thirugnanam v/s Dr. R. Jagan Mohan, AIR 1996 SC 116

Suggested Readings:

Takwani, C.K. (2018). *Code of Civil Procedure* (8th ed.). Lucknow: Eastern Book Company.

Ganguly, M.R. (2017). *Civil Court, Practice and Procedure* (11th ed.). Lucknow: Eastern Law House.

Tandon, M.P. (2018). *Code of Civil Procedure* (11th ed.) Allahabad Law Agency.

Suggested E-Learning Material:

Moschzisker, R. (1929). The Yale Law Journal. The Yale Law Journal Company. Inc. Retrieved

from: https://www.jstor.org/stable/790303?Search=yes&resultItemClick=true&searchText=res&searchText=judicata&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Dres%2Bjudicata&ab_segments=0%2Ftbsu

b1%2Frelevance_config_with_tbsub&refreqid=search%3A5b0238each16e005ee17a7c02a9680ea&seq=1#metadata_info_tab_contents

Loyd, W. (1916). University of Pennsylvania Law Review and American Law Register. The University of Pennsylvania Law Review. Retrieved From :

https://www.jstor.org/stable/3313138?Search=yes&resultItemClick=true&searchText=set&searchText=off&searchText=and&searchText=counter&searchText=claim&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Dset%2Boff%2Band%2Bcounter%2Bclaim&ab_segments=0%2Ftbsub1%2Frelevance_config_with_tbsub&refreqid=search%3A0a6f9992e42bec78a5248980be4e5e95&seq=1#metadata_info_tab_contents

3. Pettit, P. (1959). The Modern Law Review. Wiley on behalf of the Modern Law Review. Retrieved from:https://www.jstor.org/stable/1090910?Search=yes&resultItemClick=true&searchText=amendment&searchText=of&searchText=pleadings&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Damendment%2Bof%2Bpleadings&ab_segments=0%2Ftbsub1%2Frelevance_config_with_tbsub&refreqid=search%3A48cfc1e28bac7e755305ffede6e6b245&seq=1#metadata_info_tab_contents

4. Watson, W. (1947). Parties: Representative Suits under Federal Rule 23.(California Law Review, Inc.) Retrieved from: https://www.jstor.org/stable/3477256?Search=yes&resultItemClick=true&searchText=representative&searchText=suits&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Drepresentative%2Bsuits&ab_segments=0%2Ftbsub1%2Frelevance_config_with_tbsub&refreqid=search%3Ad6a134649fde7f745460a84275688b5&seq=1#metadata_info_tab_contents

Retrieved from: https://www.jstor.org/stable/3477256?Search=yes&resultItemClick=true&searchText=representative&searchText=suits&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Drepresentative%2Bsuits&ab_segments=0%2Ftbsub1%2Frelevance_config_with_tbsub&refreqid=search%3Ad6a134649fde7f745460a84275688b5&seq=1#metadata_info_tab_contents

Criminal Procedure Code– I

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

4 1 0 5

Learning Outcomes:

The students will be made aware about constitution of Criminal Courts & requisites for institution of criminal proceedings.

The students will be able to initiate various procedures for seeking justice in criminal cases.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction: Object, Nature and Development of Law relating to Criminal Procedure in India, Classification of Various Criminal Courts, their Powers and Jurisdiction.

Definitions: Summons and Warrant Cases, Cognizable and Non-Cognizable Offences, Bailable and Non-Bailable Offences, Compoundable and Non-Compoundable Cases, Meaning of Complaint and Police Report, Enquiry, Investigation, Charge, Trial and Public Prosecutor.

Unit II Preventive Actions of Police and Executive Magistrate: Powers of police officers to prevent the commission of cognizable offences and arrests of persons, Supreme Court's directions regarding arrest.

Maintenance: Scope and Extent, Person Entitled for Maintenance, Condition for grant of Maintenance, Power and Procedure.

Maintenance of Public order and Tranquility: Unlawful assemblies, Public nuisances, Security for keeping peace and good behavior.

Unit III Conditions Requisite for initiation of proceedings; Investigation by Police: Introduction, Contents and Meaning of FIR, Lodging of FIR, Registration, Recourse in case of Non-registration of FIR, Effect of Delay in lodging FIR, Difference between Investigation of Cognizable Offence and Non-cognizable Offence, Procedure of investigation, Search and Seizure, Arrest, Filing of charge Sheet / Final Report, The process to compel the accused before the court.

Unit IV Complaint before Magistrate: Complaint and its Contents, Various Courses open to the Magistrates for Verifying the Allegations made in Complaint, Enquiry and Investigation Procedure in case of Complaint to Magistrate.

Bail: Object and Meaning, Bail in Bailable Cases, Bail Non-Bailable Cases, Anticipatory Bail, Forfeiture of Bail and Bail Bonds.

Unit V Cognizance of Offences by Court: Meaning and Scope of Cognizance, Cognizance by Magistrates, Cognizance by Court of Sessions, Conditions essential before taking Cognizance.

Charge: Meaning and Content, Form of Charges/ Charges, Joinder of Charges.

Leading Cases:-

1. State of Haryana v/s Bhajan Lal, AIR 1992 SC 604
2. T.T. Anthony v/s State of Kerala, AIR 2001 SC 2637
3. Delhi Domestic working Women's Forum v/s Union of India and other, 1975 SCC 14
4. Joginder Kumar v/s State of U.P & other, 1994 SCC 260
5. D.K. Basu v/s State of West Bengal, AIR 1997 SC 610
6. Sheela Barse v/s State of Maharashtra, 1983 SCC 96
7. Icchu Devi Choraria v/s Union of India, 1980 SCC 531

8. Hussainara Khatoon v/s Home Secretary State of Bihar, AIR 1979 SC 1360
9. Nandini Satpathy v/s Dani, AIR 1978 SC 1025
10. Rupan Deol Bajaj v/s K.P.S. Gill, AIR 1996 SC 309
11. State of Gujarat v/s Lal Singh, AIR 1981 SC 368
12. Subodh Kumar v/s State of Bihar, (2009) 142 SCC 638
13. Union of India v/s Prafulla Kumar, AIR 1979 SC 366
14. Mohd. Ahmed Khan v/s Shah Bano Begum, AIR 1985 SC 945
15. D. Velusamy v/s D. Patchaiamm, (2010) 10 SCC 469
16. Vijay Manohar v/s Kashirao Rajaram, AIR 1987 SC 1100
17. Madhu Limaye v/s Sub-Divisional Magistrate Monghyr, AIR 1971 SC 2486
18. Ratlam Municipality v/s Vardhi Chand, AIR 1980 SC 1622

Suggested Readings:

Pillai, K.N.C. and Kelkar, R.V. (2007). *Lectures on Criminal Procedure*, Lucknow: EBC.

Dhirajlal and Ratanlal. (2009). *Code of Criminal Procedure*. Lexis Nexis Butterworths Wadhwa Publication,

Pillai, K.N.C. and Kelkar, R.V.(2008) *Criminal Procedure*. Lucknow: EBC,

Suggested E-Learning Material:

Sudesh k.Sharma. (1980). Dimensions of judicial discretion in bail matters. ILI. (2019, Feb.11) Retrieved from [http://14.139.60.114:](http://14.139.60.114:8080/jspui/bitstream/123456789/16651/1/015_Dimensions%20of%20Judicial%20Discretion%20in%20Bail%20Matters%20%28351-376%29.pdf)

[8080/jspui/bitstream/123456789/16651/1/015_Dimensions%20of%20Judicial%20Discretion%20in%20Bail%20Matters%20%28351-376%29.pdf](http://14.139.60.114:8080/jspui/bitstream/123456789/16651/1/015_Dimensions%20of%20Judicial%20Discretion%20in%20Bail%20Matters%20%28351-376%29.pdf)

Vrinda Grover. (2005). Prevarication on Code of Criminal Procedure code. Economic and political weekly. (2019, Feb.11) Retrieved from <https://www.ohchr.org/Documents/HRBodies/SP/CallApplications/HRC36/WGWomenAsianStates/GROVER%20Vrinda%20form.docx>

Public International Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to get indepth knowledge of Public International Law.

The students will be able pursue careers in government agencies, international organisations, non-governmental organisation and the private law firms which are dealing in global legal issues.

The students will be able get theoretical knowledge and handle the complexity of drafting of various instruments which encouraged them to think creatively about the challenges within the Public International law.

The students will able to understand a system regulating interstate interactions.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction: Definition, Development, Nature, Binding-force, Subjects, Basis and Codification of International Law, Customary and Modern International Law, Relationship between International Law and Municipal Law, Distinction between Public and Private International Law and Sources of International Law.

Unit II Recognition in International Law: Concept, kind and Theories, Legal Consequences

State Succession: Definition and kind of Succession, Consequences of State Succession

State Jurisdiction: Principles of Civil and Criminal Jurisdiction, Jurisdictional Immunities to Heads of States and Diplomatic Agents, Extradition and Asylum.

The Law of Treaties: Definition, Binding-Force, Making of Treaties, Reservations, Amendments and, Termination of Treaty and Unequal Treaty

Unit III The law of warfare: War, Total War, Effects of War, Efforts to ban war, War Crimes, Enemy character, Law of War: International Humanitarian Law – Law of Land, Naval and Aerial Warfare, International Criminal Court, Efforts towards control of Nuclear Weapons, Belligerent Occupation, Neutrality, Rights and duties of belligerents and neutral states, Blockade, Contraband of War, Doctrine of Continuous Voyage, prize courts, right of Angry, International Terrorism and Counter Terrorism.

Unit IV International Organizations: The League of Nations, Defects, The UNO – Origin, UN Charter, Amendment of The Charter, the General Assembly – Composition, Voting Right and Contribution, Security Council – Composition, Veto, Double Veto, Contribution in settlement of Disputes, Collective Security, Uniting for Peace Resolution, ECOSOC, Trusteeship Council, Secretariat and ICJ – Composition, the Statute of the ICJ, Role in the Settlement of Disputes and in the Development of International Law, Contribution of the UN on International Level.

Unit V Specialized agencies of the UN – ILO, WHO, UNESCO, IBRD, IMF AND WIPO – Origin, Functions and Contribution, The Role of International Financial Institutions in Globalization.

International Responsibility of States: Kinds of State Responsibility, Consequence of State Responsibility.

Leading Cases:-

1. UK v/s Albania, 1949 ICJ Rep 4. (Corfu Channel Case)
2. Nicaragua v/s USA, 1986 ICJ Rep 14 (Military & Paramilitary Activities against Nicaragua case)
3. Columbia v/s Peru, 1950 ICJ Rep 266. (Asylum case)
4. Federal Republic of Germany v/s Denmark & Netherlands, 1969 ICJ Rep 3. (North Sea Continental Shelf case)
5. UK v/s Norway, 1951 ICJ Rep 116. (Anglo Norwegian Fisheries case)
6. France v/s Turkey, (1927) PCIJ Ser. A, No. 10, 4. (S.S. Lotus case)
7. Liechtenstein v/s Guatemala, 1955 ICJ Rep 4. (Nottebohm case)
8. Corfu Channel Case, ICJ Rep. (1949)
9. Kutch Arbitration Award, 1968
10. Shimoda Case, 1963
11. Zamora Case, 1916 AC 77
12. Nuremberg Trial, 1946
13. Tokyo Trial, 1946
14. Aerial Incident (Israel v/s Bulgaria) TCJ Rep. 1959
15. Shooting down of Pakistani Aircraft by India during Kargil war, 1999
16. Terrorists attack on America's WTC, 2001
17. Pakistani terrorist attack on Indian Parliament, 2001

Suggested Readings:

Kapoor, S.K. (2011). *International Law* (15th ed.). Allahabad: Central Law Agency.

Tandon, M.P. (2017). *Public International Law* Allahabad: Central Law Agency.

Shearer, I. A. (2011). *Starke's International Law* New Delhi: Oxford University Press.

Stone, J. (1959). *Legal Controls of International Conflicts* US: Rinehart.

Jennigs, R. (1993). *Oppenheim's International Law* Vol. I Parts I & II. New Jersey: Law Book Exchange LTD

Kelsen, H. (2011). *The Charter of the United Nations* New Jersey: Law Book Exchange Ltd.

Suggested E-Learning Material:

Karamanian S.L. Public International Law versus Private International Law: Reconsidering the Distinction
Retrieved from
http://www.oas.org/es/sla/ddi/docs/publicaciones_digital_XL_curso_derecho_internacional_2013_Susan_L_Karamanian.pdf

Argent P. D. Lecture on International Law. Retrieved from <https://www.youtube.com/watch?v=euwsKG5MyqM>

Kashyap Aprajita. Lecture on International Organization. Retrieved from
<https://www.youtube.com/watch?v=lv3Z4VAvboM>

Note : Students will be required to opt one course from the list of Discipline electives.

Health Law

Max. Marks : 100

L T P C

Learning Outcomes:

The students will have appropriate level of knowledge of various laws relating to health care, including Mental Health, Transplantation of Organs & Tissues Act, AIDS Act, etc.

The students develop their understanding regarding medical ethics and medical profession, and topics like medical negligence, euthanasia, surrogacy, etc.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Basic Concepts/ Introduction

Concept of Health, **Constitutional Provisions relating to Health, Health as Human Rights**, Health Care and Public Health in India

Mental Health – Indian Mental Healthcare Act, 2017

Unit II Medical Science & Technology

Infertility: Causes of Infertility and Remedies, *Pregnancy*, Artificial Reproductive Techniques – Artificial Insemination, IVF, Test Tube Baby, Surrogacy and Surrogacy Bill.

Abortion: Classification of Abortion, Law relating to Abortion - Medical Termination of Pregnancy Act, 1971, The Pre-Conception and Pre-Natal Diagnostic Techniques (Prohibition of Sex Selection), 1994

HIV AIDS (Prevention and Control) Act, 2017

Unit III Medical Negligence & Liability

Medical Negligence: Civil and Criminal Negligence, *Provisions in I.P.C. and Cr.P.C.*

Liability of Doctors: Civil and Criminal Liability of Doctors, Vicarious Liability of Doctors, Liability of Doctors under Consumer Protection Act, 1986,

Defences: Volenti Non fit Injuria, Novus Actus Interveniens, Therapeutic Misadventure, Contributory Negligence, Product Liability, etc.

Exceptions: Doctrine of res ipsa loquitur, Doctrine of Common Knowledge.

Unit IV Law Relating to Medical Men

Medical Ethics: Indian Medical Council, State Medical Council, Indian Medical Councils Act, 1956, Code of Ethics by World Association of Human Experimentation (**Helsinki Declaration**).

Laws regulating Medical Profession: The Indian Medical Council Act, 1956: Objectives, Definition and Constitution of different Boards and their powers, Punishments & Penalties

Ayushman Bharat Yojana

Unit V Other Relevant Laws

Transplantation of Human Organs & Tissues Act, 1994.

Drug & Cosmetic Act, 1940: Objectives & definition; Blood – Action as Drug; Drug Licensing Procedure, Comparative study of Foreign Law & Cases decided by Courts.

Patent Regime in Pharmaceutical Industry

Law Relating to Poison – **Provisions in I.P.C., Poison Act, 1919**

Euthanasia– **Indian Law and Cases decided by Indian Courts; Comparative Study of Foreign Law.**

Leading Cases:

Aruna Ramchandra Shaunbaug vs. Union of India &Ors., 7 March, 2011

Bolam vs. Friern Hospital Mgmt. Committee, 1957 (1) WLR 583

Bolitho v. City & Hackney Health Authority, (1998) 1 AC 232

Gian Kaur vs. State of Punjab, 1996 2SCC 648

Indian Medical Association vs. V. P. Shantha &Ors., 13 November, 1995

Jacob Mathew vs. State of Punjab &Anr., 5 August, 2005

Kunal Saha vs. AMRI, 2006 CPJ 142 (NC)

Parmanand Katara vs. Union of India &Ors., 1989 4SCC 286

Paschim Banga Khet Mazdoor Samity &Ors vs. State of West Bengal &Anr., 1996 (4) SCC 37

Vincent vs. Union of India, 1987 SC 990

Suggested Readings:

Adhikary, Dr. Nandita (2015). *Law & Medicine*. (4th Edition) Allahabad, Central Law Publications.

Shana, Jyotsna William (2011). *Law of Medical Science and Medical Evidence*. Delhi, PAL Publishing House.

Srivastava, Dr. Lily (2010). *Law & Medicine*. Delhi, Universal Law Publishing Co. Pvt. Ltd.

Suggested E-Learning Material:

Chaille, Stanford Emerson (1950). Origin and Progress of Medical Jurisprudence 1776 – 1876, Retrieved from <<https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=3699&context=jclc>>

Mittal, Dr Shilekh, et. al. (2007), Evolution of Forensic Medicine in India, Retrieved from <<http://medind.nic.in/jal/t07/i4/jalt07i4p88.pdf>>

World Medical Association Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects (2008). Retrieved from <<https://www.wma.net/wp-content/uploads/2016/11/DoH-Oct2013-JAMA.pdf>>

Civil Procedure Code – II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to understand the practical aspects of Civil Procedure.

The students will be able to research properly and cite Legal authorities, such as cases, statutes and secondary sources.

The students will be able to understand the remedial procedure under the Civil Procedure.

The students will get aware with the provisions related to Law of Limitation.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit

Unit I Interim Measures during Pendency of a Suit: Temporary Injunctions and Inter- locutory Orders, Appointment of Receivers, Attachments and Arrests before Judgments.

Unit II Mode of Execution: Meaning, Executing Court, Transfer of Decree for Execution, Who can apply for Execution, Power of Executing Court, Application for Execution, Stay on Execution.

Unit III Mode of Execution: Attachment of Property, Sale of Movable and Immovable Properties, Delivery of Property, Rateable Distribution of Assets, Arrest and Detention, Execution of Decree of Restitution of Conjugal Right and Specific Performance of Contract.

Unit IV Appeal, Reviews, Revision, and Reference: Meaning and Differences, Appeal from Original decrees, Power of Appellate Courts, Appeal From Orders, Second Appeal, Appeal to Supreme Court, Review, Revision and Reference, Inherent Power of Courts.

Unit V Law of Limitation: Limitation: Meaning and application, Period of Limitation, Bar on Limitation, Continuous Running of Time, Extension of Prescribed period in certain cases, Legal Disabilities, Computation of Period of Limitation, Exclusion of Time in legal Proceeding, Effect of Death, Effect of Fraud or Mistake, Effect of Acknowledgments and Part Payment, Acquisition of Ownership by Possession.

Leading Cases:

1. Nawab Shaquafath Ali Khan v/s Nawab Imdad Jaha Bahdur, (2009) 5 SCC 162
2. Boodireddy Chandraiah v/s Arigela Laxmi, AIR 2008 SC 380
3. Puran Ram v/s Bhaguram, AIR 2008 SC 1960
4. Union of India v/s Kamalendu Shukla, AIR 2006 Pat 117
5. Deoki Nandan v/s Murlidhar, AIR 1957 SC 133
6. State of Karnataka v/s All India Manufacturers Organization, AIR 2006 SC 1846
7. Morgan Stanley Mutual Fund v/s Kartick Das, (1994) 4 SCC 225
8. Santokh Singh v/s Delhi Administration, AIR 1973 SC 1096
9. Ramchand & Sons Sugar Mills v/s Kanhayalal, AIR 1966 SC 1899
10. Damodaran v/s South India Bank Ltd., AIR 2005 SC 3460

Suggested Readings:

Takwani, C.K. (2018). *Code of Civil Procedure* (8th Ed.). Lucknow: Eastern Book Company.

Ganguly, M.R. (2017). *Civil Court, Practice and Procedure* (11th Ed.). Lucknow: Eastern Law House.

Tandon, M.P. (2018). *Code of Civil Procedure* (11th Ed.) Allahabad Law Agency.

Suggested E-Learning Material:

- Leubsdorf, J. (1978). The Standard for Preliminary Injunctions. *The Harvard Law Review Association*. Retrieved From :
https://www.jstor.org/stable/1340497?Search=yes&resultItemClick=true&searchText=%28The&searchText=Standard&searchText=for&searchText=Preliminary&searchText=Injunctions%29&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3DThe%2BStandard%2Bfor%2BPreliminary%2BInjunctions%2529&ab_segments=0%2Ftbsub-1%2Frelevance_config_with_tbsub&refreqid=search%3Af76402be5b18f26a75ce7341b059aaea&seq=1#metadata_info_tab_contents
- Gangadevi, M. (2003). RESTITUTION OF CONJUGAL RIGHTS: CONSTITUTIONAL PERSPECTIVE. *Indian Law Institute*. Retrieved From:
https://www.jstor.org/stable/43951874?Search=yes&resultItemClick=true&searchText=%28RESTITUTION&searchText=OF&searchText=CONJUGAL&searchText=RIGHTS%3A&searchText=CONSTITUTIONAL&searchText=PERSPECTIVE%29&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3D%2528RESTITUTION%2BOF%2BCONJUGAL%2BRIGHTS%253A%2BCONSTITUTIONAL%2BPERSPECTIVE%2529%2B&ab_segments=0%2Ftbsub-1%2Frelevance_config_with_tbsub&refreqid=search%3Acb1407c3ccbb3042c45cc733e9b76c64&seq=1#metadata_info_tab_contents
- Jones, G. (1987). Specific Performance of a Contract of Services? *Cambridge University Press on behalf of Editorial Committee of the Cambridge Law Journal*. Retrieved From :
https://www.jstor.org/stable/4506965?Search=yes&resultItemClick=true&searchText=Specific&searchText=Performance&searchText=of&searchText=a&searchText=Contract&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3DSpecific%2BPerformance%2Bof%2Ba%2BContract&ab_segments=0%2Ftbsub1%2Frelevance_config_with_tbsub&refreqid=search%3A51ddc5b557fd055d40760ff2eb5202a1&seq=1#metadata_info_tab_contents
- Dworkin, G. (1964). Statutes on the Limitation Act, 1963. *Wiley on behalf of the Modern Law Review*. Retrieved from :
https://www.jstor.org/stable/1093153?Search=yes&resultItemClick=true&searchText=limitation&searchText=act&searchText=1963&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Dlimitation%2Bact%2B1963&ab_segments=0%2Ftbsub1%2Frelevance_config_with_tbsub&refreqid=search%3A2000d617ac5474b674b9f9689be5241f&seq=1#metadata_info_tab_contents

Criminal Procedure Code – II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be aware with the intricacies of trial proceedings.

The concept of plea bargaining, double jeopardy etc under criminal justice system will be imbibed in the learner.

The students will understand remedial measures under criminal justice system.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Trial Procedure: General Provision regarding Trial, Session Trial, Warrant Trial – Cases Initiated upon a Police Report, Cases Initiated otherwise than on a Police Report and Conclusion, Summons Trial, by magistrates, Summary Trial,

Unit II Plea Bargaining, Provisions as to accused persons of unsound mind, Provisions as to offences affecting the administration, Rule of Double Jeopardy, Pardon to an Accomplice.

Unit III Judgment: Object, Meaning and Scope, Content of Judgment in Sessions and Warrant Cases Special Reasons to be Recorded in certain cases, Compensation and Cost, Modes of Pronouncing Judgment, Delivery of the Copies of Judgment to the Accused Person.

Unit IV Appeal, Revision and Reference: Appeal against Conviction, Appeal against Acquittal, No Appeal in Certain Cases, Powers of Appellate Courts, Revision Scope and Extent, Interlocutory and Final Order, Reference, Other Miscellaneous Provisions, Limitations for taking Cognizance of Offences, Irregular Proceeding and effects thereof, Inherent Powers of the High Court.

Unit V The Juvenile Justice Act, 2015: Preliminary, Competent Authorities and Institutions for Juveniles, Child in need of Care and Protection, child in Conflict with Law, Procedure of competent Authorities, and Appeals and Revision form Orders of such Authorities, Special Offences in respect of Juveniles, The Probation of Offenders Act, 1958, A Critical Study of the Act vis-a-vis the Provisions of Criminal Procedure Code.

Leading Cases:

1. Anil Rai v/s State of Bihar, AIR 2001 SC 3173
2. Union of India v/s Prafulla Kumar, AIR 1979 SC 366
3. Soma Chakravarty v/s State, (Th. CBI), AIR 2007 SC 2149
4. State of J&K v/s Duni Chand, 2006, Cri. L.J. (NOC) 254 (J&K)
5. Bachan Singh v/s State of Punjab, AIR 1980 SC 898
6. Machhi Singh v/s State of Punjab, AIR 1983 SC 957
7. K.P. Mohammed v/s State of Kerala, AIR 1984 Supp. SCC 684
8. Babu Singh v/s Reshampal Singh, 2007 Cr. L.J. 795

9. State of Gujarat v/s Natwar, 2005 Cri. L.J. 2957
10. Balbir Singh v/s State of Delhi, AIR 2007 SC 2397
11. Bhaskar Industries Ltd. v/s Bhiwani Denim & Apparels Ltd, AIR 2001 SC 3625
12. Chandrappa v/s State of Karnataka, (2007) 4 SCC 415
13. Sawant Singh v/s State of Rajasthan, AIR 1961 SC 715
14. Hari Singh v/s Sukhbir Singh, AIR 1988 SC 2127

Suggested Readings:

Pillai, K.N.C. and Kelkar. R.V. (2011). *Lectures on Criminal Procedure*. Lucknow: EBC.

Dhirajlal and Ratanlal. (2009). *Code of Criminal Procedure*. Lexis Nexis Butterworths Wadhwa Publication.

Suggested E-Learning Material:

Robert E. Scoot and William J. Stuntz. (1992). *Plea Bargaining as contract*. The Yale Law Journal. (2019, Feb. 11)

Retrieved from

<https://digitalcommons.law.yale.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=7444&context=ylj>

Michael H. Langley. (1973). *Juvenile Justice; Reneging on social legal obligation*. Social Survey Review.

(2019, Feb. 11) Retrieved from https://www.researchgate.net/publication/240564553_Juvenile_Justice_Reneging_on_a_Sociolegal_Obligation

Human Rights Law and Practice

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to think analytically about the implementation and development of international human rights law and to apply this body of law in your own professional and national setting.

The students will be able to promote an advanced and complex understanding of the theoretical, conceptual and practical challenges facing the fields of human rights law and sustainable development, adopting an interdisciplinary approach.

The students will be able to analyze complex problems, find and deploy a variety of legal authorities, and communicate effectively in a variety of settings.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Concept, Origin, Theories and Historical Development : International Human Rights Bill and Role of UNO - UNDHR, 1948; ICCPR, 1966; ICSCER.

Unit II Indian Constitution & the Human Rights

(i) Fundamental Rights. (ii) Directive Principles of State Policy; Implementation mechanism, Jurisprudence of Indian Judiciary & Human Rights (a) Role of the Supreme Court & High Courts (b) The Protection of Human Rights Act, 1993, National Human Right Commission.

Unit III Human Rights of Marginalized Class of the Society : Human Rights of Women, Children, Disabled and Accused, Criminals, International Convention on the Elimination of all forms of Discrimination against Women, 1979; Beijing Conference, 1995; Convention of Rights of Child, 1989.

Unit IV Rights against Torture, International Humanitarian Law : Geneva Convention, 1949; Two Protocols of 1977; Geneva Convention, 2005.

Unit V Implementation Mechanism at International Level, Human Right Commission, International Criminal Court.

Leading Cases:-

1. Aruna Ramchandra Shanbaugh v/s Union of India, AIR 2011 SC 1290
2. Dr. B.L. Wadehra v/s Union of India, (1996) 2 SCC 594
3. Rudal Shah v/s State of Bihar, AIR 1983 SC 1086
4. Virendra Gaur v/s State of Haryana, AIR 1991 SC 420
5. Chairman Rly. Board v/s Chandrima Das, AIR 2000 (2) SCC 465

6. Ramchandra Rao v/s State of Karnataka, AIR 2002 SC 1856
7. M.C. Mehta v/s State of Tamil Nadu, (1991) SCC 283
8. Bandhua Mukti Morcha v/s Union of India, (1997) 3 SC, 755
9. Vishakha v/s State of Rajasthan, AIR 1997 sc 3510

Suggested Readings:

1. Kapoor, Dr.S.K. (2017). International Law and Human Rights. (21thed.). Allahabad: Central law Agency.
2. M.P.Tandon, (2018).International Law and Human Rights. (18thEditions).Haryana: Allahabad Law agency.
3. Dr.Bhagyashree (2017). Human Rights Law and Practice, (1st ed.). Allahabad: Central Law Agency.
4. Jain, M.P. (2009). Constitution of India. LexisNexis Butterworths Wadhwas.
5. Kapoor, Dr.S.K. (2017). International Law and Human Rights. (5thed.). Allahabad: Central law Agency.
6. C.J.Nirmal (2010). Human rights In India Historical social and political perspective. (6th ed.). New Delhi:Oxford University Press.

Suggested E-Learning Material:-

1. United Nations (2015). Universal Declaration of Human Rights. Retrieved from http://www.un.org/en/udhrbook/pdf/udhr_booklet_en_web.pdf.
2. Pandey, A. Human Rights and the Indian Constitution. Retrieved from <https://sol.du.ac.in/mod/book/view.php?id=1473&chapterid=1377>.
3. Flowers, N. (1999). A Short History of Human Rights. Retrieved from <http://hrlibrary.umn.edu/edumat/hreduseries/hereandnow/Part-1/short-history.htm>.
4. Sandoz, Y., Swinarski, C. & Zimmermann, B. (Ed.). (1987). Commentary on the Additional Protocols of 8 June 1977 to the Geneva Conventions of 12 August 1949. Netherlands: International Committee of the Red Cross. Retrieved from http://www.loc.gov/rr/frd/Military_Law/pdf/Commentary_GC_Protocols.pdf

Intellectual Property Laws

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The learners will be able to use the principles of various IP laws while analyzing a problem related to IPR.

Proficiency with the ability to engage in competitive exams like Patent Attorney Trade Mark Agent etc will be developed.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction of Intellectual Property Law: Subject matter and scope of Intellectual Property Law, Nature of rights under Intellectual Property Law, Need for law on Intellectual property Rights, Definition of Intellectual Property Rights, Historical origin of Intellectual Property Law, A background to TRIPs Agreement, Structure of TRIPs Agreement, National Prospective on TRIPs.

Unit II Copyright: Meaning, Nature of copyright. International conventions on copyright, subject matter of copyright. Main feature of the Copyright Act, 1957, Definition of Copyright, Authorship and Ownership of Copyright: Rights conferred by Copyright, Copyright Board, Copyright Society, Performers Right, Licenses, Infringement of Copyright, Remedies against Infringement of Copyright.

Unit III Patents: Origin of Patent, Main features of the Patents Act, 1970. The Conceptual overview of patent ability, International agreement on Patent, Patent Co-operation Treaty, Subject matter of Patent, Procedure for obtaining the Patent, Transfer of Patent, Revocations of Patent, Infringement of Patent.

Unit IV Trademarks: Origin of Trademarks, International agreements and Trademark, main features of the Trade Marks Act, 1999, Registration of Trademarks, Property in Trademark, Assignment, Licensing of Trademark, infringement of Trademarks, remedial measures, passing off action.

Unit V Other Intellectual Property Rights: Industrial design, Geographical Indications, Know how -traditional knowledge, Plant Varieties, Farmer's Rights.

Leading Cases:-

1. Aerotel v. Telco & Macrossan's Application (UK, 2006)
2. Eldred v. Ashcroft, 537 U.S. 186 (2003)
3. Najma Heptulla v. Orient Longman Ltd. & Ors. On 19 August, AIR 1989 Delhi 63, 1988 (2) ARBLR 302 Delhi
4. R.G. Anand v. M/s Delux Films & Ors on 18 August, AIR 1978 SC 3123
5. Eastern Book Company & Ors. v. D.B. Modak & Ors. And Mr. Navin J, 101 (2002) DLT205

6. Parker v. Flook, 437 U.S. 584 (1978)
7. Diamond v. Diehr, 450 U.S. 175 (1981)
8. Bilski v. Kappos, 130 S. Ct. 3218, 561 US, 177 L. Ed. 2d 792 (2010)
9. Continental Can Company USA, and Inc Continental Pet Technologies, v. Monsanto Company, Hoover Universal, Inc. and Johnson Controls, Inc., 948 F.2d 1264 20 US.S.P.Q.2d 1746
10. Ampro food products v. Ashok Biscuit Works, AIR 1973 AP
11. Texla Metals & Pvt. Ltd. V. Anil Bhasin, 2001 OTC 146, Del.
12. B.K. Plastic Industries v. Jayantilal Kalidas Sayani, AIR 1972, Cal 339
13. Glaxo Smithkline Consumer Healthcare Gmbh and Co. Kg. v. Amigo Brushes Pvt. Ltd. 2004 14 ILD 357 Del.
14. Joginder Singh v. Tebu Enterprises (P) Ltd., AIR 1989, Del 16
15. Rotela Auto Components (P) Ltd. & Anr v. Jaspal Singh & Ors, 2002(24) PTC 449 del.

Suggested Readings:

Ahuja, V. K. (2016). *Law Relating to Intellectual Property Rights*. (2nd Edition) Gurgaon, LexisNexis.

Narayana, P. (2017). *Intellectual Property Law*. (3rd Edition Revised). Kolkata, Eastern Law House.

Sreenivasulu, N. S. (2018), *Law Relating to Intellectual Property*. (2nd Edition) Gurgaon: Universal Law Publishing

Steward, S. M. (1983). *International Copyright and Neighboring Rights*. London: Butterworth.

Wadhera, Dr. B. L. (2018). *Law Related to Intellectual Property Right*. (5th Edition). New Delhi: Universal Publisher.

Suggested E-Learning Material:

Trade Related Aspects of Intellectual Property Rights (2018, Jan. 15).

<https://www.wto.org/english/docs_e/legal_e/27-trips_01_e.htm>

What is intellectual Property? (2017, December 26)<[https:// www.wipo.int/about-ip/en/](https://www.wipo.int/about-ip/en/)>

Traditional Knowledge and IPR (2018, January 15) <https://www.wipo.int/pressroom/en/briefs/tk_ip.html>

Ludwig, S. Peter & Gogoris, Adda C. (1998) The GATT-TRIPS agreement—What it is and how it has changed the playing field for all applicants for United States patents, <https://www.science-direct.com/science/article/pii/S0167450198800289>

Administrative Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to analyse the advanced principles of administrative law, undertake self-directed legal research at primary level and evaluate complex legal information with a particular emphasis upon legislation.

The students will be able to apply principles of Administrative law to complex legal problems.

The students will be able to analyse the impact and operation of administrative law for government accountability

The students will be made aware about the legal remedies under Administrative law.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction of Administrative Law: Meaning of Administrative Law, its nature, scope, Sources of Administrative Law, Importance and functions. Droit administrative, Separation of Power, System of Check and Balance, Rule of Law.

Unit II Delegated Legislation: Meaning of Delegated Legislation, Causes for its growth, Delegated Legislation and Executive Legislation, Types of Delegated Legislation, Constitutionality of Delegated Legislation, Conditional Legislation, Controls of Delegated Legislation: Procedural, Parliamentary and Judicial.

Unit III Natural Justice: Meaning and its development. Rules of Natural Justice: Doctrine of Bias, Audi Alteram Partem; Exceptions to the Principles of Natural Justice, Ombudsman, Need and Importance of Ombudsman in modern democratic setup, The Lokpal in India: It's Jurisdiction and Functions, The Lokayukta in State: its Jurisdiction and Functions, The Central Vigilance Commission.

Unit IV Judicial Control on Administrative Actions: Remedies through writs, Article 32 and Article 226 of Constitution of India, Locus Standi, Writs : Habeas Corpus, Mandamus, Certiorari, Prohibitions and Quo Warranto.

Unit V Judicial Activism: Introduction and its origin, Instance of Judicial Activism, Public Interest Litigation, Its meaning and evolution in India, Vexatious and Frivolous Litigations, Government Privilege to withhold Evidence in Public Interest, Administrative Tribunals Act, Art.323A & B their Status.

Leading Cases:

Rai Sahib Ram Jawaya Kapur v. State of Punjab, AIR 1955 SC 549. 08

ADM Jabalpur v. Shivkant Shukla, AIR 1976 SC 1207

Indira Gandhi (Smt.) v Raj Narain AIR 1975 SC 2299

In re Delhi Laws Act, AIR 1951 SC 332. 27 Lachmi Narain v. Union of India, AIR 1976 SC 714. 41.

Rajnarain Singh v. Chairman, Patna Administration Committee, AIR 1954 SC 519.

A.K. Kraipak v. Union of India, AIR 1970 SC 150. 167

G.N. Nayak v. Goa University, AIR 2002 SC 790. 189

Hira Nath Mishra v. Principal, Rajendra Medical College, (1973) 1 SCC 197 805: AIR 1973 SC 1260.

Maneka Gandhi v. Union of India (1978) 1 SCC 248.

S.N. Mukherjee v. Union of India, AIR 1990 SC 1984.

Syed Yakoob v. K.S. Radha Krishanan (1964) 5 SCR 64: AIR 1964 SC 477. 248

Common Cause v. Union of India, AIR 2003 SC 4493.

Rupa Ashok Hurra v. Ashok Hurra, AIR 2002 SC 1771.

Dwarka Prasad Laxmi Narain v. State of U.P., (1954) SCR 803: AIR 1954 SC

Om Kumar & Others v. Union of India, AIR 2000 SC 3689

R. v. Secretary of State for the Home Department, Ex Parte Daly, 2001] UKHL 26

Ranjit Singh v. Union of India, AIR 1981 SC 461.

Nandlal Khodidas Barot v. Bar Council of Gujarat and others AIR 1981 SC 477.

L Chandra Kumar v. Union of India and others, AIR 1997 SC 1125

Suggested Readings:

Jain M.P. and Jain S.N. (2017). *Principles of Administrative Law* Revised by Amita Dhanda. Lexis Nexis.

Massey I.P. (2008). *Administrative Law*. Lucknow Eastern Book Company.

UPADHYAYA J.J.R. (2016). *Administrative Law*. Central Law Agency

Sathe S.P. (2013). *Administrative Law*. New Delhi: Lexis Nexis.

Jain. S.N. (1977). *Administrative Tribunals in India*. New Delhi: Lexis Nexis.

Kesari U.P.D. (2016). *Administrative Law*. Allahabad: Central Law Publications.

Suggested E-Learning Materials:

Lord Bingham, The Rule of Law, Vol. 66, No. 1 The Cambridge Law Journal, (March 2007) Retrieved from <https://www.jstor.org/stable/4500873?seq=1#metadata_info_tab_contents>

Report of the Committee on Ministers' Powers (Donoughmore Committee),(Cmd.4060)(1932) <https://www.jstor.org/stable/1947720?seq=1#metadata_info_tab_contents>

H.M. Seervai. (1970). "The Supreme Court of India and the Shadow of Dicey". The Position of the Judiciary under the Constitutional of India. Retrieved from <https://www.jstor.org/stable/10.2979/indjolegstu.20.1.221#metadata_info_tab_contents>

Roopashi Khatri . CALQ(2013) VOL 1.1 .Administrative Agency And Statutory Interpretation: A Comparative Analysis. Retrieved from <<https://www.manupatrafast.com/articles/PopOpenArticle.aspx?ID=df1f90e9-6f89429aab2dd262d3f948d2&txtsearch=Journal:%20Comparative%20Constitutional%20Law%20And%20Administrative%20Law%20>>

Media and Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to evaluate the role and impact of self-regulation on the media and journalists.

The students will be able to understand the role of the press in a democracy.

The students will be able to explain and apply the laws of defamation and Contempt of court, privacy law, broadcasting law and intellectual property to practice.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Press in India: A brief review – Evolution of Indian Press – Press laws before and after independence
Media and the Law: Concept of Freedom of Press.

Unit II Law Relating to Press: Freedom of Speech and Expression – Article 19 (1) (a): Includes Freedom of the Press, laws of Defamation, Obscenity Blasphemy and Sedition, Law relating to Employees' Wages and Service Conditions, Price and Page Schedule Regulation, Newsprint and Control Order, Advertisement- it is included with in freedom of speech and expression; Press and the MRTP Act.

Press laws after Independence: Defamation, Obscenity and Censorship, Contempt of Court, Parliamentary and Legislative Privileges.

Unit III Right to Information: Development of RTI in India, Right to information Act, 2005; its implementation, Right to Information Decisions; Decisions of Judiciary, RTI and Decisions of Chief Central Information Commissions and State Information Commission under the RTI Act, 2005.

Constitutional Restrictions: Radio and television subject to Law of Defamation, Morality and Obscenity, Power to legislate – Article 246 read with the Seventh Schedule, Power to Impose tax – licensing and license fee, Hate Speech, Censorship of films – Constitutionality, The Abbas Case, Difference between films and press – Why Pre-censorship valid for films but not for the press? Censorship under the Cinematography Act.

Unit IV Contempt of Court and Media – The Contempt of Courts Act, 1971

Law relating to Mass Media: Media Autonomy v Government Control, Protecting Civil Rights and Liberties – Right to Privacy, Laws of Defamation, Obscenity, Blasphemy and Sedition. Investigative Journalism & Sting operation – Harmonizing the Social Interest and promoting transparency.

Unit V Influence of Cyber laws and intellectual Property Rights on Media laws in India, Copyrights, Patents, Information Technology Act, 2000 with amendment. **Glossary of Journalism and Communication.**
Additional Readings: Newspaper Economy Enquiry Committee Report, Reports of Press Committee of India, Chanda Committee Report, B.G. Verghese Committee Report, P.C. Joshi Committee Report, Official Secrets Act.

Leading Cases: -

1. Zee Telefilms Ltd. V. Union of India, (2005) 4 SCC 649
2. Bennett Coleman and Co. v. Union of India, AIR 1973 SC 106

3. Romesh Thappar v. State of Madras, AIR 1950 SC 124
4. Sakal Papers Ltd. V. Union of India, AIR 1962 SC 305
5. Life Insurance Corporation of India v. Manu Bhai D. Shah, (1992)3 SCC 637
6. Ranjit Udeshi v. State of Maharashtra, AIR 1965 SC 881
7. Odyssey Communications Pvt. Ltd. V. Lokvidyan Sanghatana, (1983) 3 SCC 410
8. Indian Express Newspapers v. Union of India, AIR 1995 SC 965; 1995 (70) FLR 341
9. Tata Press Ltd. v. Mahanagar Telephone Nigam Ltd. (1995) 5 SCC 139
10. Hamdard Dawakhana v. Union of India, AIR 1960 SC 554
11. K.A. Abbas vs. Union of India, (1970)2 SCC 780; AIR 1971 SC 481
12. Bobby Art International v. Om Pal Singh Hoon, (1996)4 SCC: AIR 1996 SC 1846

Suggested Readings:

Goradia, Madhavi. (2010). *Facet of Media Law*. Lucknow: Eastern Book Company.

Basu, D.D. (2010). *The Law of Press of India*. Nagpur: Lexis Nexis Butterworths.

Myneni, Dr. S.R. (2017). *Media Law (with RTI Act)*. Hyderabad: Asia Law House.

Ratanlal & Dhirajlal. (34th edition). *The Indian Penal Code*. Nagpur: Lexis Nexis.

Jain, M.P. (2009). *Constitutional Law of India*. Nagpur: Wadhwa & Company.

Seervai, H.M. (2008). *Constitutional Law of India*. New Delhi: Universal Law Publishing.

Venkatramaiah, E.S. (1987). *Freedom of Press: some Recent Trends*. Delhi : B.R. Pub. Corp.

Sathe, S.P. (2005). *The Right to Information Act*. LexisNexis India.

Suggested E-Learning Material:

Press Council of India, Report on Paid News, 2010. (2019, Feb 11)

Retrieved from-<http://presscouncil.nic.in/OldWebsite/CouncilReport.pdf>

Law Commission, 200th Report on Trial by Media: Free Speech and Fair Trial under Criminal Procedure Code, 1973. (2019, Feb 11). Retrieved from: <http://lawcommissionofindia.nic.in/reports/rep200.pdf>

Press Council, Resolution for a Media Council, 2012. (2019, Feb 11). Retrieved from [http://presscouncil.nic.in/OldWebsite/ Resolution.pdf](http://presscouncil.nic.in/OldWebsite/Resolution.pdf)

Information Technology Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be made aware about different aspects of Information Technology Law.

The students will become acquainted with the ongoing issues under law managing in innovative perspective and the subject will urge them to do work in research field.

The students will learn different domains managed by information technology law, for example e-contract, digital signature.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction - Aims & objectives, Advantages and disadvantages of IT, Basic Concepts, Definitions, Salient features of Cyber Space.

E-Commerce – Definition, Advantages and Disadvantages, Models of E-Commerce, Problems in Electronic Records.

E-Governance – Meaning, Advantages of E-Governance, Legal recognition of electronic records, Retention of electronic records, E-Governance in India: An overview.

Unit II E-Contract – On-line contract, validity, Attribution of electronic records, Acknowledgement of receipt, time and place of formation of E-Contract. Dispatch and receipt of E-records, Security of Electronic records. **Digital Signature** – Function of Signature, Types of Cryptography.

Electronic Signature – Definition, Legal provisions relating to Electronic Signature and Digital Signature.

Unit III Certifying Authority – Appointment, Functions, Licenses, Powers **Electronic Signature certificates** - Application for granting of electronic signature Certificate, Digital Signature Certificate standards, suspension of Digital Signature Certificate, Revocation of Digital Signature Certificate.

Unit IV Subscriber – Meaning, Rights and Duties. **Cyber Appellate Authority** - Establishment, Composition, Qualification, Appeals, Procedures and Powers.

Unit V Cyber Crimes: - Definition, Classification, Essentials, Preventions. **Cyber Jurisdiction** - Introduction, Types of Jurisdiction, Indian Position(8)

Leading Cases:

1. Bharat Matrimony.com Pvt. Ltd. v. People Interactive (I) Pvt. Ltd., AIR 2009 Mad 78
2. Microsoft Corporation v. Rajendra Panwar, 2008 (36) PTC697 (Del).
3. Rediff Communication Ltd. V. Cyberboot, AIR 2000 Bom 27
4. Yahoo Inc. v. Akash Arora, 1999 PTC (19)201 (Delhi)
5. National Association of Software and Service Companies v. Ajay Sood, AIR 2005 NOC 269 (Del)
6. Manish Vij v. Indra Chug, AIR 2002 Del 243.
7. Aktiebolaget Volvo v. Volvo Steels Ltd, 1998 PTC 18 (Bombay) 14

8. Marks and Spencer PLC v. One in and Million, 1998 FSR 265
9. Kirloskar Diesel Recon Pvt. Ltd. V. Kirloskar Proprietary Ltd., AIR 1996 Bom 149
10. Montari Overseas v. Monatari Industries Ltd., 1996 PTC 142 (Delhi)
11. American Civil Liberties Union v. Reno, (1996) 929 F Supp 824
12. Erven Warnink v. Townend, 1980 RPC 31 12
13. Parker Knoll v. Knoll International, 1962 RPC 265
14. Cardservie International Inc. v. MC Gee, 42 USPQ 2d 1850
15. Satyam Infoway Ltd. v. Sifynet Solutions Pvt. Ltd. AIR 2004 SC 3540: (2004) 6 SCC 145
16. Sayad Asifuddin & Other v. The State of A.P., (2005) 3 Cr. L.J. 4314
17. Avinish Bazaz v. State (N.C.T.) of Delhi, (2005) 3 Comp, L.J. 364 (Delhi)

Suggested Readings:

Sharma, Vakul. (2011). *Information Technology Law and Practice*. Universal Law Publishing.

Rattan & Jyoti. (2011). *Cyber Law*. New Delhi. Bharat Law House.

Kamath & Nandan. (2009). *Law Relater to Computers Internet & E-Commerce*. Universal Law Publishing.

Seth & Karnika. (2009). *Cyber Law in the Information Technology Act*. Nagpur: Lexis Nexis Butterworth Wadhwa.

Chaubey, R.K. (2008). *Cyber Crime and Cyber Law*. Kolkata. Kamal Law House.

Suggested E-Learning Material:

Hosuk Lee-Makiyama. (2018). Potential Benefits of an Australia-EU Free Trade Agreement. University of Adelaide Press Retrieved from <https://www.jstor.org/stable/j.ctv9hj94m.19>

Mary D. Maury and Deborah S. Kleiner. (2019). E-Commerce, Ethical Commerce? .Journal of Business Ethics, Vol. 36, No. 1/2, Seventh Annual International Conference Promoting Business Ethics Retrieved from <https://www.jstor.org/stable/25074690>

Nir Kshetri.(2010). Diffusion and Effects of Cyber-Crime in Developing Economies. Taylor & Francis, Ltd. Retrieved from <https://www.jstor.org/stable/27896600>

Poonam Dass. (2010). LEGAL DIMENSIONS OF CYBER CRIMES AND PREVENTIVE LAWS WITH SPECIAL REFERENCE TO INDIA. *Journal of the Indian Law Institute from*. Retrieved from <https://www.jstor.org/stable/44782481>

Stephen Mason. (2016). Electronic Signatures in Law. School of Advanced Study, University of London, Institute of Advanced Legal Studies. Retrieved from <https://www.jstor.org/stable/j.ctv5137w8.20>

T. H. Chowdary. (2002). Information Technology for Development: Necessary Conditions. Economic and Political Weekly. Retrieved from <https://www.jstor.org/stable/4412627>

Yatindra Singh. (2019). CYBER LAWS. Journal of the Indian Law Institute. Retrieved from <https://www.jstor.org/stable/43951808>

Banking Law & Negotiable Instruments Act

Objective: As there is a growing demand for qualified manpower in the banking sector with accent on banking knowledge and skills, the course is aimed at exposing students to the legal and regulatory aspects that have a bearing on banking operations.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

UNIT - 1 INTRODUCTION

- i) Evolution of Banking and its history in India.
- ii) Bank, Banking and Bank Regulation.
- iii) Structure and function of Banking Institutions—The different types of Banks viz. Central Bank, Commercial Bank, Co-operative Banks, Specialized Banks, Regional Rural Banks (RRBs), NABARD, Financial Institutions and their respective functions – An Overview.
- iv) Commercial Banks: Structure and function.

Relation between Banker and Customer

- i) Legal character of Banker – Customer relationship.
- ii) Rights and obligations of Banker.
- iii) Types of Accounts.
- iv) Principles of good lending.
- v) Types of Loans (12)

UNIT –2 RESERVE BANK OF INDIA: Structure and Functions

- i) Central Banking: Organizational Structure of RBI
- ii) Functions of the Reserve Bank
 - Primary functions
 - Secondary functions
- iii) Controlling function of RBI over Banking and Non-Banking Companies

(8)

UNIT-3 BANKING REGULATION ACT, 1949

- i) Control over Management.
- ii) Prohibition of certain activities in relation to Banking Companies.
- iii) Acquisition of the undertakings of Banking Companies.
- iv) Suspension of Business and winding up of Banking Companies.
- v) Special provisions for speedy disposal of winding up proceedings.
- vi) Powers of the Central Government towards Banking Companies. (10)

UNIT-4 SECURITIZATION AND RECONSTRUCTION OF FINANCIAL ASSETS AND ENFORCEMENT OF SECURITY INTEREST (SARFAESI) ACT, 2002 AND RECOVERY OF DEBTS DUE TO BANKS & FINANCIAL INSTITUTIONS (RDDB) ACT, 1993: General Introduction and Overview

A) SARFAESI Act, 2002

- i) Introduction to SARFAESI Act, 2002: Purpose, Extent and the Constitutional validity
- ii) Definitions: Asset Reconstruction, Borrower, Hypothecation, Non-Performing Asset, Securitisation, Secured Asset, Secured Creditor, Secured Debt, Security Interest.
- iii) Enforcement of Security Interest
- iv) Non applicability of provisions of SARFAESI Act in certain cases

B) Recovery of Debts Due to Banks & Financial Institutions (RDDB) Act, 1993

- i) Introduction to RDDB Act, 1993: Purpose, Extent and the Constitutional Validity
- ii) Establishment and Composition of DRT and DRAT
- iii) Jurisdiction, Powers and Authority of Tribunals
- iv) Procedure of Tribunal (v) Recovery of Debts Determined by Tribunal (10)

UNIT-5 THE NEGOTIABLE INSTRUMENTS ACT, 1881

- i) Legal aspects of negotiable instruments in general and special features of the following instruments in particular: Promissory Note, Bill of Exchange, Cheque, Drawer, Drawee, Payee, Holder, Holder in due course, Inland Instrument, Foreign Instrument, Negotiable Instrument, Negotiation, Indorsement, inchoate stamped Instruments.
- ii) Crossing of Cheques— Criminal liability on dishonour of Cheque(Section 138 – 142) the law relating to payment of customers cheque— rights and duties of paying banker and a collecting banker and the changes introduced by Negotiable Instruments (Amendment) Act, 2015.
- iii) Material Alteration of Negotiable Instruments and its effects. (10)

REFERENCES:

Text Books:

1. M.L. Tannan, *Tannan's Banking Law and Practice in India* (Eighth Edition-2008), India Law House, New Delhi, 2 volumes
2. R. N. Chowdhary, *Banking Laws*, Central Law Publications, Allahabad
3. S.N. Myneni, *Law of Banking*(3rd Edition), Asia Law House, Hyderabad

Reference Books:

1. P.N. Varshney, *Banking Law & Practise* (Twenty Fifth Edition) 2014, Sultan Chand & Sons, New Delhi
2. Legal & Regulatory Aspects of Banking, Indian Institute of Banking and Finance, Second Edition (2008) Macmillan Publishers India Limited
3. Principles and Practices of Banking, Indian Institute of Banking and Finance, Second Edition (2008) Macmillan Publishers India Limited
4. SETH'S Banking Laws [Commentaries on Banking Regulation Act as amended by SARFAESI Act, 2002 and Banking Regulation Amendment Act 2007]
5. K.C Shekhar, *Banking Theory and Practice* (1998) UBS Publisher Distributors Ltd. New Delhi.
6. S. K. Basu, A. *Review of Current Banking Theory and Practice* (1998) Macmillan
7. L.C. Goyle, *The Law of Banking and Bankers* (1995), Eastern BookCompany

Law of Evidence

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The student will be able to analyse and define the concept and general nature of evidence, and illustrate the different types of evidence and court procedures relating to evidence.

The student will be able to determine and analyse the standard of proof and burden of proof in civil and criminal cases, and specify types of presumptions.

The student will be able to understand rules governing examination in chief, cross examination and re-examination, and establish the procedures in civil or criminal trial.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit

Unit I Introduction: Brief Historical Overview, Object and Basic Principles of Law of Evidence, Meaning and Types of Evidence, Fact in Issue and Relevant Facts, Document, Proved, Disproved, Not Proved, May Presume, shall Presume and Conclusive Proof, Circumstantial Evidence.

Unit II Relevancy of Facts: Res Gestae, Motive ,Preparation, Previous and Subsequent Conduct, Identification, occasion, Cause and Effect of Fact in Issue, Facts not otherwise Relevant, Relevancy of Judgment, Opinion of Experts and Third Parties, Conduct and character of Parties,

Admission and Confession: Admission-Meaning, who can make admission. Confession-Meaning, Confession to Police Officer, Evidentiary Value of Admission and Confession.

Unit III Statement of Persons who cannot be called as Witness: Principle and Rationale, Dying Declaration and its various Modes, Evidentiary Value of Dying Declaration, Other Statement; Judicial Notice.

Means of Proof: Oral Evidence, Documents-Public and Private, Proof of Contents of Documents, Primary and Secondary Evidence, Special Rules of Evidence relating to certain Documents, Presumptions as to documents.

Unit IV Burden of Proof and Presumption: Meaning of Proof and Presumption, On Whom Burden of Proof lies, Presumptions as to Offences and other Facts.

Estoppel: Meaning & scope, Estoppel and Promissory estoppel.

Unit V Witnesses and Privileges: Competency and Compatibility of Witnesses, Privileges of certain Witnesses, State Privilege.

Examination of Witnesses: Examination in-Chief, Cross Examination and Re - Examination, Court's Power of Questioning Witnesses.

Leading Cases:-

1. Nishikant Jha v/s State of Bihar, AIR 1969 SC 422
2. H.P. Administrator v/s Om Prakash, AIR 1977 SC 975
3. St. Paul v/s Delhi Administrator, AIR 1976 SC 294
4. Laxmipat Chorasias v/s State of Maharashtra, AIR 1960 SC 938
5. Pakala Narayan Swami v/s Emperor, AIR 1939 PC 47
6. Bhardunala Bhogin Bhan Heerji Bhai v/s State of Gujarat, AIR 1988 SC 753
7. R. M. Malkani v/s State of Maharashtra, AIR 1993 SC 157

Suggested Readings:

Monir M. C.J. (2011). *Textbook on Law of Evidence*, (7th ed.) New Delhi: Universal Law Books.

Prasad, M. S. (1982). *Study in Law of Evidence* Lucknow: EBC.

Ratanlal & Dhirajlal. (2011). *The Law of Evidence*. Nagpur: Lexis Nexis Butterworths Wadhwa.

Lal, B. (2011). *Law of Evidence in India*, Allahabad: ALA.

Sarathi, V.P. (2006). *Law of Evidence* (6th edn.). Lucknow: EBC.

Suggested E-Learning Material:

Ahmad, S. (2014). Modernisation of Law of Evidence during colonial India. *Proceedings of the Indian History Congress*, 75, 511-519. Retrieved from <http://www.jstor.org/stable/44158425>

Mason, S., & Stanfield, A. (2017). Authenticating electronic evidence. In Mason S. & Seng D. (Eds.), *Electronic Evidence* (pp. 193-260). School of Advanced Study, University of London. Retrieved from <http://www.jstor.org/stable/j.ctv512x65.14>

Mason, S., Sheldon, A., & Dries, H. (2017). Proof: The technical collection and examination of electronic evidence. In Mason S. & Seng D. (Eds.), *Electronic Evidence* (pp. 285-338). School of Advanced Study, University of London. Retrieved from: <http://www.jstor.org/stable/j.ctv512x65.16>

Property Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to know how to apply knowledge and able to solve practical problems related to property.

The students will be able to integrate theoretical knowledge and handle the complexity of drafting the various instruments of transfer of property.

The students will possess, understand and develop their skill in property related issues and can establish themselves in civil cases as their specific area.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Concept and meaning of property - Kinds of Property – Movable & immovable, tangible and intangible property, Introduction to the laws relating intellectual property.

The Concept of common property resources – Public Trust Doctrine, Possession and Ownership as man – property relationship.

Unit II The Transfer of Property Act, 1882- General principles of Transfer of Property.

Unit III Specific Transfers – Sales, Mortgages, Leases.

Unit IV Gifts, Exchange, Actionable Claims, Necessities of stamp duty in Transfer of Property.

Unit V The Indian Easement Act, 1882

Law of Easement ; Law of Licenses

Leading Cases:

1. Shantabai v. State of Bombay, AIR 1958 SC 532
2. Kumar Harish Chandra Singh Das v. Bansidhar Mohanty, AIR 1956 SC 1738
3. R. Kempraj v. Burton Sons & Co., AIR 1970 SC 1872
4. Jayaram Mudaliar v. Ayyasami, AIR 1970 SC 569
5. Mohar Singh v. Devi Charan, AIR 1988 SC 1365
6. Kartar Singh v. Harbans Kaur, (1994) 4 SCC 730
7. Delta International Ltd. V. Shyam Sundar Ganeriwal, AIR 1999 SC 2607
8. Shiv Dev Singh v. Suchha Singh, AIR 2000 SC 1935
9. Peoples Union for Democratic Rights v. Union of India, AIR 1982 SC

Suggested Readings:

Mulla, (2012). *Transfer of Property*, Nagpur: Lexis Nexis Butterworths Wadhwa.

Singh, A. Dr., (2016). *The Transfer of Property*. Haryana: Universal Publication.

Srivastav, A.K., (2014). *The Transfer of Property with Easements Act*. Allahabad: Central Law Publications.

Shukla, S.N., (2008). *The Transfer of Property*. Faridabad: Allahabad Law Agency.

Jain, J.D., (2018). *The Indian Easements Act*. Allahabad: Allahabad Law Agency

Suggested E-Learning Material:

Bose, P. (2016, July 16). *Transfer of Property Act, 1882* retrieved from
<https://www.slideshare.net/bosepiyush/transfer-of-property-act1882>.

Subbarao, Venkata, G. C., Revised by Jaya V. S. *Property Laws* retrieved from
14.139.60.114:8080/jspui/bitstream/123456789/738/21/Property%20Law.pdf

Mulla *on Transfer of Property*.1882 by y H. R. KHANNA, retrieved from <https://archive.org/.../2015.125756.Mulla-On-The-Transfer-Of-Property-Act-1882-Ed-5...>

Video Lecture by Agrawal, S, Transfer of Property retrived from <https://www.cakart.in>

Note :

Students will be required to opt any one course from the list of discipline electives

A student can opt for upto 1 additional Open (Generic) audit/credit Elective in IX semester onward from any of the courses offered by the Vidyapith subject to approval of Head of both departments and time table permitting.

Professional Ethics and Accountancy for Lawyers

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will demonstrate comprehensive and accurate knowledge and understanding of code of conduct required for Legal Profession.

The students will be able to exhibit understanding of Lawyers in the whole process of administration of justice.

The students will study the provisions of Advocates Act, Contempt of Courts Act & Rules of Bar Council

Unit I The Historical development of legal profession and its responsibilities; the equipment of the lawyer; Seven lamps of Advocacy; Conduct in Court and professional conduct in general; Rights & privileges of a lawyer; Salient features of the Advocates Act, 1961; Rules of admission and enrollment of advocates.

Unit II The Bar Council of India Rules on standards of professional ethics: Duty to the court, Duty to the client, Duty to opponent, Duty to colleagues, Duty in imparting training, Duty to render legal aid, Restriction on other employments, Conditions for right to practice, How to address the court, Dress to be worn by advocates.

Professional or other misconduct; Powers of the Disciplinary committee of the Bar Council of India; Procedure of complaints against advocates; Punishments for misconduct and Remedies against order of punishment.

Judgments related with professional misconduct:

Ex. Capt. Harish Uppal v. Union of India, A.I.R. 2003 S.C. 739.

P.D. Gupta v. Ram Murthi, AIR 1998 SC 283.

Shambhu Ram Yadav v. Hanuman Das Khatri, AIR 2001 SC 2509.

Harish Chandra Tiwari v. Bajju, AIR 2002 SC 548.

Bar Council of Andhra Pradesh v. Kurapati Satyanarayana, AIR 2003 SC.

Unit III Bench Bar Relationship: Meaning, necessity, nature and scope, Reciprocity as partners in administration of justice – **Duties of Judges and Advocates**

Unit IV The Contempt of Courts Act, 1971: Historical development of the Act in India; its object and constitutional validity; meaning of contempt; kinds of contempt; defenses available to contemnor; Nature and extent of punishment, remedies; Contempt by lawyers, judges, state and corporate bodies.

Judgments regarding Contempt of court:

Re: Ajay Kumar Pandey, A.I.R 1997 SC 260.

SC Bar Association v. U.O.I., AIR 1998 SC 1895.

Nirmaljit Kaur v. State of Punjab, AIR 2006 SC 605.

Zahira Habidullah Sheikh v. State of Gujarat, AIR 2006 SC 1367.

Rajendra Sail v. M.P High Court Bar Association, AIR 2005 SC 2473.

Justice C.S. Karnan vs The Honourable Supreme Court of India Ors, decided on 23rd August, 2017

Unit V Accountancy for lawyers (Elementary Accountancy) : Need for maintenance of accounts for Lawyers- Liability of the Lawyer arising out of Accounts;

Elementary aspects of Accounting- Accounting system; Rules for recording; Books of accounts - Cash Book, Journal and ledger; Final Accounts (Income & Expenditure Account, Balance Sheet)

Leading Cases:

1. Rajendra V. Pai vs. Alux Fernandes, AIR 2002 SC 1808.
2. In Re. Mr. AAn Advocate, AIR 1962 SC 1337.
3. In Re Mr. G a senior Advocate of Supreme Court, AIR 1954 SC 557.
4. In Re Lalit Mohandas, AIR 1957 SC 250.
5. Sheo Narayan Jafa vs. Judges Allahabad High Court, AIR 1953 SC 368.
6. P. J. Ratnam vs. D. Kanikaran, AIR 1964 SCC 244.
7. In Re 'M' an Advocate, AIR 1957 SC 149.
8. L. D. JaiSingham vs. Narayan Das Punjabi, (1976)1 ACC 354.
9. John D' Souza vs. Edward Ani (1994)2 SCC 64.
10. In Re Vinay Chandra Mirza, AIR 1995 SC 2348.

Suggested Readings:

1. Holland A. (1994). *Advocacy*, Delhi, Universal
2. Keith E, (1994). *The Golden Rule of Advocacy*, Delhi, Universal
3. Sandeep Bhalla. *Advocate Act and Professional Misconduct*, Nasik Press
4. Sirohi J. P. S. (2018). *Professional Ethics, Lawyers Accountability, Bench Bar Relationship*, ALA
5. Krishna Murthy, Iyer's *Book on Advocacy*.
6. Prasad A., Singh C. S. P. (2018). *Legal Education & the Ethics of Legal Profession in India*, Jaipur, University Book House Pvt. Ltd.
7. Edward A. P. (1968). *Seven Lamps of Advocacy*, New York, Freeport N.Y.

Suggested E-Learning Material:

Supreme Court Bar Association (2015, Feb 9). A Lecture by Mr. Dushyant Dave (Sr. Advocate) -Part-1. Retrieved from <https://www.youtube.com/watch?v=GQnfC8UhX18>

Supreme Court Bar Association (2015, Feb 9). A Lecture by Mr. Dushyant Dave (Sr. Advocate) -Part-2. Retrieved from <https://www.youtube.com/watch?v=h9JNA-0gYnE>

Supreme Court Bar Association (2015, Feb 9). A Lecture by Mr. Dushyant Dave (Sr. Advocate) -Part-3. Retrieved from https://www.youtube.com/watch?v=kCJH_TvtZRQ

Supreme Court Bar Association (2015, Feb 9). A Lecture by Mr. Dushyant Dave(Sr. Advocate) -Part-4. Retrieved from https://www.youtube.com/watch?v=L_qgAgutSN8

Alternative Dispute Resolution

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to understand various methods of resolving disputes under ADR system.

The students will develop understanding of participants' negotiating behavior

The students will be able to use such processes to advance the interests of clients.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit

Unit I The Arbitration and Conciliation Act, 1996: General Provisions, Arbitration Agreement, Arbitral Tribunals (Composition and Jurisdiction), Conduct of Arbitral Proceeding, Arbitral Awards, Termination of Proceeding, Setting aside of Arbitral Award, Enforcement of Arbitral Awards.

Unit II Conciliation - Conciliators, Procedure of Conciliation, Relationship of Conciliator with Parties, Settlement - Agreement, Termination of Conciliation Proceeding, Resort to Arbitral of Judicial Proceedings, Costs and Deposits.

Unit III Enforcement of Foreign Awards - New York Convention, Awards, Geneva Convention Awards.

Unit IV Objects, Role of Committee for Implementation of Legal Aid Schemes (CILAS), The Legal Services Authorities Act, 1987, Functions of National Legal Services Authority, State Legal Services Authority and District Legal Services Authority.

Unit V Organization of Lok Adalats, Jurisdiction and Power of Lok Adalats, Procedure for determination of Dispute before the Lok Adalat, Alternative Dispute Settlement System for Multinational Corporations.

Leading Cases: -

1. K.K. Modi v. K.N. Modi, AIR 1998 SC 1297.
2. Haresh Dayaram Thakur v. State of Maharashtra, AIR 2000 SC 2281.
3. Union of India v. Popular Construction Co., AIR 2001 SC 4010.
4. Narayan Prasad Lohia v. Nikunj Kumar Lohia, AIR 2002 SC 1139.
5. Bhatia International v. Bulk Trading S.A. (2002) 4 SCC 105.
6. Oil & Natural Gas Corporation Ltd. V. SAW Pipes Ltd., AIR 2003 SC 2629.
7. S.B.P. & Co. v. Patel Engineering Ltd., AIR 2006 SC 4505.
8. Krishna Bhagya Jal Nigam Ltd. v.G. Harischandra Reddy, (2007) 2 SCC 720.

Statutes to be Referred:

1. Arbitration and Conciliation Act, 1940.
2. Arbitration and Conciliation Act, 1996.
3. Legal Services Authorities Act, 1987.
4. Lokpal Bill.
5. UNCITRAL Model Law.

Suggested Readings:

1. Binder, Peter. (2005). International Commercial Arbitration and conciliation in UNCITRAL Model Law Jurisdictions (2nd Ed.). Sweet and Maxwell.
2. Rao, P.C. & Sheffield, William. (2006). Alternative Disputes Resolution- What it is and how it works?. New Delhi: Universal Law Publishing Co. Pvt. Ltd.
3. Michael, Alberstein. (2002). Pragmatism & Law: From Philosophy to dispute Resolution. Ashgate Dartmouth.
4. Singh, Dr. Avtar.(2016). Law of Arbitration and Conciliation. Lucknow: Eastern Book Company.
5. Kwatra, G.K.(2000). The Arbitration and Conciliation Law of India. (6th Ed.). New Delhi. Universal Law Publishing Co. Pvt. Ltd.
6. Malik, Surendra. (2003). Supreme Court on Arbitration. (2nd Ed.). Lucknow: Eastern Book Co.

Suggested E-Learning Material:

1. Edwards, H. (1986). Alternative Dispute Resolution: Panacea or Anathema? Harvard Law Review. 99(3), 668-684. <http://www.ncjrs.gov/App/publications/abstract.aspx?ID=105014>
2. Miles, B. Farmer. (2018).Mandatory and Fair? A Better System of Mandatory Arbitration. The Yale Law Journal. Vol. 121.<https://www.yalelawjournal.org/note/mandatory-and-fair-a-better-system-of-mandatory-arbitration>
3. Guptaeswar, K. (1988). THE STATUTORY LOK ADALAT: ITS STRUCTURE AND ROLE. Journal of the Indian Law Institute,30(2), 174-183. Retrieved from <http://www.jstor.org/stable/43951163>

Drafting, Pleading and Conveyancing

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

4 1 0 5

Learning Outcomes:

The students will be able to draft legal documents.

The students will be able to guide and advise client regarding effect and enforcement of deeds and documents.

The students will be able to structure a commercial contract, draft notices and pleadings.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Drafting-General Principles of Drafting and relevant Substantive Rules.

Unit 2 Pleading in Civil Matters: Plaint, Written statements Inter-locutory Application, Original Petition, Execution Petition, Memorandum of Appeal, Memorandum of Revision, Petition under Articles 32 and 226 of the Constitution of India.

Unit 3 Pleading in Criminal Matters: Complaints, Criminal Miscellaneous Petition, Bail Application, Memorandum of Appeal and Revision.

Unit 4 Conveyancing: Meaning, General Principles of Conveyancing, Rules of Drafting Deeds and Instruments.

Unit 5 Various types of Conveyances: Sale Deed, Mortgage Deed, Lease Deed, Gift Deed, Power of Attorney, Will, Partition Deed, Promissory Note.

Suggested Readings:

Kothari, G.M. (1982). *Drafting, Conveyancing and Pleadings*.

Mogha, P.C. 10th Ed. (1987). *The Indian Conveyancer* Rev. by Justice K.N. Goyal, etc. Eastern Law House.

Hargopal. (1995). *The Indian Draftsman; Guide to legal Drafting*; Allahabad, Vol. I & II. The University Book Agency.

Ballantine, H. W. (1915). *Hints on Drafting Legal Documents*. Law Stud. Helper.

Bindra, N.S. (1985). *Conveyancing Drafting & Interpretation for Deeds*; Allahabad, Law Publishers.

Verma, J.C. (1988). *Commercial Drafting & Conveyancing Ed.*: New Delhi, Bharat Law House.

Ryder, R. D. (2005). *Drafting Corporate & Commercial Agreements*. Universal Law Publishing Co.

Mogha P.C. (1987). *The Law of Pleadings in India*. Eastern Law House.

DeSouza 13th Ed. (1999). *Forms and Precedents of Conveyancing*. Rev. by C.R. Datta and M.N. Das. Eastern Law House

Suggested E- Learning Material:

Drafting Of Pleading And Conveyancing. Retrieved from

<http://kamkus.org/coursematerial/Drafting%20Pleading%20&%20Conveyance.pdf>

Professional Programme, Study Material on Drafting Appearances and Pleadings. Retrieved from

<http://www.icsi.in/Study%20Material>

[%20Professional/DRAFTING%20APPEARANCES%20AND%20PLEADINGS.pdf](http://www.icsi.in/Study%20Material%20Professional/DRAFTING%20APPEARANCES%20AND%20PLEADINGS.pdf)

S.v. College of Law–Tirupatirecord Materialpractical Training-1 Drafting, Pleading and Conveyancing; *Retrieved from* http://humanhandstogether.com/Drafting%20_%20Pleadings.pdf

Chapter 1- General Principles of Drafting and Relevant Substantive Rules of Siddharth Academy; *Retrieved from* <http://siddharth-academy.in/images/Downloads/Company%20Secretary%20Free%20Notes/CS%20PROFESSIONAL/DRAFTING.pdf>

PLEADINGS AN OVERVIEW; *Retrieved from* <http://law.uok.edu.in/Files/5ce6c765-c013-446c-b6ac-b9de496f8751/Custom/pleading-.pdf>

Moot Court, Internship and Corporate Legal Training

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	48	24

Learning Outcomes:

The students will be able to develop advocacy skills.

The students will get familiarize with the various stages of trial in civil and criminal cases.

The students will be exposed to real court experience and they should imbibe the skills of client interviewing.

- (a) Moot-Court (CA:20 Marks) :** Every student may be required to do at least three Moot-Courts in a year. The moot court work will be on assigned problem and it will be evaluated as (1) written submissions (marks 10) and (2) oral advocacy (marks 10).
- (b) Observance of Trail in two cases, one Civil and one Criminal (CA.20 marks).** Students may be required to attend two trials in the course of the last two or three years of LL.B. studies. They will maintain a record and enter the various steps observed during their attendance on different days in the court assignment. This scheme will carry 20 marks.
- (c) Interviewing techniques and Pre-trial Preparations and Internship diary (ESA : 40 marks):** Each student will observe two interviewing sessions of clients at the Lawyer's Office / Legal Aid office and record the proceedings in a diary, which will carry 20 marks. Each student will further observe the preparation of documents and Court papers by the Advocate and the procedure for the filling of the suit / petition. This will be recorded in the diary, which will carry 20 marks.
- (d) Viva-Voce : [ESA : 20 Marks]**
- The fourth component of this paper will be Viva-Voce examination of all the above three aspects. This will carry 06 Marks.

1.6 Introduction to Psychological Process

Objective: The course will familiarize students with the basic psychological processes and the studies relating the factors which influence them. It will also focus on important areas of the application of psychology.

Note: The paper will contain 10 questions having two questions from each unit. Candidates will be required to attempt five questions taking at least one question from each unit.

Unit 1: Introduction: Definition, Nature, Scope and applications of Psychology. Approaches of psychology: Biological, Psychological, Psychodynamic, Behavioural, Cognitive, Humanistic and Evolutionary approach, Social, Cultural and Multi Cultural perspective. Methods of psychology: Experimental, Observation, Interview, Questionnaire, Case Study, Survey, and Meta analysis. (10)

Unit 2 Biological Basis of Behaviour Nervous System: Central, Peripheral, Autonomic, Somatic and Limbic Nervous System. Sensory and Perceptual processes: Theories of Hearing and Vision, Colour Blindness, Attention and Perception– Selectivity of Attention, Determinates of Attention and Perception, Organizing Principles of Perception, Form and Depth Perception. (10)

Unit 3 Learning, Remembering and Forgetting: Basic processes of Classical and Operant conditioning - Acquisition, Extinction, Spontaneous recovery, Generalization and Discrimination. Trial and Error method of Learning, Cognitive learning, Observational Learning, Laws and Curves of learning, Transfer of Training. Verbal Learning and Memory: Encoding, Storage and Retrieval processes Short term and Long term Memory, Mnemonic Methods of Retention. Motivation and Learning, Causes of forgetting: Decay, Interference, Retrieval failure, Motivated Forgetting and Amnesia.(10)

Unit 4 Thinking Motivation and Emotion Concept formation, Problem solving, Creativity, Inductive and Deductive Reasoning.

Indicators of Motivated Behaviour, Nature and Classification of Motives – Biogenic and Psycho-sociogenic motives, Intrinsic and Extrinsic Motivation, Conflict and Frustration; Techniques of Assessment of Motivation, Maslow's Need Hierarchy and other theories of Motivation. Emotion: Nature and Development of Emotion, Expression and Control of Emotions. Theories of Emotion, Culture and Emotion, Polygraphic techniques. (10)

Unit 5 Intelligence and Personality: Intelligence- Nature, Measurement and Theories of Intelligence. Genetic/Biological and Environmental influences, Cross-Cultural issues in Intelligence.

Personality: Meaning and Nature, Trait and Type theories of Personality and Psycho-analytical theory by Freud. Biological and Socio-Cultural Determinants of Personality. Assessment of Personality. (10)

Note: Experimental Learning: The subject teacher could encourage students to plan some experimental learning activity from each topic. 5 Marks of Internal Assessment could be allotted to such activity.

Books Recommended:

1. Atkinson, R.L., Atkinson, R.C., & Hilgard, E.R. (2005). Introduction to Psychology, (10th ed.), New York: Harcourt Brace Jovanovich.
2. Baron, R.A. (2007). Psychology. New Delhi: Pearson Education.
3. Cohen, R.J. (1994). Psychology and Adjustment. Allyn & Bacon.
4. Hockenbury, D. H. & Hockenbury, S.E. (2002). Psychology 3rd Edition New York, Worth Publisher.
5. Morgan, C. T., & King, R. A. (2005). Introduction to Psychology. Delhi: Tata McGraw Hill.
6. Singh, A.K. (1997). Uchhtar Samanya Manovigyan. Varanasi: Motilal Banarsi Das.
7. Weiten, W., & Margaret, A.L. (2007). Psychology Applied to Modern Life. Thompson Woods worth.
8. Zimbardo, P.G., & Weber, A.L. (1997). Psychology. New York: Harper Collins College Publishers.

Cost Accounting for LAW

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course student will be able to:

Express the place and role of cost accounting in the modern economic environment.

Select the cost according to their impact on business.

Make cost sheet.

Calculate the cost of stock consumption.

Note: The paper will contain 10 questions having two questions from each unit; candidates will be required to attempt five questions taking one question from each unit.

Unit 1 Introduction, Nature and scope of Cost Accounting, Advantages and limitations of cost accounting. Installation of costing system. Cost concepts, classification of cost, preparation of cost sheet.

Unit 2 Elements of cost, material cost, Direct and indirect material cost. Issue of materials of production, pricing methods.

Unit 3 Labour cost, Direct and indirect labour cost, Methods of payment of wages, incentive plans, over heads classification, allocation and apportionment of over heads.

Unit 4 Marginal Costing: concept, relevance, difference vis-a vis absorption costing, statement, CVP, BEP, P/V analysis.

Unit 5 Introduction to standard costing and managerial applications.

Suggested Readings:

Lal, J. and Srivastav S. (2013). *Cost Accounting*. New York: McGraw-Hill/Irwin.

Khan, M. Y., & Jain, P. K. (2017). *Cost Accounting*, New York: McGraw-Hill/Irwin.

Lanen, W. N. (2011) *Fundamentals of Cost Accounting*, New York: McGraw-Hill/Irwin.

Nigam, B. M., & Jain, I. C. (2010). *Cost Accounting: Principles and Practice*. New Delhi: PHI Learning Private Limited.

Suggested E-Learning Material:

Agarwal, R. (2017, Oct 14), Introduction to Cost and Management Accounting Retrieved from Youtube: <https://www.youtube.com/watch?v=nAZhp69dPRM>.

Inflibnet. Absorption and marginal costing. Retrieved from: http://content.inflibnet.ac.in/dataserver/eacharyadocuments/53e0c6cbe413016f234436f6_INFIEP_18/6/SA/18-6-SA-V1-S1__solved_problems_mc.pdf

Aggrwal, N. (2018, Nov 12), FIFO Method of Store Ledger. Retrieved from Youtube: <https://www.youtube.com/watch?v=TxM9Z306Cb8>

Aggrwal, N. (2017, Oct 11). Material Variance analysis. Retrieved from Youtube: <https://www.youtube.com/watch?v=Wi2Ud3IseJY>

Law of Contract – II (Special Contract)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to analyze the implications of a contractual arrangement falling under any of the discussed head of special contracts.

The students will be able to determine the legality of the transactions and also the rights and duties of the parties thereto

The students will be able to purposefully deal with the disputes arising out of such contractual arrangements.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I E-Contracts: Legal Principle & Practice, Emergence of E-Contracts, Types of Electronic & Online Contracts, Relevant Legal Principles to Online Contract Formation.

Unit II Contract of Indemnity: Nature of Contract of Indemnity, Rights of Indemnifier and Indemnity Holder, Liability of Indemnity Holder, Commencement of Indemnity, Right of Indemnity Holder when Sued, Indemnity for acts done at another's request, Differentiate Indemnity and Guarantee, Indemnity and Insurance.

Contract of Guarantee: Nature of Contract of Guarantee, Kinds of Guarantee, Consideration for Guarantee, Continuing Guarantee, Revocation of Continuing Guarantee, Bank Guarantee, Guarantee and Insurance, Surety, Rights and Liabilities of Surety and Discharge of surety's Liability.

Unit III Contract of Bailment and Pledge: Nature of Bailment, Types of Bailment, Bailment and Agency, Bailment and Instruments, Bankers, Carriers, Hire of Goods, Right of Lien, Hypothecation.

Contract of Agency: Agent and Principal Definition, Nature of Agency, Formation for Contract of Agency, Fiduciary Relationship, Modes of Termination of Agency, Rights and Duties of Principal and Agent, Right and Liabilities of Undisclosed Principal, Personal liability of Agent, Types of Agent and Sub Agent.

Unit IV Sales of goods Act: Nature and Definition of Contract of Sale of Goods, Conditions of Warranties: Meaning and inter se relations, Rule of Caveat Emptor: Meaning, relevance and exceptions, Role relating to transfer of title, Unpaid Seller: Meaning and Rights, Hire -Purchase Agreement: Meaning, form, contents and distinction between sale and hire-purchase agreement.

Unit V Partnership Act: Nature and Definition of Partnership, essentials of the determination of the existence of partnership, relationship of partnership with other forms of business organization, non-partnership interests, Partner by holding out, Minor and partnership firm, Registration of partnership firms and effects of its non-registration, Dissolution of Partnership firms.

Leading Cases:

1. Gajanan Moreshwar v/s Moreshwar Madam, (1942) AB 304
2. Adamson v/s Jarvis, (1827) 4 Bing 66, 130 ER 693
3. Shaw & Co. v/s Symmons & Sons, (1917) 1 KB 799
4. Revenue Authority v/s Sudarshan Pictures, AIR 1968 Mad. 319

5. Bank of Maharashtra v/s Pandurange Keshav Gorvardhan, AIR 2013
6. W.H. Smith & Sons v/s Clinton
7. N.R. Srinivasa Aiyer v/s New India Assurance Co., AIR 1983 SC 905
8. Central National Bank v/s United Industrial Bank, AIR 1954 SC 181
9. Union of India v/s R. Gandhi, President, Madras Bar Association (Civil appeal No. 3067 of 2004)
10. Madras Bar Association v/s Union of India (Civil appeal No. 3717 of 2005) SC 2010

Suggested Readings:

1. Singh, Avtar. (2008). *Law of Contract and Specific Relief*. Lucknow: EBC.
2. Mulla and Pollock (2012) *Law of Contracts*. Nagpur: Lexis Nexis Butterworths Wadhwa.
3. Kapoor, Dr. S.K. (2017). *Contract II along with Sale of Goods Act and Partnership Act*. Central Law Agency.
4. Rao, S. V. Joga. (2003). *Computer Contract & Information Technology Law*. Nagpur: Wadhwa & Company.
5. Sarkar, M.C, (2001). *Sakar's on Specific Relief Act*. New Delhi: Wadhwa & Company,
6. Beatson, J, Anson's (2005). *Law of Contract*. New York: Oxford University Press.

Suggested E-Learning Material:

Toppo Ankita & Tiwari Sanchita (2018 May). Contract of Indemnity Case Laws. *International Journal of Scientific Engineering and Research*. Retrieved from

<http://www.ijser.in/archives/v6i5/IJSER172511.pdf>

Pandey Anubhav (2017 May, 22). Law relating to Indemnity in India. Retrieved from <https://blog.ipleaders.in/laws-indemnity/>

Pandey Anubhav (2017 July, 26). Everything you need to know about contract of Guarantee. Retrieved from <https://blog.ipleaders.in/everything-need-know-contract-guarantee/>

Agarwal Sakshi (2018 August, 10). Contract of Bailment and Pledge. *Law Time Journal*. Retrieved from <https://lawtimesjournal.in/contract-of-bailment-and-pledge/>

Law of Consumer Protection and Motor Vehicle Act, 1988

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will have a comprehensive understanding about the existing law on consumer protection in India.

The students will be aware of the basic procedures for handling consumer dispute and issues on motor vehicle.

The students will be able to appreciate the emerging questions and policy issues in consumer law and motor vehicle law for future research

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction: Concept of Consumer Sovereignty, Need of Consumer Protection and Consumerism, Objective and the Legislative History, Nature of Liability, Protection of consumer Interest before enactment of Consumer Protection Act, 1986,

Unit II Consumer Interest under Law of Torts, Consumer interest under law of Contract, Consumer interest and Criminal Law , Doctrine of Caveat Emptor, consumer interest and Doctrine of Negligence.

Consumer Protection Act, 1986: Definition: Consumer, Consumer Dispute; Complaint, Complainant, Trader; Manufacturer Service, Unfair Trade Practice, Defect and deficiency, Restricted Trade Practices.

Unit III Consumer Rights and Consumer Protection Council: Objective, Composition and Procedures of Central, State and District Consumer Council, Executive efforts for Consumer Protection

Consumer Dispute Redressal Agencies: Establishment of Consumer Dispute Redressal Agencies, Procedure for filing and hearing of Complaint.

Unit IV Relief under Consumer Protection Act, 1986, Appeals and Revisions, Penalties, Permanent Lok Adalat under the Legal Services Authorities Act, Enforcement of Decrees and Order: Dismissal of Frivolous and Vexatious Complaints, Limitation.

Unit V Motor Vehicle Act, 1988: Compulsory Insurance, Nature and extent of Insurer's liability, Claims tribunal and award of compensation.

Leading Cases:-

1. Spring Meadows Hospital v/s Harjal Ahluwalia, 1998 (4) SCC 39
2. Indian Medical Association v/s V.P. Shantha, (1995) 6 SCC 651
3. Lucknow Development Authority v/s A.K. Gupta, AIR 1994 SC 787
4. Konark Roller Flour Mills Pvt. Ltd. v/s New India Assurance Co. Ltd. (2003) 3 SPR 47 (NC)
5. U.T. Chandigarh Adm. & another v/s Amarjeet Singh, 2009 (4) SCC 660
6. New India Assurance Co. Ltd. v/s M/s Shiva Lal Ramesh Chand, AIR 2008 SC 2620
7. Anita Bhaita v/s Kenan Airways, (2004) ICPJ. 58 (N.C.)
8. Awaz v/s R.B.I, AIR 2008 (NOC) 2528 (NCC)
9. Goltish Scale & System Pvt. Ltd. v/s Gurumuk Singh, (2003) 3 CPR 4 (NC)

Suggested Readings:

Tripathi, S.C,(2008) *The Consumer Protection Act*, Allahabad: Allahabad: Central Law Publication

Bangia, R.K, Consumer Protection Law, Faridabad: Allahabad Law Agency, 2009

Bangia, R.K,(2001) *Law of Torts*, Faridabad: Allahabad Law Agency

Rao, Y.V,(1986) *Commentary on Consumer protection Act*, Hyderabad: Asia Law House

Ratanlal and Dhirajlal,(2009) *The Law of Torts*, Nagpur: Butterworths.

Suggested E-Learning Material:

Hamilton, Walton H., "The Ancient Maxim Caveat Emptor" (1931). Faculty Scholarship Series. Paper 4668.
Retrieved from <https://pdfs.semanticscholar.org/4a26/b6b8dc9099e053266ec7c7a55ed8a0b6ebd6.pdf>.

Caveat Emptor: Retrieved from: <https://www.hg.org/legal-articles/let-the-buyers-beware-caveat-emptor-1951>

Roy Kumar Amar, From Caveat Emptor To Caveat Venditor: A Paradigm Shift: Retrieved From: http://ijlljs.in/wp-content/uploads/2016/07/Research_Paper.pdf

A study on unfair trade practices in India: Retrieved From:

<http://jcil.lsyndicate.com/wpcontent/uploads/2018/08/A-STUDY-ON-UNFAIR-TRADE-PRACTICES-IN-INDIA-8.pdf>

Cindy C. Heenan, Consumer Protection - The Unfair Trade Practices Act and the Insurance Code: Does Per Se Necessarily Preempt? - Pearce v. American Defender Life Insurance Co., 10 Campbell L. Rev. 487 (1983).
Retrieved from: Co. <https://scholarship.law.campbell.edu/cgi/viewcontent.cgi?article=1164&context=clr>

Shekhar Sonika, Unfair Trade Practices and Restrictive Trade Practices (2018) Retrieved from: <https://lawtimesjournal.in/unfair-trade-practices-and-restrictive-trade-practices/>

Sandesara J.C, Restrictive Trade Practices in India, 1969-91: Experience of Control and Agenda for Further Work:
Retrieved from: <https://www.jstor.org/stable/pdf/4401594.pdf>

Chakravarty Sangeeta, Third Party Insurance in India, Retrieved from: <http://www.legalserviceindia.com/article/l264-Third-Party-Insurance.html>

Banking and Financial Institutions

Fundamentals of Insurance

Objective: To acquire specialized knowledge of law and practice relating to Insurance.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Introduction to insurance, Types of insurance: General & Life, Principle of insurance **General Concepts of Insurance:** , Insurable Interest - Indemnity - proximate Cause - Subrogation and Contribution - Differentiation Insurance and Guarantee - Insurance and Wager - Disclosure - Moral Hazards; (10)

Unit 2 Insurance Contract: Nature of Insurance Contract - Features of Insurance Contract Regulatory body of insurance, Regulation of Insurance Business, Insurance Act, Insurance Regulatory and Development Act, Powers and Functions of IRDA, Relevant Regulations and Guidelines issued by IRDA, Licensing, Grievance Redressal. (10)

Unit 3 Life Insurance : Term, Pension, endowment, child plan etc. products & procedure. Nomination & beneficiary. General insurance :- Various products of individual & corporate general insurance. Procedure to apply, beneficiaries. (10)

Unit 4 Process of claim, Underwriter, surveyor, disclosure, representation. Assignment of policy. Non Life:- underwriter, surveyor, disclosure, representation, condition of average, recovery of salvage, multiple claims and settlement. (10)

Unit 5 Regulatory Environment: other relevant legislation, motor vehicle act, marine insurance act, employee state insurance act, fire insurance act. Misc insurance, ombudsman and nodal consumer protection laws and tribunals. (10)

Suggested Readings:

1. Tena Crews: Fundamentals of Accounting: 2nd edition, Cengage Learning
2. Emmett J. Vaughan, Therese M. Vaughan: Fundamentals of Insurance, John Wiley & Sons
3. B.S. Bodla & M. C. Garg: Insurance: Fundamentals, Environment & Procedures, Deep & Deep Publications
4. Emmett J. Vaughan, Therese M. Vaughan: Fundamentals of Risk & Insurance: Wiley India

Law of Crimes – I (IPC)

Objective: The Indian society has changed very rapidly since Independence. A proper understanding of crimes, methods of controlling them and the socio-economic and political reasons for their existence is now extremely important in the larger context of India's development, if students are to use their knowledge and skills to build a just and humane society. The curriculum outlined here attempts to bring in these new Perspectives.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Introduction – Nature and Concept, Origin of Criminal Law, History of the Indian Penal Code; Elements of Crime, actus reus, mens rea, Kinds of punishment; Jurisdiction of Indian Penal Code – Intra territorial and Extra territorial Jurisdiction (10)

Unit 2 Definitions – Public Servant, Wrongful gain, Wrongful loss, Dishonestly, Dishonestly, Fraudulently, act, omission, Good faith, (10)

Unit 3 General Exceptions – Introduction, Burden of proof to prove and Exception, mistake of fact and the Mistake of Law, Accident, Necessity, Insanity intoxication, Consent, causing slight harm. Right of Private Defense. (10)

Unit 4 Abetment, Conspiracy, Acts done by several persons in furtherance of Common Intention (Joint & constructive Liability) (10)

Unit 5 Attempt to commit offences, Offences against the State (10)

Leading Cases: -

1. J.D. Desai v. State of Bombay, AIR 1960 SC 889
2. Mehboob Shah v. Emperor, AIR 1943 P.C. 188
3. MH. Hoskot v. State of Maharashtra AIR 1978 SC 1548
4. Queen v. Dudley and Stephen, (1884) 14 & BD 273
5. Topan Das v. State of Bombay, AIR 1956 SC 33
6. Tara Singh v. State of Punjab, AIR 1951 EP 27
7. Kedar Nath v. State of Bihar, AIR 1962 SC 955
8. Sudhir Kumar Mukerjee v. State of W.B. AIR 1962 SC 2655

Test Books

1. Ratanlal & Dhirajlal. Indian Penal Code, Nagpur: Lexis Nexis Butterworths, 2011
2. Gaur, K.D. Indian Penal Code. Universal Law Publisher Co. Pvt. Ltd. 2011

Reference Books –

Gaur, Hari Singh. Penal Law of India. Allahabad: Law Publisher, 2006

International Trade Procedure and Practice

Business Environment

Objective: The purpose of this paper is to enable the students learn nature scope and structure of International Business, and understand the influence of various environmental factors on international business operations.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Introduction to International Business: Importance nature and scope of International business; modes of entry into International Business, internationalization process and managerial implications. Framework for analyzing international business environment (11)

Unit 2 Global Trading Environment: World trade– Major trends and developments; World trade and protectionism – Tariff and non-tariff barriers; Counter trade. (9)

Unit 3 International Economic Institutions and Agreements and other International agreements; International commodity trading and agreements. (9)

Unit 4 Regional Economic Groups: Nature, Importance & types. Regionalism vs. multilateralism, Structure and functioning of Economic Groups. (11)

Unit 5 Multinational Corporations and their involvement in International Business: Issues in foreign investments, technology transfer, pricing and regulations; (10)

Suggested Readings:

1. Bennet, Roger, International Business, Financial Times, Pitman Publishing, London, 1999.
2. Bhattacharya, B., Going International: Respon se Strategies of the Indian Sector, Wheeler Publishing, New Delhi, 1996.
3. Czinkota, Michael R., et. al., International Business, the Dryden Press, Fortworth, 1999.
4. Danoes, John D. and Radebaugh, Lee H., International Business: Environment and Operations, 8th ed., Addison Wesley, Readings, 1998.
5. Griffin, Ricky W. and Pustay, Michael W, International Business: A Managerial Perspective, Addison Wesley, Readings, 1999.
6. Hill, Charles W. L., International Business, McGraw Hill, New York, 2000.(12) Paper 517:

Law of Crimes – I (IPC)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will get familiar to the principles of criminal law.

The students will be able to expose the range of mental states that constitutes mens-rea essential for committing crime.

The students will get acquainted to the latest developments and changes in the field of criminal law.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction – Nature and Concept, Origin of Criminal Law, History of the Indian Penal Code; Elements of Crime, actus reus, mensrea, Kinds of punishment; Jurisdiction of Indian Penal Code – Intra territorial and Extra territorial Jurisdiction

Unit II Definitions – Public Servant (Section 21), Wrongful gain & Wrongful loss (Section 23), Dishonestly (Section 24), Fraudulently (Section 25), Act & Omission (Section 32, 33), Voluntarily (Section 39), Good faith (Section 52).

Unit III General Exceptions – Introduction, Burden of proof to prove and Exception, mistake of fact and the Mistake of Law, Accident, Necessity, Infancy, Insanity, Intoxication, Consent, Causing slight harm, Right of Private Defense.

Unit IV Abetment, Conspiracy, Group Liability: joint & constructive (Section 34, Sections 141, 149).

Unit V Stages in the commission of crime, Attempt to commit offences, Offences against the State.

Leading Cases:

1. J.D. Desai v. State of Bombay, AIR 1960 SC 889
2. Mehboob Shah v. Emperor, AIR 1943 P.C. 188
3. MH. Hoskot v. State of Maharashtra AIR 1978 SC 1548
4. Queen v. Dudley and Stephen, (1884) 14 & BD 273
5. Topan Das v. State of Bombay, AIR 1956 SC 33
6. Tara Singh v. State of Punjab, AIR 1951 EP 27
7. Kedar Nath v. State of Bihar, AIR 1962 SC 955
8. Sudhir Kumar Mukerjee v. State of W.B. AIR 1962 SC 2655

Suggested Readings:

1. Ratanlal & Dhirajlal. (2011) Indian Penal Code, Nagpur: Lexis Nexis Butterworths,
2. Gaur, K.D. (2011) Indian Penal Code Universal Law Publisher Co. Pvt. Ltd.
3. Gaur, Hari Singh. (2006) Penal Law of India, Allahabad: Law Publisher.

Suggested E-Learning Material:

- McBride, M. (2014). SECTION 300(C) OF THE INDIAN PENAL CODE: FROM FIRST PRINCIPLES. *National Law School of India Review*, 26(1), 77-86. Retrieved from <http://www.jstor.org/stable/44283783>
- Rao, S. (1996). TAKING OFFENDING SPOUSE SERIOUSLY. *Journal of the Indian Law Institute*, 38(4), 502-506. Retrieved from <http://www.jstor.org/stable/43951664>
- Chandra, G. (1966). MR. JUSTICE GAJENDRAGADKAR AND CRIMINAL LAW. *Journal of the Indian Law Institute*, 8(4), 588-605. Retrieved from <http://www.jstor.org/stable/43949922>
- Jolly, S., & Rast, M. (2006). RAPE AND MARRIAGE: REFLECTIONS ON THE PAST, PRESENT AND FUTURE. *Journal of the Indian Law Institute*, 48(2), 277-284. Retrieved from <http://www.jstor.org/stable/43952037>
- Sharma, A. (2008). Section 377: No Jurisprudential Basis. *Economic and Political Weekly*, 43(46), 12-14. Retrieved from <http://www.jstor.org/stable/40278169>

Business Environment

Objective: The purpose of this paper is to enable the students learn nature scope and structure of International Business, and understand the influence of various environmental factors on international business operations.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Introduction to International Business: Importance nature and scope of International business; modes of entry into International Business, internationalization process and managerial implications. Framework for analyzing international business environment (11)

Unit 2 Global Trading Environment: World trade– Major trends and developments; World trade and protectionism – Tariff and non-tariff barriers; Counter trade. (9)

Unit 3 International Economic Institutions and Agreements and other International agreements; International commodity trading and agreements. (9)

Unit 4 Regional Economic Groups: Nature, Importance & types. Regionalism vs. multilateralism, Structure and functioning of Economic Groups. (11)

Unit 5 Multinational Corporations and their involvement in International Business: Issues in foreign investments, technology transfer, pricing and regulations; (10)

Suggested Readings:

1. Bennet, Roger, International Business, Financial Times, Pitman Publishing, London, 1999.
2. Bhattacharya, B., Going International: Respon se Strategies of the Indian Sector, Wheeler Publishing, New Delhi, 1996.
3. Czinkota, Michael R., et. al., International Business, the Dryden Press, Fortworth, 1999.
4. Danoes, John D. and Radebaugh, Lee H., International Business: Environment and Operations, 8th ed., Addison Wesley, Readings, 1998.
5. Griffin, Ricky W. and Pustay, Michael W, International Business: A Managerial Perspective, Addison Wesley, Readings, 1999.
6. Hill, Charles W. L., International Business, McGraw Hill, New York, 2000.(12) Paper 517:

Law of Crimes – II (IPC)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will get familiarize with the key concepts regarding crime and criminal law.

The students will be able to learn various offences punishable under IPC.

The students get acquainted to the latest developments and changes in the field of criminal law.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Offences against Public Tranquility - Unlawful Assembly, Rioting & Affray; **False Evidence** – Giving False Evidence, Fabricating False Evidence.

Unit II Offences against Human Body; Offence affecting Life – Culpable Homicide, Murder Causing Death by Negligence, Dowry Death, Sexual offences: (Sections 375-377).

Unit III Abetment of suicide, Infanticide (Sec. 315); Hurt, Grievous Hurt; Wrongful restraint & Wrongful Confinement; Criminal Force & Assault; Kidnapping, Abduction.

Unit IV Offences against Property – Theft, Extortion, Robbery, Dacoity; Dishonest Misappropriation of Property and Criminal breach of Trust; Stolen Property, Dishonestly Receiving Stolen Property. Cheating, Mischief, Forgery, Criminal Trespass, House Breaking.

Unit V Offences Relating to Marriage: Bigamy; Adultery. Cruelty (Section 498A). **Defamation.**

Leading Cases: -

1. Major Singh v. State of Punjab, AIR 1967 SC 63
2. Yousuf Abdul Aziz v. State, AIR 1954 SC 321
3. K.M. Nanawati v. State of Maharashtra, AIR 1962 SC 605
4. State of A.P.U.R. Pannayya, AIR 1977 SC 45
5. S. Vardarajan v. State of Madras, AIR 1965 SC 945
6. Bharwala Bhoginbhai Hirjibhai v. State of Gujarat., AIR 1983 SC 1096
7. Common Cause, A Registered Society v. Union of India, AIR 1999 SC 2979
8. Inder Raj Malik v. Sunita Malik, (1986) Cr. L.J. 1510
9. M' Naghten's case, (1843) 10 Clark & Finnelly, 200-214 (H.L.)

Suggested Readings:

Misra, S.N., (11th Ed.) (2003). *Indian Penal Code*, Central Law Publication,
Gaur K.D. (2011). *Indian Penal Code*. Universal Law Publisher Co. Pvt. Ltd.
Gaur, K.D. (6th Ed.) (2009) *Criminal Law – Cases and Materials*. Lexis Nexis India.
Nigam, R.C. (1965) *Law of Crimes in India* (Vol. I). London, Asia Publishing House.
Raju, V.B. (4th Ed.) (1982) *Commentary on Indian Penal Code* (Vol. I & II)

Suggested E-Learning Material:

- Bakshi, P. (1994). SUICIDE AND CRIMINAL LAW. *Journal of the Indian Law Institute*, 36(4), 522-524. Retrieved from <http://www.jstor.org/stable/43952373>.
- Seshadri, P. (1965). THE CONCEPT OF "TAKING" IN RELATION TO THE OFFENCE OF KIDNAPPING. *Journal of the Indian Law Institute*, 7(4), 399-404. Retrieved from <http://www.jstor.org/stable/43949856>
- Knox-Mawer, R. (1956). Defamation: Some Indian Precedents and the Common Law. *The International and Comparative Law Quarterly*, 5(2), 282-285. Retrieved from <http://www.jstor.org/stable/755851>
- SEN, R. (2010). Law Commission Reports on Rape. *Economic and Political Weekly*, 45(44/45), 81-87. Retrieved from <http://www.jstor.org/stable/20787533>
- S.L.A. (1958). Does Section 124-A, I.P.C. contravene Article 19(1)(a) of the Constitution? *Journal of the Indian Law Institute*, 1(1), 185-189. Retrieved from <http://www.jstor.org/stable/43952895>
- Heong, Stanley Yeo Meng. "Rashness under Section 304a of The Penal Code: Ramlan Bin Salleh v. Public Prosecutor." *Malaya Law Review*, vol. 30, no. 1, 1988, pp. 172-177. Retrieved from www.jstor.org/stable/24865482.

Theories of Development and Indian Economics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course the student will be able to

Acquainted with comprehensive knowledge of the conditions and limitations of the developing system of India.

Understand the indicators to measure economic development

To impart the knowledge of capital formation in India

Understand different aspects of agricultural sector and industrial sector

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Economic Development and Growth: concept of development, human right dimension in economic growth, economic development and economic growth, features and indicators of economic development – vicious cycle of poverty and determination of BPL – indicators of development and growth

Unit 2 Capital formation – significance of capital formation, capital formation during pre and post independence period.

Strategies of economic growth – balanced Vis- a- Vis unbalanced growth, features and distinctions, sustainable development, requirements and strategies.

Unit 3 Problem of Agrarian economy in India: Subdivision and fragmentation, unorganized labour, paucity of agricultural capital and issues on corporatization of agriculture – issues of agricultural marketing and commodity market.

Problem of Industrial economy in India: Controversy on acquisition of land for industry, critical issues of industrial labour and labour legislation, domestic capital and foreign capital, various issues, limited liability and bankruptcy issues.

Unit 4 Poverty and PDS –determination of BPL under World Bank standard – Various issues on PDS – Food security, Problem of unemployment, under-employment and features– remedial measures, production problem.

Unit 5 Revenue Commission – various types of taxation in India –overview Special Economic Zones – various considerations and issues, Black Money and corruption.

Suggested Readings:

Misra, S. K., &Puri, V. K. (2011). *Indian Economy* (p. 174). Himalaya Publishing House.

Agrawal, A. N. (2015). *Indian Economy*. New Age International Pvt.

Dutt, R., &Sundaram, K. P. M. (2008). *Indian Economy*, S Chand & Co. New Delhi.

Dhingra, I. C. (1998). *The Indian Economy*. Sultan Chand & Sons.

Dewett, K. K., Verma, J. D., & Sharma, M. L. (1994). *Elementary Indian Economics*. Chand and Company Ltd., New Delhi.

Dewett, K. K., Varma, J. D., & Sharma, M. L. (1992). *Indian Economy*, New Delhi, S. Chand and Company Ltd.

Suggested E-Learning Material:

- Nandi, S., & Gamkhar, S. (2013). Urban challenges in India: A review of recent policy measures. *Habitat International*, 39, 55-61.
- Kumar, N., & Pradhan, J. P. (2002). Foreign direct investment, externalities and economic growth in developing countries: Some empirical explorations and implications for WTO negotiations on investment. *RIS Discussion Papers*, 27, 2002.
- Bardhan, P. (1999). The Political Economy of Development in India: Expanded edition with an epilogue on the political economy of reform in India. *OUP Catalogue*.
- Nagaraj, R. (2000). Indian economy since 1980: Virtuous growth or polarisation?. *Economic and Political Weekly*, 2831-2839.
- Ravallion, M., & Datt, G. (2002). Why has economic growth been more pro-poor in some states of India than others?. *Journal of development economics*, 68(2), 381-400

International Finance

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course student will be able to:

Understand the working of International economic Institution.

Develop capacity to advice and guide in FOREX market.

Understand the aspect of currency trade and its effect on economy.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Introduction to International Financial System : International Monetary System: Features and requirements; System of exchanging currencies – From Bretton Woods system to free float and convertibility.

Unit 2 Pegging of currencies; European monetary system; International liquidity.Foreign Exchange Markets and its Activities: Exchange rate quotations and practices; Foreign exchange market activities; Arbitraging, hedging and speculation. (theory only)

Unit 3 Exchange Rate Determination: Exchange rate determination in spot and forward market – Interest rate parity (IRP), purchasing power parity.

Unit 4 International Financial Markets and Instruments: Changing scenario; International capital and money market instruments; Euro – currency markets.

Unit 5 International securities markets and instruments -Bond and notes market; equity market, GDR, ADR, EDR and IDR; Role of financial intermediaries; Financial swaps.

Suggested Readings:

Daniels, Jhon D., Radebaugh, Lee H. Sullivan, Daniel P. and Salwan,P., International Business: Environment and Operations (15 ed), Prentice Hall, New Delhi

Shapiro,Alan. C: Multinational Financial Management (11 ed), Prentice Hall, New Delhi.

Suggested E-Learning Material

Sharma,M. &Mittal,R.(2015) *An Effective analysis on Status of International Trade Polices in India*.Retrieved from <http://www.ijecbs.com/July2015/20.pdf> .

Tucci,L.A.(2013) The general agreement on tariffs and trade (GATT): implications for consumer products marketing.Retrieved from<https://www.emeraldinsight.com/doi/abs/10.1108/07363769610107383> .

Shivkuamr.M.,& Moses L.J.P.,(2016) *impact of FDI with reference to Indian retail sector*. Retrieved from http://ijarie.com/AdminUploadPdf/Impact_of_FDI_with_reference_to_Indian_Retail_Sector_C_1116.pdf .

Goyal M. (2015) *Foreign Exchange Markets, Intervention and Exchange Rate Regimes*.Retrieved from <http://www.igidr.ac.in/pdf/publication/WP-2015-011.pdf>

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to resolve typical legal conflicts, select and interpret codes and other current legislation.

The student not only will be able to use this skill in practice but will also be motivated to take up detailed historical studies on his own after the course.

The logical analysis of legal concepts sharpens the logical technique of the students.

They will be able to find the difference between enforcement of codes and cases.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Sources of Law: Various Sources of law - Legal and Historical Sources **Custom:** Definition of Custom, Kinds of Custom, Custom and Prescription, Requisites of a valid custom **Legislation** - Definition of legislation, Classification of legislation- Supreme and Subordinate Legislation, Direct and Indirect Legislation **Precedent-** Definition of Precedent, Kinds of Precedent- Ratio Decidendi, Stare Decisis , Obiter Dicta ,Original and Declaratory Precedents, Authoritative and Persuasive Precedents, When precedents become weak law, Relative merits and demerits of Legislation, Precedent and Custom as a source of Law.

Unit II Administration of Justice and Theories of Punishment: Liabilities: Theory of Remedial Liability and Theory of Penal Liability, Vicarious Liability, Strict Liability and Absolute Liability.

Unit III Legal Person: Nature and Concept, Theories of Legal Personality, Legal status of Animals, Dead Person, unborn person and idol.

Unit IV Concept of Right and Duties: Definition, Basics and Characteristics, Kinds of Legal Rights, Hoh field's Conception of Rights and Duties and their Corelatives.

Unit V Ownership, Possession and Titles: Ownership- Definition, Nature and incidents of Ownership, Kinds of Ownership, Possession- Nature and Concept, De facto and De jure possession, Kinds of Possession, Distinction between Ownership and Possession, Titles- Concept and Classification.

Leading Cases: -

1. Ashray Adhikar v. Union of India, AIR 2002 SC 554
2. SGPC v. Somnath Das, (2000) 4 SCC 186
3. Salomon v. Salomon and Company, (1887) AC 22
4. Diamler Compnay Ltd. v. Continental Tyre and Rubber Company, (1916) AC 307
5. Rylands v. Fletcher, (1868) 3 HL 330
6. D.K. Basu v. State of West Bengal, (1997) Cr. L.J. 743
7. In Re Delhi Law Act case, AIR 1951 SC 347
8. Bachan Singh v. Union of India, 1980 SC 898
9. S.R. Bommai v. Union of India, (1999) 3 SCC 1

10. Keshavananda Bharti v. State of Bengal, AIR 1973, SC 1461

11. M.C. Mehta v. Union of India, AIR 1987 SC 1086

Suggested Readings:

1. Mahajan, V.D. (2017). Jurisprudence and Legal Theory (Reprint of 5th ed.). Lucknow: Eastern Book Company.
2. Jayakumar, N.K. (2015) Lectures in Jurisprudence (3rd ed.). Gurgaon: Lexis Nexis.
3. Paranjaype, N.V. (2016). Jurisprudence and Legal Theory (8th ed.). Lucknow: Eastern Book Company.
4. Tonapi, Veena Madhav. (2013). Textbook on Jurisprudence (2nd ed.). New Delhi: Universal Law Publishing Co. Pvt. Ltd.
5. Pillai, P.S.A. (2016). Jurisprudence and Legal Theory (Reprint of 3rd ed.). Lucknow: Eastern Book Company.
6. Paton, G.W. (2004). A Textbook of Jurisprudence (1st Indian ed.). New Delhi: Oxford University Press.
7. Fitzgerald, P.J. (2018). Salmond on Jurisprudence (South Asian Edition of 12th ed.). London: Sweet & Maxwell.
8. Dias, R.W. (2013). Dias Jurisprudence (5th ed.). Gurgaon: Lexis Nexis.
9. Bodenheimer, Edgar. (2009) Jurisprudence: The Philosophy and Method of the Law (Revised ed., 6th Indian Reprint). New Delhi: Universal Law Publishing Co. Pvt. Ltd.

Suggested E- Learning Material:

1. Kramer, M. (2000). On the Nature of Legal Rights. The Cambridge Law Journal, 59(3), 473-508. Retrieved from <http://www.jstor.org/stable/4508711>.
2. Raz, J. (1984). Legal Rights. Oxford Journal of Legal Studies, 4(1), 1-21. Retrieved from <http://www.jstor.org/stable/764353>.
3. Wilson, G. G. (1957). Jurisprudence and the discussion of ownership. Cambridge Law Journal 1957(2), 216-229. Retrieved from <https://heinonline.org/HOL/P?h=hein.journals/camlj1957&i=229>.
4. Shartel, B. (1932). Meanings of possession. Minnesota Law Review 16(6), 611-637. Retrieved from <https://heinonline.org/HOL/P?h=hein.journals/mnlr16&i=625>.
5. Furnish, D. (1982). Custom as Source of Law. American Journal of Comparative Law Supplement 30, 31-50. Retrieved from <https://heinonline.org/HOL/P?h=hein.journals/amcomps30&i=41>.
6. Campbell, Kenneth. (2017). Legal Rights. The Stanford Encyclopedia of Philosophy. Retrieved from <https://plato.stanford.edu/archives/win2017/entries/legal-rights/>.
7. Duff, Antony and Hoskins, Zachary (2018). Legal Punishment. The Stanford Encyclopedia of Philosophy. Retrieved from <https://plato.stanford.edu/archives/fall2018/entries/legal-punishment/>.
8. Lamond, Grant. (2016). Precedent and Analogy in Legal Reasoning. The Stanford Encyclopedia of Philosophy. Retrieved from: <https://plato.stanford.edu/archives/spr2016/entries/legal-reas-prec/>.

Environmental Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to evaluate and formulate environmental law and policy.

The students will be able to understand effectively the working of the Institutions relating to environment.

The students will be able to develop ability to assess the social and ecological impacts of environmental law and policy.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Introduction Environment – Meaning and Scope; environmental pollution: Definitions, Sources & Kinds, Need for Legal Control of Pollution, Indian Environmental Ethics, Constitutional Provisions, International Perspective: U.N. Conference on Human Environment, 1972 – Stockholm Principles, Establishment of Environmental Institutions like UNEP, World Charter for Nature, 1982, Ozone Protection – Montreal Protocol for the Protection of Ozone Layer, 1987 as amended, U.N. Conference on Environment and Development, 1992 - Rio Principles; U.N. Convention on Biological Diversity, 1992; Cartagena Protocol on Biosafety, 2000; U.N. Convention on Climate Change, 1992, Kyoto Protocol, 1997; Forest Principles; Agenda 21, Johannesburg Conference, 2002, Delhi Summit, 2002. Fundamental Principles of Environmental Protection: Sustainable Development, Inter-generational and Intra-generational Equity; Precautionary Principle; Polluter Pays Principle; Public Trust Doctrine.

Unit II The Environment Protection Act, 1986, with Rules: Aims and Objects; Meaning of “Environment” and “Environmental Pollutant”; Powers and Functions of the Central Government; Environment Authority - Constitution; Delegation Powers; Offences/Penalties; Effectiveness of the Act; The Hazardous Wastes (Management and Handling) Rules, 1989 as amended in 2000 and 2003; Noise Pollution – Definition, Causes, Effects, Legal Remedies, Noise Pollution (Regulation and Control) Rules, 2000, Environment Impact Assessment Rules 2006, Coastal Zone Management Regulation, 2010.

Unit III The water (Prevention and Control of Pollution) Act, 1974- Definitions, constitution of the Boards, Powers of the Boards. The Central Government: Prosecution Procedure and Punishment.

The Air (Prevention and Control of Pollution) Act, 1981- Definitions, Constitution, Power & Functions of Boards, Powers of the Central Government, Prosecution procedure and punishment.

Unit IV The Indian Forest Act, 1927: Kinds of Forest Land - Private, Reserved, Village, Protected; The Forest (Conservation) Act, 1980, De-reservation of Forests - Non-Forest Use of Forest Land; Rights of Tribals, Forest Dwellers; Use of Forest Land - Mining, Eco-Tourism, Mega Projects.

Unit V The Wildlife Act, 1972 – Definition, wildlife sanctuaries, wildlife / parks, offences under the Act, kinds of forest offences and punishments under the Act. The Prevention of Cruelty to Animals Act, 1960, Greenhouse Effect–Causes, Effects, Remedies, International declaration regarding it.

Leading Cases:

1. Indian Council for Enviro-Legal Action v/s Union of India, AIR 1996 SC 1446 (Bichhri Village Case)
2. Narmada Bachao Andolan v/s Union of India, AIR 2000 SC 3751
3. M.C. Mehta v/s Union of India, AIR 2002 SC 1696 (CNG Vehicles case)
4. Rural Litigation and Entitlement Kendra v/s State of U.P, AIR 1983 SC 652 (Dehradun Mussorie Hills Quarrying case), (1985) 2 SCC 431
5. M.C. Mehta v/s Union of India, AIR 1997 SC 734 (Taj Trapezium case)
6. M.C. Mehta v/s Union of India, (2006) 3 SCC 399 (Closure of Industries in Delhi)
7. M.C. Mehta v/s Union of India, AIR 1988 SC 1037 (Kanpur Tanneries case)
8. M.C. Mehta v/s Union of India, AIR 1988 SC 1115 (Municipalities case)
9. M.C. Mehta v/s Union of India, (Oleum Gas Leakage) & AIR 1987 SC 1086
10. U.P. Pollution Control Board v/s Dr. Bhupendra Kumar Modi, (2009) 2 SCC 147
11. T.N. Godavarman Thirumanlpad v/s Union of India, (1997) 2 SCC 267
12. Vellore Citizen welfare forum v/s Union of India, (1966) 5 SCC 647
13. In re Noise Pollution, (2005) 5 SCC 733
14. M.C. Mehta v/s Kamal Nath, (1997) 1 SCC 388
15. U.P. Pollution Control Board v/s Mohan Meakins Ltd., (2000) 3 SCC 745

Suggested Readings :

1. Diwan, S. and Rosencranz, Armin.(2002). *Environmental Law and Policy in India*. New Delhi.: Oxford University Press,
2. Sahasranaman,P.B.(2009). *Handbook of Environmental Law* New Delhi.: Oxford University Press,
3. Doabia,T.S.(2010). *Environmental and Pollution Laws in India*.Lexis Nexis, Butterworths Wadhwa.

Suggested E- Learning Material:

Lecture _39 environmental laws, by IIT Kanpur, National Program on Technology Enhanced Learning(NPTEL),an MHRD initiative Retrieved from
<https://www.youtube.com/watch?v=CTUOchYZG2k>

Environmental laws video Lectures, by Prof. Mukesh Sharma, free video lectures. Retrieved from
<http://free video lectures.com>

Management Principles

Objective: This course seeks to introduce the students to the foundational principals of Management.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Introduction to Business Management – What is Business – defining the concept of management and administration – quality management versus quantity management – management and productivity – management and leadership. (10)

Unit 2 Management Functions: Management functions – planning, Organization, human resources – leadership – motivation and training – communication – technology selection – management process in a dynamic business environment. (10)

Unit 3 Theories of management – Classical management thought - Taylor's scientific management - 12 principles of scientific management by Henry Fayol, Scientific management by objectives of Peter Drucker (10)

Unit 4 Management by performance – Neo-classical theory of management, Hawthorne experiment – modern management theories (i) operation research (ii) system approach (iii) contingency approach (10)

Unit 5 Conflict management and management controls: causes of conflict resolution – organizational conflict management control process – queuing model – communication and coordination. (10)

Suggested Readings :

1. R. D. Agarwal : Organization and Management. Tata McGraw Hill, New Delhi.
2. P.C. Tripathi & P. N. Reddy: Principles of Management. Tata McGraw Hill, New Delhi.
3. Koontz & Weihrich : Essentials of Management, McGraw Hill.
4. Stoner : Management, PHI, New Delhi, 1982.
5. Weihrich & Koonts - Management - A Global Perspective – Tata McGraw
6. Robbins & D. Cenzo - Fundamentals of Management - Pearson Education Asia other relevant readings will be provided by the instructors.

Business Economics

Micro Economics

Objective : In this paper, student is expected to understand the behavior of an economic agent, namely, a consumer and producer.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Nature, scope and significance of Economics. Positive and Normative Economics, Consumer Equilibrium : Utility Approach-Concept, assumptions, marginal utility, Law of diminishing utility, equi-marginal utility and criticism, Indifference curve Approach – Concepts and properties of Indifference curves, Marginal rate of substitution, Principle of diminishing marginal rate of substitution, its reasons, Budget Line, Determinants of demand. (12)

Unit 2 Elasticity of Demand - concept and measurement of Price elasticity of demand, determinants, measurement and types of price elasticity of demand. Income and cross elasticity of demand and numerical problems related to elasticity of demand. (10)

Unit 3 Production function: Law of variable proportions, Returns to scale-concept of Isoquants, its properties and Iso-cost line, Least-Cost combination, concept of ridge lines. (8)

Unit 4 Concept of cost: Accounting & Economic costs, opportunity cost, sunk cost, Private cost and social cost. Short-Run Cost curves: Total cost, Total Fixed and variable costs, Average cost and Marginal cost and relationship between average and marginal cost curves. (10)

Unit 5 Introduction to various market structures: perfect compaction, Monopoly and oligopoly, Modern theory of Distribution. (10)

*Handouts to be prepared consolidated. Much deeper detail not required.

Books Recommended:

- Gauld, J. P. and Edward P. L. Micro Economic theory, Richard Irwin, Homeword.
2. Lipsey, R. G. and K. A. Chrystal, Principles of Economics (9th Edition) Oxford University Press Oxford.
 3. Mansfield, Micro Economics (9th Edition) W. W. Norton and Company, New York.
 4. Samuelson, P. A. and W. D. Nordhaus, Economics, Tata McGraw Hill, New Delhi.
 5. Varian, H.R., Intermediate Micro economics: A Modern Approach (5th Edition), East West Press, New Delhi.
 6. Ahuja.H.L., Principle of microeconomics, S.Chand& Company LTD. Delhi.

Law of Contract – I

Objective: Every man in his day to day life from dawn to dusk makes a variety of contracts. Man's contract making activities increase with the increasing trade, commerce and industry. In a way living in a modern society would be impossible if the law did not recognize this contract making power of a person. This course is designed to acquaint a student with the conceptual and operational parameters of these various general principles of contractual relations.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit: 1 Definition and Classification of Contracts: Deeds and Simple Contracts, Bilateral and Unilateral Contracts, Express and Implied contracts, Valid, Void, Voidable and illegal Contracts, Executed and Executory Contract.

Formation of an Agreement: Offer and Invitation to Offer, Acceptance, Revocation of offer, Communication of offer & Communication of acceptance. (10)

Unit: 2 Consideration: Meaning, Nature and Need, Doctrine of privity of contract, Kinds and Exceptions of Consideration.

Capacity to Contract: Minors, Lunatics, Idiots, Nature and Effects of an agreement with a person under legal disability. (10)

Unit: 3 Free Consent: Factor vitiating free consent, coercion, Undue Influence, Fraud, Misrepresentation, Mistake of Law and fact.

Limitation on freedom of Contract: Unlawful agreements, Public Policy, Agreements and Unlawful Consideration in Part and Objects, Agreements without Consideration, Agreement in restraint of Marriage, Agreement in restraint of Trade, Agreement in restraint of Legal Proceeding Wagering Agreements. (10)

Unit: 4 Contingent Contract: Performance of Contingent Contract, Conditional Contract, when Enforcement Depends upon Happening or non Happening of an Event, Event Linked with Human Conduct.

Discharge of a Contract: Discharge by Performance, Discharge by Agreement, Frustration, Supervening Impossibility of Performance, Discharge by Operation of Law, Discharge by Breach and Novation. (10)

Unit: 5 Quasi Contracts: Obligations Resembling those Created by Contract, Concept and Classification.

Remedies for Breach of Contract: Damages, Remoteness of Damages, Mitigation of Damages, Penalty and Liquidated Damages. (10)

Leading Cases:

1. Lalman Shukla v/s Gouri Dutt, (1913) 11 All L. J. 489
2. Balfour v/s Balfour, (1919) 2 K.B. 571
3. Bhagvandas Goverdhandas Kedia v/s Gidharilal Pursottamdas, AIR 1966 SC 543
4. Carlill v/s Carbolic Smoke Ball Co., (1892) 2 QB. 48, (1893) 1 & B 256
5. Mohoribibee v/s Dharmodas Ghosh, Privy Council 1903
6. Hadley v. Baxendale
7. Mc Pherson v/s Appana, AIR 1951 SC 184
8. Dunlop Pneumatic Tyre Co. V/s Selfridge & Co. (1915) AC 847
9. Chinnaya v/s Ramaya, (1882) 4 Mad. 137
10. Durga Prasad v/s Beldev (1880) 3 ALL 221

Text Books:

1. Singh, Avtar. Law of Contract and Specific Relief. Lucknow: EBC, 2008
2. Mulla and Pollock. Law of Contracts. New Delhi: Butterworths, 2005.

Reference Books:

1. Beatson, J. Anson's Law of Contract. New York: Oxford University Press, 2005
2. Atiah, P. S. an Introduction to the Law of Contract. Oxford: Clarendon Press, 1998
3. Sarkar, M.C. Sakar's on Specific Relief Act. New Delhi: Wadhwa & Company, 2001

Introduction to Computer Applications

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Understand input and output devices of computers and recognize the basic terminology used in computer programming

Understand the Microsoft Office package, MS-DOS and Unix Systems

Understand concept of Database and Networking

Unit 1 Introduction to Computer System: Simple model of computer, Basic components of computer system, Generation of computers.

Introduction to Software: System and Application Software

Introduction to Operating System: Types and Function, MS DOS, Basic DOS and Unix Commands, Windows Operating System.

Unit 2 Number System: Data Representation-Binary, Octal, Hexadecimal, 1's and 2's complement method of representation and binary arithmetic (addition, subtraction)

Characters and codes: BCD, ASCII, EBCDIC Unicode coding.

Unit 3 Input/ Output devices: Types of I/O Devices, Serial, Parallel and Graphical.

Memory: RAM, ROM, EPROM, PROM and concepts of other types of memory, Storage devices – Sequential, Direct and Index Sequential.

Unit 4 Office automation with word and Excel: working with MS Office packages

MS Word: creating file, editing, inserting object, formatting, inserting table, mail merge, spell check etc.

MS Excel: Creating sheet, formatting, inserting function, creating charts etc.

Unit 5 Presentation and data skill development

MS Power Point: creating presentation, editing, inserting animation etc.

MS Access: concept of database and DBMS, database operation, creation, updation, selection, deletion, Report generation etc.

Suggested Readings:

1. Sinha, P.K. *Computer Fundamental*. New Delhi: B.P.B. Publications.
2. Govil, R. et al. *PC Software*. New Delhi : B.P.B. Publications.
3. Norton, Peter. (1989) *Peter Norton's DOS guide*. Auburn: Brady.
4. Rajaraman, V. *Fundamentals of Computers*. New Delhi: PHI
5. Das, Sumitabha.(2006).*UNIX Concepts and Applications*. New Delhi: Mc Graw hill
6. Rutkosky, S. (2008). *Office 2007*. New Delhi : B.P.B. Publications.

Suggested E-Learning Material:

Introduction to Programming in C

<https://nptel.ac.in/courses/106104128/>

Introduction to MS Office

<https://support.office.com/>

Organizational Behaviour and Behavioral Psychology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course the student will be able to:

Understand the basic of organizational behaviour.

Develop an outlook towards leadership and group dynamics.

Understand the concept of conflict and resolution.

Note: The paper will contain 10 questions having two questions from each unit; candidates will be required to attempt five questions taking one question from each unit.

Unit 1 Introductory : Historical context of Organizational Behavior - challenges, scope and opportunities for OB; Perspectives for understanding OB- Open system approach, human relations perspective, developing an OB model responsive to Indian realities

Unit 2 Person in the Organization: Biographical characteristics, personality: definitions and measurement, concept of skill, self-awareness; major personality affecting OB, matching personality and job; personality and culture

Unit 3 Groups and Leadership: Group Dynamics and Teams - Theories of Group Formation, Formal and Informal Groups and their interaction, Importance of teams, Formation of teams, Team Work. ; Leadership: definition and functions; trait; situational, interactional and contingency approaches to leadership; leadership effectiveness; the charismatic leadership.

Unit 4 Motivation and Communication: Theories of Motivation - Content and Process theories; Communication - The importance of communication, the communication process, Interpersonal communication, Multicultural communication, Barriers to effective communication, Improving Communication in organizations, Promoting ethical communications.

Unit 5 Conflict and Change Management: Management of Change – Importance, Factors responsible for change, Resistance to change , Overcoming resistance to change; Conflict Management - Traditional vis-a-vis Modern view of conflict, Constructive and Destructive conflict, Conflict Process, Strategies for encouraging constructive conflict, Strategies for resolving destructive conflict; Stress Management - Concept of stress, Sources of stress, Effects of stress on humans, Management of Stress

Suggested Readings:

Robbins, Stephen P., and Sanghi, Seema (2007). *Organizational Behavior* (11 ed). Delhi: Pearson Education.

Luthans, Fred (2016). *Organizational Behavior* (12 ed). New York: McGraw-Hill Companies, Inc.

Pareek, Uday (2016). *Understanding Organizational Behaviour* (4 ed). New Delhi: Oxford University Press.

Dennis, David A., and Robbins, Stephen P. (2008). *Fundamentals of Human Resource Management* (8 ed). Haryana: Wiley India (P) Ltd.

Flippo, Edwin B. (1984). *Personnel Management* (6 ed). Singapore: McGraw-Hill Book Co.

Dessler, Gary (2009). *Human Resource Management* (11 ed). Delhi: Pearson Education.

Suggested E Learning Material:

Johnson, J. A. (2017). Big-Five model. In V. Zeigler-Hill, T.K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (1-16). New York: Springer. DOI: 10.1007/978-3-319-28099-8_1212-1.

Smriti. (2018). *Motivation Cycle-Fundamentals of Psychology/ Management Notes*. Retrieved from <https://www.managementnote.com/motivation-cycle/>.

Cappelli, P. (2018). *HR Exchange at Think*. Retrieved From <https://www.youtube.com/watch?v=bTH3qEoXAhk>

Macro Economics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course the student will be able to:

Understand the perspectives of macroeconomics.

Understand about the financial markets and banking system in India.

Know about the concept and measurement of money supply and inflation.

Understand latest trends and impact of monetary, fiscal and globalization policies.

Know about the concept of international trade as well as significance of various institutions (WTO, IMF, WB, and ADB).

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in taking at least one question from each unit.

Unit 1 Methods of Economic Analysis: Micro and Macro Economic analysis, Central Problems of Economic Systems, Solutions of central problems in different economies – Capitalist, Socialist and Mixed Economy.

Unit 2 Economy as a circular flow of income and expenditure in two, three and four sector economies, Major leakages and injections. Concept and Components of National Income – GDP, GNP, NDP, NNP, Private income, Personal income and Personal disposable income.

Unit 3 Inter-relationship among National Income aggregates, Methods of Measuring National Income- Product or value added method, Income method and Final Expenditure method, Precautions and limitations of various methods, Problems in the estimation of national income.

Unit 4 Estimation of national income in India : a general discussion of the methods and difficulties, National Income and Welfare, problem of inflation-cause & remedies.

Unit 5 Factor Influencing Consumption, Investment and Introduction to business cycles, Role& Instrument of Fiscal & Monetary Policy.

Suggested Readings:

Ahuja, H. L. (2017). Macro Economic Theory and Policy (20th ed.). New Delhi: S. Chand and Co.

Diwedi, D. N. (2015). Managerial Economics (8th ed.). New Delhi: Vikas Publications.

Dwivedi, D. N. (2015). Macro Economics Theory & Policy (4th ed.). New Delhi: McGraw Hill Education (India) Pvt. Limited.

Hajela, T. N. (2009). Money and Banking Theory with Indian Banking (8th ed.). New Delhi: Ane Books Pvt. Ltd.

Jhingan, M. L. (2016). Macro Economic Theory (12th ed.). Delhi: Vrinda Publication (P) Ltd.

Mishra, S. (2012). Banking Law and Practice (2nd ed.). New Delhi: S. Chand and Co.

Ohri, V. K., & Jain, T. R. (2015). Macro Economics. New Delhi: V.K. Global Publications.

Varshney, R. L., & Maheshwari, K. L. (2014). Managerial Economics (22nd ed.). New Delhi: Sultan Chand & Sons.

Suggested E-Learning Material:

MSG. (2014). Principles of Managerial Economics. Retrieved from Managment Study Guide:
<https://www.managementstudyguide.com/principles-managerial-economics.htm>

Mayank, K. (2018, September). Theories of International Trade. Retrieved from:
<https://www.youtube.com/watch?v=uBp6secGhoE>

Economics on your tips (2016, August 22). Concepts of National Income. Retrieved from:
<https://www.youtube.com/watch?v=95ijkT2vFJ4>

Jacob Clifford (2017, May 9). Macroeconomics-Everything you need to Know. Retrieved from
<https://www.youtube.com/watch?v=MKO1icFVtDc>

Business Strategy

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course the student will be able to

Understand the business and business strategy

Understand how organizations formulate and implement strategies.

Apply and evaluate relevant theories and tools in the context of case studies.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Nature , Purpose and Importance of Business Policies. Defining and explaining Strategy. What makes a decision strategic? Levels at which strategy operates. Process of formulating Strategies

Unit 2 Vision, Mission & Purpose, Business definition.Environmental Appraisal.Organizational Appraisal, Corporate Level Strategies -Expansion, Stability, Retrenchment, Combination.

Unit 3 Business Level Strategies. Strategic Analysis and Choice - Strategic choices Models-BCG Matrix, GE Cells, Hoffer's Product Market evolution matrix, Porter's Model. Societal Level Strategies.

Unit 4 Strategy Implementation - Structural, Functional & Operational, Behavioral.

Unit 5 Strategic Evaluation and Control: Strategic Evaluation process, Strategic Control, Operational Control, Role of Organization's systems in Evaluation.

Case Study Analysis of small cases related to various aspects of the course has to be facilitated by the instructor in the class.

Suggested Readings:

Kazmi A. (2015). *Business Policy & Strategic Management* (4 ed.) Tata McGraw Hill India.

Wheelen& Hunger. (2013). *Strategic Management & Business Policy* (13 ed.) Pearson.

Suggested E-Learning Material:

Business Jargon. (n.d.). Strategy Implementation. Retrieved March 1, 2019, from businessjargons.com: <https://businessjargons.com/strategy-implementation.html>

Community Tool Box. (n.d.). An Overview of Strategic Planning or "VMOSA" (Vision, Mission, Objectives, Strategies, and Action Plans). Retrieved Feb 23, 2019, from ctb.ku.edu/en: <https://ctb.ku.edu/en/table-of-contents/structure/strategic-planning/vmosa/main>

Gupta, N. (2017, March 27). Idea and Vodafone Merger: A saga of becoming India's Largest Telecom Company. Retrieved March 1, 2019, from [www.jagranjosh.com: https://www.jagranjosh.com/ articles/idea-and-vodafone-merger-a-saga-of-becoming-indias-largest-telecom-company-1490598696-1](http://www.jagranjosh.com/articles/idea-and-vodafone-merger-a-saga-of-becoming-indias-largest-telecom-company-1490598696-1)

ICMR. (2018). Idea- Vodafone Merger: Consolidation in the Indian Telecom Sector. Retrieved Feb 22, 2019, from [http:// www.icmrindia.org: http://www.icmrindia.org/casestudies/catalogue/Business%20Strategy/Idea-%20Vodafone%20Merger%20Consolidation%20in%20the%20 Indian%20Telecom%20Sector-Excerpts.htm](http://www.icmrindia.org)

MSG. (n.d.). Business Policy - Definition and Features. Retrieved March 1, 2019, from [www.managementstudyguide.com: https://www. managementstudyguide.com/business-policy.htm](https://www.managementstudyguide.com/business-policy.htm)

Status.net. (n.d.). 1500+ Best Company Vision and Mission Statements [by Industry]. Retrieved March 1, 2019, from [status.net: https://status.net/articles/best-company-slogans-vision-mission-statements-examples](https://status.net/articles/best-company-slogans-vision-mission-statements-examples)

Financial Accounting

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course the student will be able to

Understand book keeping and financial accounting.

Maintain basic books of accounts

Prepare and present final accounts.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Financial Accounting- Definition & its difference with cost accounting and management accounting, accounting principles (GAAP)- concepts & conventions, capital & revenue, overview of single entry system.

Unit 2 Preparation of voucher, invoices & memos, Rules of Dr. & Cr. Preparation of Journal, ledger & cash book understanding the format.

Unit 3 Trial balance, Rectification of Errors, Bank Reconciliation Statement meaning & methods of preparing.

Unit 4 Depreciation- Straight line Method & Written Down Value Method, Accounting for Bills of Exchange, Reserves & Provisions.

Unit 5 Preparation of final accounts- trading, profit & loss account and balance sheet, format & adjustments.

Suggested Readings:

D.K. Goel, Rajesh Goel&ShallyGoel. (2017) Accounting (16ed). New Delhi: Arya Publications

T.S. Grewal. (2017) Introduction to Accountancy (18ed). New Delhi: Sultan Chand

M.C. Shukla, T.S. Grewal, S.C. Gupta. (2016) Advanced Accounts (19ed) . New Delhi: Sultan Chand

Mukherjee and Mukherjee. (2016) Accounting (10ed). New Delhi: Sultan Chand

Suggested E-Learning Material:

MSG. (2016). *What is single entry system:Pros and Cons*. Retrieved from Managment Study Guide: <https://www.managementstudyguide.com/single-entry-system-in-accounts.htm>

MSG. (2018). *What is Accounting*. Retrieved from Management Study Guide: <https://www.managementstudyguide.com/financial-accounting-articles.htm>

Kumar, S. (2017, May 6). *Basic concept of accounting*. Retrieved from Youtube: <https://www.youtube.com/watch?v=eaJosm9Y5dQ>.

Badlani, D. (2014, Sep 5). *Financial Statement of Companies*. Retrieved from Youtube: <https://www.youtube.com/watch?v=TzBGN1OJS1E>.

Principles of Marketing Management

Objectives: The objective of the course is to provide the students to the knowledge of marketing management concepts and their relevance in organizational functions.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit-1 Marketing Concept & Approaches of Marketing, Market planning, Marketing Environment, Marketing Mix, Concept of Market Segmentation, Targeting & Positioning.(10)

Unit-2 Product Mix: Type of products, Product mix & product line decision, New- product development, product life cycle, branding & packaging decision. (10)

Unit-3 Product Pricing: Pricing concepts, Understanding price, Setting the price, Methods of pricing, Price Adaptations, Initiating and Responding to price changes. (10)

Unit-4 Distribution: Distribution channel & Type of channels of distribution and Factors effecting choice of distribution channels, Channel Management. (10)

Unit-5 Promotion: Promotion Mix, Objectives & Types of Advertising, Major Advertising Media, Integrated Marketing Communication concepts, Meaning Objective & Tools of Sales Promotion, Basic concepts of Personal Selling & Publicity (10)

Suggested Readings:

1. Kotler Philip, Marketing Management (Analysis, Planning and Control)
2. Srivastava P.K.: Marketing Management.
3. J. C. Gandhi: Marketing – Managerial Introduction.
4. Subhash C. Mehta: Marketing Environment (concepts & cases)

Management Accounting

Objective: To give an overview of accounting principles and practices used by accountants in decision making. The course also seeks to acquaint the students about financial statement and corporate accounting.

Note: The paper will contain 10 questions having two questions from each unit; candidates will be required to attempt five questions taking one question from each unit.

Unit 1 Measuring business Income: Capital and Revenue, Classification of income, classification of expenditure, classification of receipts, Profit and loss account, Balance sheet, adjustment entries. (10)

Unit 2 Accounting of Partnership firm: General principles, Accounting Records, Goodwill, final account of partnership. (10)

Unit 3 Corporate Accounts: Joint Stock Companies, Distinction between partnership and joint stock companies, class of shares (10)

Unit 4 P& L Account and Balance sheet of Companies (10)

Unit 5 Consignment, Joint Ventures and Branch Accounts: Books of consignee and Consignor, joint venture concept, distinction from consignment, types of branch (10)

Text Books:

1. Maheshwari, S.N. and S. K. Maheshwari (2003), An Introduction to Accountancy, Eighth Edition, Vikas Publishing House.
2. Gupta, R.L. and V.K. Gupta (2003), Financial Accounting: Fundamental, Sultan Chand Publishers.
3. Shukla & Grewal – Advanced Accounts, Chand & Company
4. T.S.Grewal and S.C. Gupta- Introduction to Accountancy

Advertisement & Media Management

Objective : To give an overview of the scope and idea of advertising and media in the Indian Society and learn ethical and unethical advertising.

Note : The paper will contain 10 questions having 2 questions from each unit. Candidates will be required to attempt 5 questions taking 1 question from each unit.

Unit 1 Defining advertising : Meaning and Scope, brief history of development and growth of advertising, benefits of advertising, Relationship of advertising with other elements of promotion mix, Legal, Ethical and Social issues in advertising. (10)

Unit 2 Advertising Agency: Need, organizing and functions of ad agency, Types of ad agencies, Choice of an ad agency, Agency compensation. (10)

Unit 3 Planning and developing an Ad Campaign: Advertising Planning, Advertising Objectives, and Advertising Budget. (10)

Unit 4 Creative strategy: Facets of creative strategy, Advertisement appeals, themes and framework, Methods of copywriting, copywriting for different medias. (10)

Unit 5 Advertising Media Strategy: Types of Media with Relative Importance, emerging media options, Media Selection, Media Planning and Buying, Media Challenges; Unethical advertising (10)

Suggested Readings:

1. Batra Myers & Aaker : Advertising Management - Prentice Hall.
2. Manendra Mohan: Advertising management - Tata Mcgraw Hill

Jurisprudence – I

Objective: At the heart of the legal enterprise is the concept of law. Without a deep understanding of this concept neither, legal education nor legal practice, can be a purposive activity oriented towards attainment of justice in society. The objective of this paper is to impart knowledge of doctrines about law and justice, developed over the years, in various nations and historical situations.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Introduction: Meaning, Scope and Nature of Jurisprudence, Importance of the Study of Jurisprudence, Kinds of Law; Relationship between Jurisprudence and Legal Theory.

Unit 2 Natural Law School: Classical Natural Law, Revival of Natural Law – Rudolf Stammler; Law and Morality.

Unit 3 Analytical School: Analytical Positivism, Imperative Theory by John Austin; Pure Theory of Law.

Unit 4 Sociological School: Background and Characteristics, Ihering, Ehrlich and Roscoe Pound, Duguit.

Unit 5 Historical School: Frederick, Karl-Von-Savigny, Sir Henry Maine; American Realist School: Background and Characteristics, Holmes, Llewellyn and Frank; Marxist Theory: Law as Ideological Apparatus, Theory of Karl Marx.

Leading Cases: -

1. A.D.M. Jabalpur v. S. Shukla, AIR 1976 SC 1207
2. Collector of Madurai v. Mooto Ramalinga Moore: Indian Appeals 397
3. State of Rajasthan v. Union of India, AIR 1977 SC 1361
4. Vishakha v. State of Rajasthan, AIR 1997 SC 3011

Text Books: -

1. Mahajan, V.D., Jurisprudence and Legal Theory., Lucknow: Eastern. Book Company, 2010
2. Paranjaype., Jurisprudence and Legal Theory. Allahabad:, Central Law Agency, 2008
3. Dhayani, S.R., Jurisprudence and Indian Legal Theory., Allahabad Central Law Agency, 2006
4. Pillai, P.S.A., Jurisprudence and Legal Theory., EBC, (Latest Edition)

Reference Books:

1. Dias, R.W., Dias Jurisprudence. New Delhi:, Aditya Book Law House, (Latest Edition)
2. Jois, Rama., Seeds of Modern Public Law in Ancient Indian Jurisprudence., Lucknow: EBC, 1990

Audit Practice

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course, the student will be able to:

To discuss need for an external audit and its importance.

Describe the various levels of persuasiveness of different types of audit evidence.

Identify appropriate assertions at risk and apply appropriate audit procedures to test the assertions identified

Understand auditors' legal liabilities, and be able to apply case law in making a judgment whether auditors might be liable to certain parties.

Note: The paper will contain 10 questions having questions from each unit. Candidate will be required to attempt 5 questions taking 1 question from each unit

Unit 1 Auditing Concepts: Nature, Scope and Significance of Auditing, Basic Principles Governing an Audit, Generally Accepted Auditing Standards

Unit 2 Company Auditor: Auditor appointment and removal, Resignation of auditor, Disqualification of auditor, Statutory Audit, Internal Audit, Branch Audit, Joint Audit, Special Audit, CAG Audit. Forms of Audit - Propriety Audit, Compliance Audit and Efficiency Audit.

Unit 3 Internal Audit: Nature, Scope and Techniques of Internal Audit, Functions and Responsibilities of Internal Auditors, Internal Audit tools and techniques. Distinction between internal audit and external audit.

Unit 4 Vouching and verification: Objectives, procedure, principle, techniques, verification of asset and liabilities, difference between verification and valuation. Problems in verification.

Unit 5 Operational Audit- techniques and procedures, Operational audit report, Audit Engagement and Documentation, Audit Procedures: Audit Plan, Audit Programme,

Suggested Readings:

Basu, S. K. (2006). *Auditing: Principles and Techniques*. New Delhi: Pearson Education.

Kumar, R., & Sharma, V. (2015). *Auditing Principles and Practice*. Delhi: PHI Learning Private Limited

Blank, R. (1999). *The basics of Quality Auditing*. Boca Raton, FL: CRC Press.

Suggested E-Learning Material:

HUB India(2017).What an Audit is and Types of Audit.RetrievedFromhttps://www.youtube.com/watch?v=KM_ntoyBYMs

Zuin,S.(2017). *The hidden power of auditing*.Retrieved From <https://www.youtube.com/watch?v=465Bkxh4uMw>

EsfahaniSmith,E. (2017).*There's more to life than being happy*. Retrieved Fromhttps://www.ted.com/talks/emily_esfahani_smith_there_s_more_to_life_than_being_happy

Business Ethics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon Completion of the course the students will be able to:

Understand the aspect of Indian values and ethics.

Understand the aspects of business ethics and its compliance.

Correlate law and ethics and its practices in life.

Objective : The objective of the course is to give a basic idea about the principles of business ethics. The students will learn about the importance of ethics its evolution and its relation with Law and business disciplines.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit 1 Business Ethics: Meaning, nature, and Scope of business ethics; evolution of business ethics; relation between ethics and business ethics; Values – Importance, Sources of Value Systems, Types, Loyalty and Ethical Behaviour, Culture and Ethics, Values across Cultures.

Unit 2 The Ethical Value System – Plato, Aristotle, Benedict Spinoza, Immanuel Kant, Bhagwat Gita, Buddhism, Sufism, Capitalism, Marxism, Socialism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes. (10)

Unit 3 Indian Values and Ethics – Respect for Elders, Hierarchy and Status, Need for Security, Non – Violence, Cooperation, Simple Living high Thinking, Rights and Duties, Ethics in Work life, Holistic Relationship between Man and Nature, Attitudes and Beliefs.

Unit 4 Law and Ethics – Relationship between Law and Ethics, Other bodies in enforcing Ethical Business Behavior, Impact of Laws on Business Ethics, Social Responsibilities of Business – Environmental Protection, Fair Trade Practices, Fulfilling all National obligations under various Laws, Safeguarding Health and well being of Customers, Trusteeship Management- Gandhian Philosophy of Wealth Management

Unit 5 Ethics in Business Disciplines: Ethics in Advertising, Ethics in HRM and Marketing, Ethics in Finance and Accounting, Ethics in Information Technology.

Ethical Aspects of Corporate Policy, Morality and Rationality in Organization, Making Moral Decisions. Conflict between personal values and organizational goals. Ethical Corporate culture.

Suggested Readings:

Chakraborty, S. K. (2009). Values and Ethics in Organisation (5 ed.). New Delhi: Oxford.

Ghosh, B. (2013). Business Ethics and Corporate Governance. Delhi: Tata McGraw Hill.

Hosmer, L. T. (2009). The ethics of Management (2 ed.). New Delhi: Universal Books.

Murthy, C. S. (2012). Business Ethics and Corporate Governance (3 ed.). New Delhi: Himalayan Publishing House.

Tripathi, A. N. (2010). Human Values (1 ed.). New Delhi: New Age International.

Suggested E-Learning Material:

Joshi, A. (2016, Dec 7). *Management from Bhagwad Geeta :A Few Insights*. Retrieved Feb 18, 2019, from Shastriya Prabandhan - A Bharatiya Design Thinking Approach to Education and Management: <http://ankurjoshi.in/bhagwad-gita-management/>

Sharma, S. (1999, Oct 1). *Corporate Gita: Lessons for Management, Administration and Leadership*. Retrieved March 1, 2019, from journals.sagepub.com: <https://journals.sagepub.com/doi/10.1177/097168589900500203>

Swami Vivekananda *Chicago Speech on 15th September,1893*. (2013, Aug 12). Retrieved Jan 5, 2019, from www.youtube.com

Principles of Taxation Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	1	0	5

Learning Outcomes:

The students will be able to understand the procedure of direct tax assessment.

The students will get thorough knowledge about the means and techniques of computing the total income and define tax complicacies and structure.

The students will be imbibed with the understanding of amendments made from time to time in Finance Act

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I Concept of Taxation: Social Welfare Context; History of Taxation in India - Kautilya and Manu, Diversity levies by Government; Levies, Toll, Fee, Charge, Surcharge, Octroi, Cess, etc.

Constitutional Provisions: Art. 265 to 289 of the Constitution of India - Scope of Tax Laws; Kinds of Taxes: Direct and Indirect; Competence to levy Tax – issues of constitutionality of a tax; Doctrine of Non-Retroactivity of Tax laws; Doctrine of Restrictive Interpretation.

Unit II Direct Tax Laws: Concept of Direct Tax; Kinds of Direct taxes: Income, Wealth, Capital gains, Estate duty etc' Proposed Direct Tax Code.

Income Tax Law: Historical outline, Definitions – Agriculture Income, Previous Year, Assessment Year, Assessee; Incidence of Tax and Residential Status; Capital Receipt v/s Revenue Receipt; Basis of Charge (Receipt & Accrual), Annual Budget, Statutory Exemptions (Ss 10 to 13A)

Heads of Income (Sections 14-59): Heads of income, Rationale and Heads whether mutually exclusive.

Unit III Salaries (Sections 15 to 17): Chargeability, Meaning of Salary and other relevant areas, Fringe benefits tax & Perquisites, Profits in Lieu of Salary.

Income from House Property (Sections 22 to 27): Ingredients of Section 22, Annual Value how to be determined, Deductions under Section 24, Deemed Owner.

Capital Gains (Sections 45 to 55): Definition of Capital Assets, Short and Long Term Capital Assets, Short and Long Term Capital Gain, Meaning of Transfer, Computation Transactions not amounting to Transfer, Mode of Computation, Meaning of Terms Adjusted, Cost of Improvement and Cost of Acquisition.

Unit IV Profits and Gains of Business and Profession (Sections 28 to 44): Applicability, Deductions, Bad Debts, Business Expenditure – Allowability, Tests of distinctions between Business expenditure and Capital expenditure.

Income from other Sources (Sections 56 to 59): Income of Other Persons included in Assessee's Total Income- Concept of Clubbing of Income and its Justifiability, Throwing of Separate Property into the Common Stock of HUF and subsequent partition of the same Section 64 (2); Set off & Carry Forward of Losses (Section 70-74 A), Deduction under Section 80 & exemptions for GTI.

Unit V Income Tax Authorities: Officers under IT Act, Powers & Functions of Authorities.

Assessment procedure: Filling of Return, Types of Assessment, Limitation of Time, Search and Seizure (Sections 132, 132A, 132B), Survey [Section 133A], Permanent Account Number

Remedies: Appeals & Revision (Sec. 246 to 264), Penalty & Prosecutions.

Leading Cases:

1. Janab A. Sayed Saheb V/s C.I.T., (1960) 391 I.T.R.
2. P. Krishna Menon v/s C.I.T., (1959) 35, I.T.R. 48 (SC)
3. Tata Sons Ltd. v/s C.I.T. Bombay City, (1950) 18 I.T.R. 460
4. Bacha F. Gadar v/s C.I.T. Bombay, AIR 1955, SC
5. The Commissioners of Income Tax Madras v/s Bhagya Lakshmi & Co., AIR 1955 SC 1708

Suggested Readings:

1. Singhania, Vinod K. (2018) Student Guide to Income Tax, Taxman.
2. Rai Kailash. (2016). Taxation Laws. Allahabad Law Agency.
3. Myneni, S.R. (2018). Law of Taxation. Allahabad Law Agency.
4. Ahuja, Girish. (2018). Systematic Approach to Income Tax. Delhi: Bharat Law House Pvt. Limited.
5. Palkivala, Nani. Income Tax. Lexis Nexis Butterworths Publications.
6. The Income Tax Act, 1961 (Bare Act)

Suggested E-Learning Material:

1. Direct Taxation Group _I study Notes- I by Icmαι, Retrieved from http://icmai.in/upload/Students/Syllabus-2012/Study_Material_New/Inter_Paper7-Revised.pdf
2. Direct Tax Complete Theory by Badlani classes Retrieved from <https://www.badlaniclassess.online/copy-of-ay-17-18-income-tax>
3. Agrawal, CS K.K. Fast Track Quick Revision Income Tax. Retrieved from <https://taxguru.in/wp-content/uploads/2014/04/FT-QR-IT.pdf>
4. Study Material of The Institute of chartered Accountants of India on Direct Tax, Retrieved from https://www.icai.org/post.html?post_id=13752

Principles of Kathak Dance – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome

Discuss the Tandava, Lasya and Hastabhinaya.

Understand the technical terms of Kathak and Musical aspects of Dance

Know about the contribution of Kathak maestro.

Learn about notation skills.

Content -

Unit – I

1. Types of Tandav and Lasya
Study of Tandav and Lasya with their types.
2. Study of Hastmudras according to Abhinaya Darpan :
(a) Nritya Hastmudra (b) Dev Hastmudra (c) Jati Hastmudra

Unit – II

1. Detail study of the following –
(i) Amad (ii) That (iii) Parmelu
(iv) Paran (with their types) (v) Kavitt
(vi) Salami (vii) Gatbhav (viii) Gat Nikas
2. Detailed study of Laya and Layakari

Unit – III

1. Life Sketch and Contribution of Kathak Dance
(a) Pt. Krishna Kumar
(b) Pt. Mohan Rao Kalyanpurkar
(c) Pt. Lachhoo Maharaj
2. Ability to write in notation all the boles learnt in practical.

Suggested Readings:

1. Khare, Shikha (2005), Kathak Saundaryatmak Shastriya Nritya, Kanishk Publishers, Distributers, New Delhi.
2. Shukla, Babulal Shastri (2017), Natyashastra, Chaukhambha Sanskrit Sansthan, Varanasi.
3. Dadhich, Dr. Puru (1948), Kathak Nritya Shiksha, Part-II, Bindu Prakashan, Indore.
4. Tak, Dr. Maya (2006), Aitihāsik Pariprekshya main Kathak Nritya, Kanishk Publishers, Distributers, New Delhi.
5. Misra, Susheela (1992) Some Dancers of India, Manjit Singh Harman Publishing House, New Delhi.

History of Indian Classical Dance – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome

Understand the depth of dancing history and different Indian Classical dance forms.

Explain, texts, based on Nritya, Nritya and Natya and have knowledge of different Gharanas of Kathak.

Appreciate famous ancient Indian Theatologists of Classical Dance

Content -

Unit – I

1. Origin of Dance and development (Ancient to Medieval Period)
2. Origin of Kathak Dance and their development .

Unit – II

1. Origin and development of following Classical Dances-
 - (a) Bharat Natyam
 - (b) Manipuri
 - (c) Kathakali
2. Introduction of following Granth :-
 - (a) Nattyashastra
 - (b) Abhinaya Darpan

Unit – III

1. History of famous School (Gharana) of Kathak Dance -
 - (a) Lucknow
 - (b) Jaipur
 - (c) Banaras
 - (d) Raigarh
2. Contribution and life sketch :-
 - (a) Acharya Bharat
 - (b) Acharya Nandikeshwar
 - (c) Pt. Sharang Dev
 - (d) Abhinav Gupta (Podacharya)
 - (e) Dhananjay

Suggested Readings:

1. Dadhich, Dr. Puru (1998), Kathak Nritya Shiksha, Part-II, Bindu Prakashan, Indore.
2. 'Azad' Pt. Tirathram (2015), Kathak Gyaneshwari, Nateshwar Kala Mandir, New Delhi.
3. Singh, Mandvi (1990), Bhartiya Sanskriti main Kathak Nritya Parampara, Swati Publications, Delhi.

Performance of Abhinaya and Taal - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	16	8

Learning Outcome

Learn the characteristics of different Gharana's of Kathak.

Understand the basic technique and their improvisation in Kathak.

Know about the technique of footwork in Kathak.

Improve Expression through the use of Rasa.

Content -

(Practical- One and half hour each student)

1. Performance in selected taal	16 Marks
2. Dance performance by according to examiner	10 Marks
3. Abhinaya in Shlok and Thumari	10 Marks
4. Abhinaya in Shringar and Karun Rasa	07 Marks
5. Abhinaya of Vasaksajja and Virohat Kanthita-Nayika	07 Marks
6. Foot work-Zarab, Tihai in different Laya	<u>10 Marks</u>

Total - 60 Marks

Suggested Readings:

1. Dadhich, Dr. Puru (1998), Kathak Nritya Shiksha, Part-II, Bindu Prakashan, Indore.
2. 'Azad' Pt. Tirathram (2015), Kathak Gyaneshwari, Nateshwar Kala Mandir, New Delhi.

Online references:

https://youtu.be/Grsl_1_rFZA

(Interview of Pt. Birju Maharaj, Published on 11 Jan, 2015)

<https://youtu.be/piP4AB0Kzoo>

(Kathak Performance by Kajal Sharma)

Paper III Practical Performance of Abhinaya and Taal - I

(Practical- One and half hour each student)

1. Performance in selected taal	25 marks
2. Dance performance by according to examiner	15 marks
3. Abhinaya in Shlok and Thumari	15 marks
4. Abhinaya in Shringar and Karun Rasa	10 marks
5. Abhinaya of Vasaksajja and virohat Kanthita Nayika	10 marks
6. Foot work-Zarab, Tihai in different Laya	<u>15 marks</u>

Total - 90 marks

Paper – IV Stage Performance - I

1. Solo performance (30 minutes) selected by student according to syllabus
2. Ability to recite the Boles giving Taal during the performance as in a Traditional Kathak recital.

Total - 50 marks

Paper III – IV (Practical)

List of Taals :

- (a) Trital (b) Chautal (c) Jhaptal (d) Pancham savari (e) Dhamar Taal
(f) Rudra Taal (g) Shikar Taal

Note

1. Performance of any three taals according to syllabus.
2. Special Attention of used Bandish in performance.
3. Compulsory practice in variety of Bandish and Layakari.

Paper I- Principles of Kathak Dance (Part-II)

Unit – I

1. Brief Study -
(a) Paad-Bheda (b) Karan (c) Rechak (d) Anghaar (e) Mandal
2. According to Abhinaya Darpan :-
(a) Shiro-Bheda (b) Drishti Bheda
(c) Greeva Bheda (d) Bhrikuti Bheda

Unit – II

1. Short Notes :-
(a) Poorvarang (b) Sutradhar (c) Nat-Nati (d) Nautanki
(e) Nakkali (f) Nritya-Natika (g) Bellet (h) Opera
2. Introduction of following vocal styles in Kathak Dance
(a) Pada and Bhajan (b) Thumari (c) Dadra (d) Hori
(e) Gazal (f) Tarana (g) Tirvat (h) Chaturang

Unit – III

1. Ability to write taal in various Layakari (Aad, Kuaad, Biaad) according to syllabus.
2. Ability to write notation of all the boles learnt.

History of Indian Classical Dance (Part-II)

Unit – I

1. Development of Dance (Medival to Modern Period)
2. Origin and development of following Classical Dance
(a) Kuchipudi (b) Odissi (c) Mohiniattam

Unit – II

1. Origin of Dance According to Raas.
2. Relation between Raas and Kathak Dance

Unit – III

1. Introduction of following Granth :-
(a) Sangeet Ratnakar (b) Dashroopak
2. Introduction of Indian Folk Dance
(a) Special Context of Rajasthani Folk Dance

Practical Performance of Abhinaya and Taal - II

Performance of one and half hour each student

1. Performed by selected taal (One Paran-in each Jati-Chatasra, Tisra, Khand, Mishra and Sankeern)
25 marks
2. Performance- According to Examiner 15 marks
3. Abhinaya in Bhajan and gat-Bhav Kaliya Mardan,
Madan Dahan 20 marks
4. Performance of any three Rasa and Nayikas. 15 marks
5. Foot-work-Tihai in various Layas, Kram Laya
(Thah to Athgun) 15 marks

Total - 90 marks

Paper IV- Stage Performance - II

1. Solo performance (30 minutes) selected by student according to syllabus.
2. Ability to recite the boles giving taal during the performance as in a traditional Kathak recital.

Total - 50 marks

Paper III –IV (Practical)

List of Taals :

- (a) Trital (b) Ektal (c) Sooltal (d) Gaj-Jhampa tal (e) Aadachautal (f) Ashtmangal (g) Matittal

Note :

1. Performance of any three taals according to syllabus.
2. Special Attention of used Bandish in performance.
3. Compulsory Practice in variety of Bandish and Layakari.

Books -

1. Kathak Nritya Parampara - Dr. Prem Dave
2. Kathak Nritya Shiksha Part – 1, 2 - Dr. Puru Dadhich
3. Aitihasik Pariprekshay main Kathak Nritya - Maya Tak
4. Bharat ke Shastriya Nritya - Chaya Bhatnagar
5. Kathak Darpan - Pt. Tirath Ram Aazad
6. Natya Shastram - Acharya Bharat
7. Natya Shastram - Shri Paras Nath Dwivedi
8. Natya Shastra ka Itihas - Dr. Paras Nath Dwivedi
9. Natya Shastra - Shri Braj Ballabh Mishra
10. Braj ka Ras Rang - Shri Ram Narayan Agrawal
11. Bhartiya Natya Parampara aur
Abhinaya Darpan - Vachspati Gerola
12. Abhinaya Darpan - Dr. Puru Dadhich
13. Abhinaya Darpanam - Acharya Nandikeshwar
14. Sangeet Ratnakar - Sharangdev
15. Sangeet Ratnakar - Dr. Subhadra Choudhary
16. Dashrupak - Acharya Dhananjay
17. Kathak Prasang - Rashmi Vajpai
18. Hamare Sangeet Ratna - Dr. Lakshmi Narayan Garg
19. Kathak Nritya - Dr. Lakshmi Narayan Garg
20. Bhartiya Sangeet aur Sangeetagya - Shri Ramlal Mathur
21. India's Kathak Dance Centre - Reginald Massey
22. Dance of India - David Waterhouse
23. Indian Classical Dances - Kapila Vatsyayan
24. Some Dancers of India - Susheela Mishra
25. Natya Shastra - Kapila Vatsyayan

Analytical Study of Taals (Part – I)**Unit – I**

1. Origin and Development of Taal
2. Dus Prans of Taal

Unit – II

1. Technical Terms (Explain with Example)
(a) Tatkar (b) Palta (c) Kram Laya (d) Zarab (e) Ladi
(g) Tihai and its types (h) Chala
2. Introduction of non-prevalent taal.

- (a) Brahm Taal (28) (b) Laxmi Taal (18) (c) Vishnu Taal (17)
 (d) Ganesh Taal (21) (e) Matt Taal (18)

Unit – III

- Study of prevalent Taals.
- Ablity to write notation of all learnt Bandish
- Notation of following Layakari
 $2/3$, $3/2$, $5/4$, $4/5$, $9/4$, $4/9$, $7/4$, $4/7$

Practical Performance of Abhinaya and Taal - III

1. Teen Taal :-

25 marks

- Ganesh Paran
- That
- Advanced Aamad
- Aamad-Tisra Jati
- Kamali Paran-One
- Pakhawaj Paran-One simple-One-Chakradar
- Parmelu
- Gat Nikas

2. Foot-Work :-

15 marks

- Advanced Zarab
- Advanced Tihais in different Laya

3. Abhinaya :-

25 marks

- Abhinaya of any two-geet, gazal, gat-bhav (Draupadi cheer Vishvamitra)

Haran, Menka

- Ability to perform any two taal-Raas Taal Jhap-Taal, Ashtmangal, jhampa Taal

Laxmi Taal, Roopak, Gaj-

25 marks

Total - 90 marks

Paper- IV- Stage Performance-III

- A perfect independent Kathak Dance performance (30 minutes)
- Ability to recite the Boles giving taal during the performance as in a traditional way.

Total - 50 marks

Aesthetic Sense of Kathak Dance (Part – II)

Unit – I

- Methods of Aesthetic Sense in Dance :- Nayan bhav, Bol Bhav, Gat Arth Bhav, Ang Bhav.
- Types of Nayak :- According to swabhav Dharm, Awastha.

Arth Bhav, Sabha Bhav,

Unit – II

1. Study of Asht-Nayika according to Natyashastra (with example)
2. Ras Theory as described in Sanskrit Literature Prominent authors :-
(1) Bhatt Lollat (2) Bhatt Nayak (3) Shri Shankak
(4) Abhinav Gupta

Unit – III

1. Importance of Thumri in Kathak Dance
2. Navin Prayog in Kathak Dance
3. Aesthetic Sense in Kathak Dance

Analytical Study of Taals (Part – II)

Unit – I

1. Northern and Southern Taal System
2. Comparative study of Northern and Southern tal System

Unit – II

1. Described “Jati” and Yati (with example)
2. Introduction of Instruments related to Kathak Dance

Unit – III

1. Contribution in Development of Indian Classical Dance -
(a) Rabindra Nath Tagore (b) Rukmani Devi Arundel
(c) Mahakavi Vallthol (d) Pt. Udaya Shankar (e) Madam Menka
2. Comparative study of Saman Matrik Taal
(a) Rudra Taal-Ashtamangal
(b) Pancham Sawari-Gaj-Jhampa taal
(c) Ektaal-Chautaal
(d) Aada Chautaal-Dhamar Taal

Practical Performance of Abhinaya and Taal - IV

1. **Teen taal :-** **25 marks**
(a) Stuti Paran
(b) That
(c) Aamad
(d) Aamad any two jati
(e) Badhaiya Paran
(f) Chakradar Permolu
(g) Kavitt and Chhand
(h) Gat Nikas
2. **Foot-Work :-** **15 marks**
(a) Kramlaya-(Athgun to Solagun
(b) Laya Bant and Bol Bant
3. **Abhinaya :-** **25 marks**
(a) Abhinaya in any two-Thumari, Gazal Nayika, Gat-Bhav

4. Ability to perform any two taals :-Dhamar, Basant, Pancham Sool Taal. **25 marks**

Sawari, Teevra, Matt and

5. Ability to play Harmonium (Nagma) in Kathak Dance (basic taals)

Total - 90 marks

Paper - IV Stage Performance - IV

1. A perfect independent Kathak Dance performance (30 minutes)
2. Ability to recite the Boles giving Taal during the performance

as in traditional way.

Total - 50 marks

Books -

1. Natya Shastram - Shri Paras Nath Dwivedi
2. Hindi Natya Shastram - Shri Babu Lal Shastri
3. Natya Shastra ka Itihas - Shri Paras Nath Dwivedi
4. Taal Vadhy Shastra - Dr. Manohar Bhal Chandra Rao Marathe
5. Bhartiya Talon ka Shastriya Vivechan - Dr. Arun Kumar Sain
6. Saundarya Shastra evam Ras Nishpatti - Dr. Nirmala Jain
7. Kathak Darpan - Pt. Tirath Ram Azad
8. Kathak Nritya Parampara - Dr. Prem Dave
9. Kathak Nritya Shiksha Part – 1, 2 - Dr. Puru Dadhich
10. Bhartiya Sanskriti main Kathak Parampara - Mandvi Singh
11. Thumri ki Utpatti, Vikas aur Shailiya - Shri Shatrudhan Shukla
12. Thumri Parichaya - Shri Leela Karwal
13. Sangeet Nibandh - Shri R.S. Agnihotri
14. Sangeet Nibandh Mala - Shri Jagdish Narayan Pathak
15. Sangeet Nibandh Sangrah - Shri Harishchandra Shrivastava
16. Sangeet Nibandhawali - Dr. Lakshmi Narayan Garg
17. Bhartiya Sangeet aur Sangeetagya - Shri Ramlal Mathur
18. Rangmanch - Shri Sitaram Chaturvedi
19. Ras Mimansa - Acharya Ramchandra Shukla
20. Sahitya Darpanam - Pt. Shankhraj Sharma Rengmin
21. Kathak ke Prachin Nrityang - Geeta Rachuveer
22. Bhartiya Natya Parampara aur Abhinaya Darpan - Vachspati Gerola
23. Abhinaya Darpan - Dr. Puru Dadhich
24. Tabla Puran - Pt. Vijay Shankar Mishra
25. Taal Parichya Part – 2, 3 - Girish Chandra Shrivastava

Remedial Mathematics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning outcomes

Upon completion of the course, the student shall be able to know

Mathematical concepts and principles to perform various calculations in Pharmacy

mathematical expressions and mathematical relationships

Abstract mathematical reasoning

Section-A

Partial fraction: Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics

Logarithms: Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

Function: Real Valued function, Classification of real valued functions.

Limits and continuity: Introduction, Limit of a function, Definition of limit of a function (definition), $\lim_{x \rightarrow a} x^n = a^n$, $\lim_{x \rightarrow a} x^n = na^{n-1}$, $\lim_{x \rightarrow a} \frac{1}{x-a} = \infty$

Section-B

Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley-Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations

Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – Without Proof, Derivative of x^n w.r.t.x, where n is any rational number, Derivative of e^x , Derivative of $\log_e x$, Derivative of ax , Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point.

Section-C

Analytical Geometry

Introduction: Signs of the Coordinates, Distance formula, Straight Line : Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line

Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, Application in solving

Pharmacokinetic equations

Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations

Books Recommended:

Narayan, S., Mittal, P.K. (2005). *Differential Calculus*, S Chand Publisher.

Panchaksharappa, G.D.H. (2014). *Pharmaceutical Mathematics with application to Pharmacy*, New Delhi: CBS Publishers and Distributors.

Narayan, S. (2005). *Integral Calculus*, S Chand Publisher.

Grewal, B.S. (2001). *Higher Engineering Mathematics*, 36th Ed., Khanna Publisher.

Suggested e-material:

1. www.openculture.com/free-math-textbooks
2. E-Books | mathematics.library.cornell.edu

Pharmaceutical Analysis-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Different types of analysis

Principles, instrumentation and applications of various types of titration

Impurities in medicinal agents

Section-A

Pharmaceutical analysis- Definition and scope, Different techniques of analysis, Methods of expressing concentration, Primary and secondary standards, Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate.

Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.

Pharmacopoeia, sources of impurities in medicinal agents, limit tests.

Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves

Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

Section-B

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.

Basic principles, methods and application of diazotisation titration.

Redox titrations: Concepts of oxidation and reduction, types of redox titrations (Principles and applications), cerimetry, iodimetry, iodometry, bromatometry, dichrometry, titration with potassium iodate

Section-C

Conductometry: Introduction, conductivity cell, conductometric titrations, applications.

Potentiometry: Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

Polarography: Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

Books recommended:

Beckett, A.H., Stenlake, J.B. (1962). *Practical Pharmaceutical Chemistry*, 4thEd., vol 1-2. London: Stahlone Press.

Mendham, (2019). Vogel,s AI- *Text Book of Quantitative Inorganic analysis*, 6thEd.,Pearson.

Rao, P.G. (2006). *Inorganic Pharmaceutical Chemistry*, 3rdEd.,Pharma Med Press.

[Atherden](#), L.M. (2004). *Bentley and Driver's Textbook of Pharmaceutical Chemistry*, Oxford University Press.

Kennedy, J.K. (1990). *Analytical chemistry principles*, 3rdEd.,Brooks/ Cole.

Indian Pharmacopoeia, (2014). Addendum 2016.

Suggested e-material:

<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118695425.ch 10>

https://www.researchgate.net/publication/280224434_Handbook_of_Inorganic_Impurities_in_Pharmaceuticals

<http://www.rroij.com/open-access/a-review-on-impurity-profile-in-pharmaceutical-substances.php?aid=34989>

[https://www.scribd.com/doc/101354608/Chapter-5-Gastro_intestinal-Agents- Reviewer](https://www.scribd.com/doc/101354608/Chapter-5-Gastro_intestinal-Agents-Reviewer)

<https://www.who.int/medicines/publications/pharmacopoeia/Radgenmono>

Pharmaceutical Analysis - I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

I Limit Test of the following

- (1) Chloride
- (2) Sulphate
- (3) Iron
- (4) Arsenic

II Preparation and standardization of

- (1) Sodium hydroxide
- (2) Sulphuric acid
- (3) Sodium thiosulfate
- (4) Potassium permanganate
- (5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization of Titrant

- (1) Ammonium chloride by acid base titration
- (2) Ferrous sulphate by Cerimetry
- (3) Copper sulphate by Iodometry
- (4) Calcium gluconate by complexometry
- (5) Hydrogen peroxide by Permanganometry
- (6) Sodium benzoate by non-aqueous titration
- (7) Sodium Chloride by precipitation titration

IV Determination of Normality by electro-analytical methods

- (1) Conductometric titration of strong acid against strong base
- (2) Conductometric titration of strong acid and weak acid against strong base
- (3) Potentiometric titration of strong acid against strong base

Pharmaceutical Inorganic Chemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Principles of limit tests

Preparation, assay, properties and medicinal uses different inorganic compounds

Identification of different anions, cations and different inorganic pharmaceuticals.

Sources of impurities and methods to determine the impurities in pharmaceuticals

Section-A

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.

General methods of preparation, assay for the compounds superscripted with asterisk (), properties and medicinal uses of inorganic compounds belonging to the following classes.*

Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

Section-B

Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Acidifiers: Ammonium chloride* and Dil. HCl

Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture
Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations

Section-C

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite

Astringents: Zinc Sulphate, Potash Alum

Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I^{131} , Storage conditions, precautions & pharmaceutical application of radioactive substances.

Books recommended:

Beckett, A.H., Stenlake, J.B. (1962). *Practical Pharmaceutical Chemistry*, 4thEd., vol 1-2. London: Stahlone Press.

Mendham, (2019). *Vogel's AI- Text Book of Quantitative Inorganic Analysis*, 6thEd., Pearson.

Rao, P.G. (2006). *Inorganic Pharmaceutical Chemistry*, 3rdEd., Pharma med press.

Schroff, M.L. (1968). *Inorganic Pharmaceutical Chemistry*, Calcutta: National book centre.

[Atherden](#), L.M. (2004). *Bentley and Driver's Textbook of Pharmaceutical Chemistry*, Oxford University Press.

Chatwal, G.R. (2010). *Pharmaceutical Chemistry Inorganic*, Himalaya Publishing House.

Indian Pharmacopoeia, (2014). Addendum 2016.

Suggested e-material:

<http://www.sciencedirect.com/science/book/9780123851109>

https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118695425.ch_10

https://www.researchgate.net/publication/280224434_Handbook_of_Inorganic_Impurities_in_Pharmaceuticals

<http://www.rroij.com/open-access/a-review-on-impurity-profile-in-pharmaceutical-substances.php?aid=34989>

<https://www.scribd.com/doc/101354608/Chapter-5-Gastro-intestinal-Agents-Reviewer>

<https://www.who.int/medicines/publications/pharmacopoeia/Radgenmono>

Pharmaceutical Inorganic Chemistry Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

I Limit tests for following ions

Limit test for Chlorides and Sulphates

Modified limit test for Chlorides and Sulphates

Limit test for Iron

Limit test for Heavymetals

Limit test for Lead

Limit test for Arsenic

II Identification test

Magnesium hydroxide

Ferrous sulphate

Sodium bicarbonate

Calcium gluconate

Copper sulphate

III Test for purity

Swelling power of Bentonite

Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV Preparation of inorganic pharmaceuticals

Boric acid

Potash alum

Ferrous sulphate

Pharmaceutics - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Importance of IP, BP, USP and Extra Pharmacopoeia

Definition, preparation, classification, advantages and disadvantages of different dosage forms

Pharmaceutical incompatibilities and calculations

Professional handling of prescription

Section-A

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

Dosage forms: Introduction to dosage forms, classification and definitions

Prescription: Definition, Parts of prescription, handling of Prescription and

Errors in prescription.

Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

Section-B

Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.

Section-C

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.

Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms

Books recommended:

Allen, I.V., Popovich, J.N.G. Ansel, H.C. (2005). *Ansel's Pharmaceutical Dosage Form and Drug Delivery System*, 8thEd., New Delhi: Lippincott Williams and Walkins.

Carter, S.J. (2008). *Cooper and Gunn's-Dispensing for Pharmaceutical Students*, 12thEd., New Delhi: CBS publishers.

Aulton, M.E. (2002). *Pharmaceutics, The Science & Dosage Form Design*, 2ndEd., Edinbrg: Churchill Livingstone.

Indian Pharmacopoeia (2014). Addendum 2016.

British pharmacopoeia (2019).

Lachmann, L., Lieberman, H.A., Kaing, J.L. (2009). *Theory and Practice of Industrial Pharmacy*, Lea and Febiger Publisher.

[Remington](#), J.P., [Gennaro](#), A.R., Remington, A.R.G. (2005). *The Science and Practice of Pharmacy*, 21stEd., New Delhi: Lippincott Williams and willikins.

Carter, S.J. (2005). *Cooper and Gunn's-Dispensing for Pharmaceutical Students*, 12thEd., New Delhi: CBS publishers.

Rawlins. (2010). *Bentley's Text Book of Pharmaceutics*, Elsevier.

Bodmier, R. (1989). *Pharmaceutical Pelletization Technology*, New York: Marcel Dekker.

Pareekh, D.M. (2005). *Handbook of Pharmaceutical Granulation Technology*, 2ndEd., New York: Marcel Dekker.

Nieloud, F., Mestres, G.M. (2000) *Pharmaceutical Emulsions and Suspensions*, New York: Marcel Dekker, INC.

Suggested e-material:

https://health.sbmua.ac.ir/uploads/Remington_Essentials_of_Pharmaceutics_-_Felton,_Linda.pdf

<http://gmpua.com/Process/EncyclopediaPT.pdf>

<http://pharmacentral.in/wp-content/uploads/2018/05/INDIAN%20PHARMACOPOEIA%202007.pdf>

<https://www.pdfdrive.com/pharmacy-calculations-for-pharmacy-technicians-d58957811.html>

<http://file.akfarmahadhika.ac.id/E-BOOK/12-1213-akfarmahad-6-1-fasttrac-g.pdf>

Pharmaceutics - I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

1. Syrups

- a) Syrup IP'66
- b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs

- a) Piperazine citrate elixir
- b) Paracetamol pediatric elixir

3. Linctus

- a) Terpin Hydrate Linctus IP'66
- b) Iodine Throat Paint (Mandles Paint)

4. Solutions

- a) Strong solution of ammonium acetate
- b) Cresol with soap solution
- c) Lugol's solution

5. Suspensions

- a) Calamine lotion
- b) Magnesium Hydroxide mixture
- c) Aluminium Hydroxide gel

6. Emulsions

- a) Turpentine Liniment
- b) Liquid paraffin emulsion

7. Powders and Granules

- a) ORS powder (WHO)
- b) Effervescent granules
- c) Dusting powder
- d) Divided powders

8. Suppositories

- a) Glycero gelatin suppository
- b) Cocoa butter suppository
- c) Zinc Oxide suppository

9. Semisolids

- a) Sulphur ointment
- b) Non staining-iodine ointment with methyl salicylate
- c) Carbopol gel

10. Gargles and Mouthwashes

- a) Iodine gargle
- b) Chlorhexidine mouthwash

Human Anatomy and Physiology-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Gross morphology, structure and functions of cell, skeletal, muscular, lymphatic cardiovascular system of the human body

Various homeostatic mechanisms and their imbalances

Different types of bones and joints in human body

Various tissues of different systems of human body

Various experimental techniques related to physiology

Various techniques like blood group determination, blood pressure measurement, blood cells counting.

Structure and functions of special senses and PNS

Section-A

Introduction to human body: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization: Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization: Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Section-B

Integumentary system: Structure and functions of skin

Skeletal system: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.

Joints: Structural and functional classification, types of joints movements and its articulation

Body fluids and blood: Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

Section-C

Peripheral nervous system: Classification of peripheral nervous system, Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.

Special senses: Structure and functions of eye, ear, nose and tongue and their disorders.

Cardiovascular system: Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

Books recommended:

1. Sembulingam, K., Sembulingam, P. (2012). *Essentials of Medical Physiology*, 6th Ed., New Delhi: Jaypee Brothers' medical publisher.
2. Kathleen, J.W. (1992). *Anatomy and Physiology in Health and Illness*, 7th Ed., New York: Churchill Livingstone.
3. Tandon, O.P., Tripathi, Y. (2011). *Physiological basis of Medical Practice*- Best and Tailor, Wolters Kluwer India Pvt. Ltd.
4. Hall, J.E. (2010). *Guyton and Hall Textbook of Medical Physiology*, 11th Ed., Saunders.
5. Tortora, G.J., Grabowski S.R. (2000). *Principles of Anatomy and Physiology*, 9th Ed., New York: Wiley.
6. Singh, I. (2011). *Textbook of Human Histology*, 6th Ed., New Delhi: Jaypee brother's medical publishers.
7. Ghai, C.L. (2013). *Textbook of Practical Physiology*, 8th Ed., New Delhi: Jaypee brother's medical publishers.
8. Srinageswari, K., Sharma, R. (2015). *Practical workbook of Human Physiology*, New Delhi: Jaypee brother's medical publishers.
9. Chatterje, C.C. (2005). *Human Physiology*, vol 1-2. Kolkatta: Academic Publishers.

Suggested e-material:

www.opentextbc.ca

www.study.com

www.getbodysmart.com

www.kenhub.com

Human Anatomy and Physiology - I Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Practical physiology is complimentary to the theoretical discussions in physiology. Practical's allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of blood pressure.

Pharmaceutical Organic Chemistry – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Types, classification, principles/mechanisms, applications of isomerism in organic compounds

General methods of preparation and reactions types, principles/ mechanisms, applications of alkanes, alkenes, conjugated dienes, alkyl halides, alcohols, carbonyl compounds (aldehydes and ketones), carboxylic acids & aliphatic amines

General methods of preparation and reactions of compounds superscripted with asterisk () to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences*

Section-A

Classification, nomenclature and isomerism: Classification of Organic Compounds. Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds). Structural isomerisms in organic compounds

Alkanes*, Alkenes* and Conjugated dienes*: sp^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, sp^2 hybridization in alkenes. E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 versus E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

Section-B

Alkyl halides*: SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions. Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

Alcohols*: Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

Carbonyl compounds* (Aldehydes and ketones): Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

Section-C

Carboxylic acids*: Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids , amide and ester. Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid.

Aliphatic amines*: Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine.

Books Recommended:

Boyd, M. (2010). *Organic Chemistry*, 7thEd., Pearson.

Finar, I.L. (2002). *Organic Chemistry*, Vol. 1, 6thEd., Pearson Education Ltd.

Suggested e-material:

<http://lib.myilibrary.com?id=527161>

<http://lib.myilibrary.com?id=527192>

<http://lib.myilibrary.com?id=527020>

Pharmaceutical Organic Chemistry - I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

1. Systematic qualitative analysis of unknown organic compounds like

Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.

Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test

Solubility test

Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.

Melting point/Boiling point of organic compounds

Identification of the unknown compound from the literature using melting point/ boiling point.

Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.

Minimum 5 unknown organic compounds to be analysed systematically.

2. Preparation of suitable solid derivatives from organic compounds

3. Construction of molecular models

Biochemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Fundamentals roles of biomolecules

Various metabolic pathways and regulations of biological/ biochemical processes

Introduction, properties, nomenclature, classification, therapeutic and diagnostic applications of enzymes

Section-A

Biomolecules: Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

Bioenergetics: Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP

Carbohydrate metabolism: Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance. Hormonal regulation of blood glucose level and Diabetes mellitus

Section-B

Biological oxidation: Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate phosphorylation. Inhibitors ETC and oxidative phosphorylation/Uncouplers

Lipid metabolism: β -Oxidation of saturated fatty acid (Palmitic acid). Formation and utilization of ketone bodies; ketoacidosis. De novo synthesis of fatty acids (Palmitic acid). Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D. Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

Amino acid metabolism: General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders. Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alcaptonuria, tyrosinemia). Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline. Catabolism of heme; hyperbilirubinemia and jaundice

Section-C

Nucleic acid metabolism and genetic information transfer: Biosynthesis of purine and pyrimidine nucleotides. Catabolism of purine nucleotides and Hyperuricemia and Gout disease. Organization of mammalian

genome. Structure of DNA and RNA and their functions. DNA replication (semi conservative model). Transcription or RNA synthesis. Genetic code, Translation or Protein synthesis and inhibitors.

Enzymes: Introduction, properties, nomenclature and IUB classification of enzymes. Enzyme kinetics (Michaelis plot, Line Weaver Burke plot). Enzyme inhibitors with examples. Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation. Therapeutic and diagnostic applications of enzymes and isoenzymes. Coenzymes –Structure and biochemical functions.

Books Recommended:

Nelson, D.L., Cox, M.M. (2012). *Lehninger-Principles of Biochemistry*, 6th Ed., W. H. Freeman & Co.

Murry, R.K., Bender, D.K., Botham, K.A., Kennely, P.J., Well, P.A., Rodwell, V.W. (2009). *Harper's Biochemistry*, 28th Ed., New York: McGraw-Hill.

Chakrapani, U., Satyanarayan, U. (2012). *Biochemistry*, Books and Allied PVT.

Rao, A.V.S.S.R. (2008). *Textbook of Biochemistry*, UBS Publishers Distributors Pvt. Ltd.

Conn, E.E., Stumpf, P.K., Bruening, G., Doi R.Y. (2009). *Outlines of Biochemistry*, 5th Ed., New York: John Wiley & Sons.

Gupta, R.C., Bhargavan, S. (2019). *Practical Biochemistry*, 5th Ed., New Delhi: Jaypee brother's medical publishers

Plummer, D.T. (1987). *An Introduction of Practical Biochemistry*, 3rd Ed., McGraw-Hill.

Suggested e-material:

<http://lib.myilibrary.com/?id=276871>

<http://lib.myilibrary.com/?id=527025>

<http://onlinelibrary.wiley.com/book/10.1002/9783527622023> (Enzyme Kinetics: Principles and Methods, Second Edition Hans Bisswanger Wiley publisher)

<http://www.sciencedirect.com/science/book/9780123851109>

Biochemistry Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2. Identification tests for Proteins (albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of blood creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of pH
9. Study of enzymatic hydrolysis of starch
10. Determination of Salivary amylase activity
11. Study the effect of Temperature on Salivary amylase activity.
12. Study the effect of substrate concentration on salivary amylase activity.

Human Anatomy and Physiology-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Anatomy and physiology of various body systems

Principles of body energetics

Concept of genetic material

Section-A

Nervous system: Organization of nervous system, neuron, neuroglia, classification and properties of nerve fiber, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

Digestive system: Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

Energetics: Formation and role of ATP, Creatinine Phosphate and BMR.

Section-B

Respiratory system: Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

Urinary system: Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Section-C

Endocrine system: Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

Reproductive system: Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition

Introduction to genetics: Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

Books Recommended:

Sembulingam, K., Sembulingam, P. (2012). *Essentials of Medical Physiology*, 6th Ed., New Delhi: Jaypee Brothers' medical publisher.

Kathleen, J.W. (1992). *Anatomy and Physiology in Health and Illness*, 7th Ed., New York: Churchill Livingstone.

Tandon, O.P., Tripathi, Y. (2011). *Physiological basis of Medical Practice*- Best and Tailor, Wolters Kluwer India Pvt. Ltd.

Hall, J.E. (2010). *Guyton and Hall Textbook of Medical Physiology*, 11th Ed., Saunders.

Tortora, G.J., Grabowski S.R. (2000). *Principles of Anatomy and Physiology*, 9th Ed., New York: Wiley.

Singh, I. (2011). *Textbook of Human Histology*, 6thEd., New Delhi: Jaypee brother's medical publishers.

Ghai, C.L. (2013). *Textbook of Practical Physiology*, 8thEd., New Delhi: Jaypee brother's medical publishers.

Srinageswari, K., Sharma, R. (2015). *Practical workbook of Human Physiology*, New Delhi: Jaypee brother's medical publishers.

Chatterje, C.C. (2005). *Human Physiology*, vol 1-2. Kolkatta: Academic Publishers.

Suggested e-material:

www.apchute.com

www.openstax.cnx.org

www.wesnorman.com

Human Anatomy and Physiology - II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

1. To study the integumentary and special senses using specimen, models etc.
2. To study the nervous system using specimen, models, etc.
3. To study the endocrine system using specimen, models, etc
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basal mass index.
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

COMPUTER FUNDAMENTALS AND PROGRAMMING

4 Hrs/week

Max. Marks: 60

Section-A

Brief introduction to computer organization: Block diagram, hardware and software. Introduction to operating system, concept of data and information, representation of data, bits and bytes. Number system (binary, octal, decimal, hexadecimal), representation of integers, real numbers, positive and negative numbers, binary arithmetic, simple concepts and theorems of boolean algebra. Representation of characters: BCD, ASCII, EBCDIC codes.

Programming fundamentals: Program, steps in program development, programming language, compilers, interpreters. Algorithms, flowcharts, control statements -sequencing, conditional and unconditional branching and looping.

Section-B

Overview of C language- History, structure of a program data types, variables, constants, operators (arithmetic, logical, relational), expressions(arithmetic and logical), assignments, conditional statements, control statements, simple I/O. Single and multi-dimensional arrays, searching (linear, binary), sorting (bubble, selection) and merging, matrix arithmetic.

Section-C

Concept of pointers, pointer expression, pointer v/s arrays, functions, parameter passing (call by value, call by reference), recursion, structure, union and enumerated data types, concept of structured programming.

Books recommended:

1. Kanetkar Yashwant, Let us C, 3rd edition, BPB Publication
2. Sinha P.K Computer Fundamentals, BPB publication, New Delhi

Computer Applications in Pharmacy Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page to show personal information.
3. Retrieve the information of a drug and its adverse effects using online tools
4. Creating mailing labels Using Label Wizard, generating label in MS WORD
5. Create a database in MS Access to store the patient information with the required fields using access
6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages

Remedial Biology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning outcomes

Upon completion of the course, the student shall be able to know

Evolutionary biology and behavior.

Anatomy, physiology and regulation of various body system

Plant physiology

Section-A

Living world:

Definition and characters of living organisms, Diversity in the living world, Binomial nomenclature, Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus.

Morphology of Flowering plants:

Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit and seed.

General Anatomy of root, stem, leaf of monocotyledons & Dicotyledones.

Body fluids and circulation:

Composition of blood, blood groups, coagulation of blood, Composition and functions of lymph, Human circulatory system, Structure of human heart and blood vessels, Cardiac cycle, cardiac output and ECG.

Digestion and Absorption:

Human alimentary canal and digestive glands, Role of digestive enzymes, Digestion, absorption and assimilation of digested food

Section-B

Breathing and respiration:

Human respiratory system, Mechanism of breathing and its regulation, Exchange of gases, transport of gases and regulation of respiration, Respiratory volumes.

Excretory products and their elimination:

Modes of excretion, Human excretory system- structure and function, Urine formation, Renin angiotensin system.

Neural control and coordination:

Definition and classification of nervous system, Structure of a neuron,

Generation and conduction of nerve impulse, Structure of brain and spinal cord, Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata.

Chemical coordination and regulation:

Endocrine glands and their secretions, Functions of hormones secreted by endocrine glands.

Section-C

Human reproduction:

Parts of female reproductive system, Parts of male reproductive system, Spermatogenesis and Oogenesis, Menstrual cycle.

Plants and mineral nutrition:

Essential mineral, macro and micronutrients, Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis:

Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

Plant respiration:

Respiration, glycolysis, fermentation (anaerobic). Plant growth and development, Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators

Cell - The unit of life:

Structure and functions of cell and cell organelles. Cell division

Tissues:

Definition, types of tissues, location and functions.

Books recommended:

Gokhale, S.B., Kokate, C.K., Bidarkar, D.S. (2007). *Pharmaceutical Biology*, 5th Ed., Pune: Nirali Prakashan.

Thulajappa, Y., Seetaram, P.I. (2005). *New Expert Biology*, vol 2, Expert educational publisher.

Suggested e-material:

www.opentextbc.ca

www.study.com

www.getbodysmart.com

www.kenhub.com

www.apchute.com

www.openstax.cnx.org

Pathophysiology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Basic principles of cell injury and adaptation

Etiology and pathogenesis of the various disease

Signs, symptoms and complications of various diseases

Section-A

Basic principles of cell injury and adaptation: Introduction, definitions, homeostasis, components and types of feedback systems, causes of cellular injury, pathogenesis (cell membrane damage, mitochondrial damage, ribosome damage, nuclear damage), morphology of cell injury - Adaptive changes (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia), cell swelling, intra cellular accumulation, calcification, enzyme leakage and cell death acidosis & alkalosis, electrolyte imbalance.

Basic mechanism involved in the process of inflammation and repair: Introduction, clinical signs of inflammation, different types of inflammation, mechanism of inflammation - Alteration in vascular permeability and blood flow, migration of WBC's, mediators of inflammation, basic principles of wound healing in the skin.

Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) **Respiratory system:** Asthma, chronic obstructive airways diseases.

Renal System: Acute and chronic renal failure.

Section-B

Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia

Endocrine System: Diabetes, thyroid diseases, disorders of sex hormones. **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.

Section-C

Gastrointestinal System: Peptic ulcer, inflammatory bowel diseases, jaundice, hepatitis (A, B,C,D,E,F) alcoholic liver disease.

Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout.

Principles of Cancer: Classification, etiology and pathogenesis of cancer.

Infectious Diseases: Meningitis, typhoid, leprosy, tuberculosis, urinary tract infections. Sexually transmitted diseases: AIDS, syphilis, gonorrhea.

Recommended Books:

Kumar, V., Abas, A.K. Aster, J.C. (2014). Robbins & Cotran Pathologic Basis of Disease, South Asia edition, Elsevier.

Mohan, H. (2010). *Text book of Pathology*, 6th Ed., Jaypee Publications.

Laurence, B., Bruce, C., Bjorn, K. (2011). *Goodman Gilman's the Pharmacological Basis of Therapeutics*, 12th Ed., New York: McGraw-Hill.

Herbert, C., Taylor, Burke, N. (2011). *Best and Taylor's Physiological basis of medical practice*, 13th Ed., Wolters Kluwer India Pvt. Ltd.

Colledge, N.R., Walker, B.R., Stuart, H.R. (2010). *Davidson's Principles and Practice of Medicine*, 21st Ed., London: ELBS/Churchill Livingstone.

Guyton, A.J., Hall, E. (2010). *Textbook of Medical Physiology*, 12th Ed., WB Saunders Company.

Piro, J.D., Talbert, R.L., Yee, G., Wells, B., Michael, L., Posey, (2014). *Pharmacotherapy: A Pathophysiological Approach*, 9th Ed., London: McGraw-Hill Medical.

Kumar, V., Cotran, R.S., Robbins, S.L. (1997). *Basic Pathology*, Philadelphia, WB Saunders Company.

Walker, R., Edwards, C. (2003). *Clinical Pharmacy and Therapeutics*, 3rd Ed., London: Churchill Livingstone publication.

Suggested e-material:

www.wesnorman.com

www.pharmacologyeducation.org

www.pharmacology2000.com

www.healthline.com

www.mayoclinic.org

Pharmaceutical Organic Chemistry - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

General methods of preparation and reactions of various organic compounds

Classification, reaction principles/mechanisms, properties and applications of various organic compounds

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences.

Section-A

Benzene and its derivatives

- I. Analytical, synthetic and other evidences in the derivation of structure of benzene, orbital picture, resonance in benzene, aromatic characters, Huckel's rule.
- II. Reactions of benzene - nitration, sulphonation, halogenation, Friedel crafts alkylation- limitations and Friedel crafts acylation.
- III. Type of substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction.
- IV. Structure and uses of DDT (Dichloro diphenyl trichloroethane), Saccharin, BHC (Benzene hexachloride) and Chloramine.

Section-B

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, structure and uses of phenol, cresols, resorcinol, naphthols

Aromatic Amines* - Basicity of amines, effect of substituents on basicity and synthetic uses of aryl diazonium salts.

Aromatic Acids* - Acidity, effect of substituents on acidity and important reactions of benzoic acid.

Fats and Oils-

- I. Fatty acids reactions- Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.
- II. Analytical constants - Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value - significance and principle involved in their determination.

Section-C

Polynuclear hydrocarbons: Synthesis, reactions, structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane & their derivatives (1-naphthol, 1-hydroxyphenanthrene, 1-hydroxyanthracene, diphenylmethanol, triphenylmethanol)

Cyclo alkanes*: Stabilities - Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.

Books Recommended:

Morrison, R.T., Boyd, R.T. (1992). *Organic Chemistry*. 6th Ed., New York:Prentice Hall.

Finar, I.L. (1963). *Organic Chemistry*. 4th Ed., London: Longsman.

Bahl, A., Bahl, B.S. (2014). *Textbook of Organic Chemistry*. 5th Ed., New Delhi: S Chand and Company Ltd.

Soni, P.L., Chawla, H.M. (2012). *Textbook of Organic Chemistry*. 29th Ed., New Delhi: S Chand & Sons.

Mann, F.G., Saunders, B.C. (2009). *Practical Organic Chemistry*. 4th Ed., London: Pearson. 2009.

Vogel, A.I., Tatchell, A.R., Furnis, B. S., Hannaford, A.J., Smith, P.W.G. (1989). *Vogel's text book of Practical Organic Chemistry*. 5th Ed., London: Pearson.

Vishnoi, N.K. (2009). *Advanced Practical organic chemistry*. 3rd Ed., New Delhi: Vikas Publishing House.

Pavia, D.L., Lampman, G.M., Kriz, G.S. (1998). *Introduction to Organic Laboratory techniques*. 3rd Ed..

Suggested e-material:

<http://lib.myilibrary.com?id=527383>

<http://lib.myilibrary.com?id=527192>

<http://lib.myilibrary.com?id=527184>

Pharmaceutical Organic Chemistry - II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

I Experiments involving laboratory techniques

Recrystallization

Steam distillation

II Determination of following oil values (including standardization of reagents)

Acid value

Saponification value

Iodine value

III Preparation of compounds

Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol/Aniline by acylation reaction.

2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/Acetanilide by halogenation (Bromination) reaction.

5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid/Nitro benzene by nitration reaction.

Benzoic acid from Benzyl chloride by oxidation reaction.

Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.

1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.

Benzil from Benzoin by oxidation reaction.

Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction

Cinnammic acid from Benzaldehyde by Perkin reaction

P-Iodo benzoic acid from P-amino benzoic acid

Pharmaceutical Engineering

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Various type of flow and flow meter

Various objectives, applications and functions of various processes used in pharmaceutical industries.

Various preventive methods used for corrosion control in pharmaceutical industries.

Different types of conveyors

Various material used in plant construction

Section-A

Flow of fluids: Types of manometers, reynolds number and its significance, bernoulli's theorem and its applications, energy losses, orifice meter, venturimeter, pitot tube and rotometer.

Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, construction, working, uses, merits and demerits of double cone blender, twin shell blender, ribbon blender, sigma blade mixer, planetary mixers, propellers, turbines, paddles & silverson emulsifier.

Heat Transfer: Objectives, applications & heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

Section-B

Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation.

Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

Section-C

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & supercentrifuge.

Materials of pharmaceutical plant construction, corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non-metals, basic of material handling systems.

Books Recommended:

Badger, W.L., Banchero, J.T. (1955). *Introduction to chemical engineering*. New York: McGraw- Hill.

Simpson, N.J.K. (2000). *Solid phase extraction, Principles, techniques and applications*. 1st Ed., California: CRC Press.

McCabe, W., Smith, J., Harriott, P. (2017). *Unit operation of chemical engineering*. 7th Ed., New York: McGraw-Hill.

Subrahmanyam, C.V.S., Setty, J.T., Sarasija, S., Kussum, D.V. (2009). *Pharmaceutical engineering principles and practices*. New Delhi: Vallabh Publication.

Martin, E.W., Cook, E.F. (2005). *Remington practice of pharmacy*. 21st edition. Philadelphia: Lippincott Williams and Wilkins.

Lachman, L., Lieberman, H.A., Kanig, J.L. (1990). *Theory and practice of industrial pharmacy*. 3th Ed., New Delhi: Varghese Publishing House.

Carter, S.J. (2005). *Cooper and Gunn's Tutorial pharmacy*. 6th Ed., New Delhi: CBS Publication.

Suggested e-material:

gmpua.com/Process/ProcessEngineering

Pharmaceutical Microbiology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Methods of identification, cultivation and preservation of various microorganisms

The importance and implementation of sterilization in pharmaceutical processing and industry

Sterility testing of pharmaceutical products

Microbial standardization of pharmaceuticals

Cell culture technology and its applications in pharmaceutical industries

Section-A

Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes. Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

Section-B

Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical, gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators. Study of morphology, classification, reproduction/ replication and cultivation of Fungi and Viruses.

Classification and mode of action of disinfectants. Factors influencing disinfection, antiseptics and their evaluation. Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Section-C

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

Principles and methods of different microbiological assay.

Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

Books Recommended:

- Hugo, W.B., Russel A.D. (2004). *Pharmaceutical Microbiology*, 7th Ed., London: Blackwell Scientific publications.
- Reed, G (2004). *Prescott and Dunn Industrial Microbiology*. 4th Ed., Delhi: CBS Publishers & Distributors.
- Pelczar, M.J., Chan, E.C.S, Kreig, N.R. (2002). *Microbiology*. 5th Ed., New Delhi: Tata McGraw Hill.
- Harris, M., Tindall, B. (2000). *Pharmaceutical Microbiology*. London.
- Rose, A.H. (1961). *Industrial Microbiology*. London: Butterworths.
- Frobisher, M., Hinsdill, R., Crabtree, K.T., Goodheart, C.R. (1968). *Fundamentals of Microbiology*. 9th Ed., WB Saunders Co.
- Carter, S.J. (2005). *Cooper and Gunn's: Tutorial Pharmacy*. 12th Ed., New Delhi: CBS Publisher and Distributors.
- Peppler, H.J., Perlman, D. (1979). *Microbial Technology*. 2nd Ed., Wisconsin: Elsevier.
- I.P., B.P., U.S.P. - latest editions.
- Ananthnarayan, R. (1990). *A Text Book of Microbiology*. 4th Ed., Hyderabad: Orient Longman Limited.
- Edward, A.I. (1983). *Fundamentals of Microbiology*. 4th Ed., Addison Wesley Publishing Company.
- Jain, N.K. (2005). *Pharmaceutical Microbiology*. 2nd Ed., Delhi: Vallabh Prakashan.
- Bergey, D.H., Holt, J.G. (1994.) *Bergeys manual of systematic bacteriology*. 2nd Ed., Baltimore: Williams and Wilkins.

Suggested e-material:

[https://www.elsevier.com/books/pharmaceutical-microbiology/
moscomm.org/pdf/Ananthanarayan%20microbio.pdf](https://www.elsevier.com/books/pharmaceutical-microbiology/moscomm.org/pdf/Ananthanarayan%20microbio.pdf)

Pharmaceutical Microbiology Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.

Sterilization of glassware, preparation and sterilization of media.

Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.

Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).

Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.

Microbiological assay of antibiotics by cup plate method and other methods

Motility determination by Hanging drop method.

Sterility testing of pharmaceuticals.

Bacteriological analysis of water

Biochemical test.

Physical Pharmaceutics - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Various physicochemical properties of drug molecules

Various aspects in pre formulation studies

Surface and interfacial phenomenon on formulation

Various aspects of size reduction and size separation pertaining to dosage preparation

Section-A

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids (Binary solutions, ideal solutions). Raoult's law, real solutions. Partially miscible liquids, critical solution temperature and applications. Distribution law, its limitations and applications.

States of matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols - inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism.

Section-B

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB scale, solubilisation, detergency, adsorption at solid interface.

Complexation and protein binding: Introduction, classification of complexation, applications, methods of analysis, protein binding, complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

Section-C

pH, buffers and isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

Size reduction: Objectives, mechanisms & laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of hammer mill, ball mill, fluid energy mill, edge runner mill & end runner mill.

Size separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation. Principles, construction, working, uses, merits and demerits of sieve shaker, cyclone separator, air separator, bag filter & elutriation tank.

Books Recommended:

- Martin, A., Swarbrick, J. (1993). *Physical Pharmacy*. 3rd Ed., Maryland: Lippincott Williams and Wilkins.
- Parott, L.E., Sasaki, W. (1977). *Experimental Pharmaceutics*. 4th Ed., Minneapolis: Burgess Publishers.
- Cater, S.J. (2005). *Tutorial Pharmacy*. 6th Ed., New Delhi: CBS publishers.
- Stocklosam, M.J., Ansel, H.C. (1986). *Pharmaceutical Calculations*. 8th Ed., Philadelphia: Lippincott Williams and Wilkins.
- Lieberman, H.A., Lachman, C., Schwartz, J.B. (1990). *Pharmaceutical Dosage forms, Tablets*, 2nd Ed., New York: Marcel Dekkar Inc.
- Lieberman, H.A., Lachman, C. (1990). *Pharmaceutical Dosage forms. Disperse systems*, 2nd Ed., New York: Marcel Dekkar Inc.
- Ramasamy, C., Manavalan, R. (2015). *Physical Pharmaceutics*. 2nd Ed., Chennai: Vignesh Publisher.
- Subramanyam, C.V.S., Settee, T.J. (2014). *Laboratory Manual of Physical Pharmaceutics*. 2nd Ed., New Delhi: Vallabh Publication.
- Subramanyam, C.V.S. (2000). *Text book of Physical Pharmaceutics*. 2nd Ed., New Delhi: Vallabh publication.
- Jain, G., Khar, R.K., Ahmad, F.J. (2012). *Theory and practice of Physical Pharmacy*. 1st Ed., New Delhi: Elsevier India.

Suggested e-material:

- <https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>
- <https://www.pdfdrive.com/pharmaceutical-books.html>
- <https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>
- <http://202.74.245.22:8080/xmlui/handle/123456789/39>
- www.elsevier.com/books/
- <https://accesspharmacy.mhmedical.com/book.aspx?bookid=513>

Physical Pharmaceutics - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning outcomes

Upon completion of the course, the student shall be able to know

Principles of chemical kinetics & to use them in assigning expiry date for formulation

Rheology principles and their applications on formulations

Various aspects of drug stability

Section-A

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers.

Deformation of solids: Plastic and elastic deformation, Heckel equation, stress, strain, elastic modulus.

Section-B

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

Micromeritics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

Section-C

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

Books Recommended:

Martin, A., Swarbrick, J. (1993). *Physical Pharmacy*, 3rd Ed., Maryland: Lippincott Williams and Wilkins.

Parott, L.E., Saski, W. (1977). *Experimental Pharmaceutics*, 4th Ed., Minneapolis: Burgess Publishers.

Cater, S.J. (2005). *Tutorial Pharmacy*, 6th Ed., India: CBS publishers.

Stocklosam, M.J., Ansel, H.C. (1986). *Pharmaceutical Calculations*, 8th Ed., Philadelphia: Lippincott Williams and Wilkins.

Lieberman, H.A., Lachman, C., Schwartz, J.B. (1990). *Pharmaceutical Dosage forms, Tablets*, 2nd Ed., New York: Marcel Dekkar Inc.

Lieberman, H.A., Lachman, C. (1990). *Pharmaceutical Dosage forms. Disperse systems*. 2nd Ed., New York: Marcel Dekkar Inc.

Ramasamy, C., Manavalan, R. (2015). *Physical Pharmaceutics*. 2nd Ed., Chennai: Vignesh Publisher.

Suggested e-material:

<https://accesspharmacy.mhmedical.com/book.aspx?bookid=513>

<http://www.pharmtech.com/>

<https://www.ncbi.nlm.nih.gov/pmc/>

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<https://www.pdfdrive.com/pharmaceutical-books.html>

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<http://202.74.245.22:8080/xmlui/handle/123456789/39/browse?type=subject>

www.elsevier.com/books/

Medicinal Chemistry - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Various aspects of medicinal chemistry

Classification, synthesis, SAR, mechanism of action and uses of various drugs

Study of the development of the following classes of drugs, classification, mechanism of action, uses of drugs mentioned in the course, structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

Section-A

Introduction to medicinal chemistry: History and development of medicinal chemistry. Physicochemical properties in relation to biological action (Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation). Effect of bioisosterism, optical and geometrical isomerism on biological activity.

Drugs acting on autonomic nervous system:

Sympathomimetic Agents: SAR of Sympathomimetic agents.

Direct acting: Nor-epinephrine, epinephrine, phenylephrine*, dopamine, methyl dopa, clonidine, dobutamine, isoproterenol, terbutaline, salbutamol*, bitolterol, naphazoline, oxymetazoline and xylometazoline.

Indirect acting agents: Hydroxyamphetamine, pseudoephedrine, propylhexedrine.

Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, phentolamine, phenoxybenzamine, prazosin, dihydroergotamine, methysergide.

Beta adrenergic blockers: SAR of beta blockers, propranolol*, metibranolol, atenolol, betazolol, bisoprolol, esmolol, metoprolol, labetalol, carvedilol.

Parasympathomimetic agents: SAR of Parasympathomimetic agents.

Direct acting agents: Acetylcholine, carbachol*, bethanechol, methacholine, pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, neostigmine*, pyridostigmine, edrophonium chloride, tacrine hydrochloride, ambenonium chloride, isofluorophate, echothiophate iodide, parathion, malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, cyclopentolate hydrochloride, clidinium bromide, dicyclomine hydrochloride*, glycopyrrolate, methantheline bromide, propantheline bromide, benztropine mesylate, orphenadrine citrate, biperidine hydrochloride, procyclidine hydrochloride*, tridihexethyl chloride, isopropamide iodide, ethopropazine hydrochloride.

Section-B

Drugs acting on central nervous system

General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, enflurane, sevoflurane, isoflurane, desflurane.

Ultra-short acting barbiturates: Methohexital sodium*, thiamylal sodium, thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and Non-Narcotic Analgesics:

Morphine and related drugs: SAR of morphine analogues, morphine sulphate, codeine, meperidine hydrochloride, anileridine hydrochloride, diphenoxylate hydrochloride, loperamide hydrochloride, fentanyl citrate*, methadone hydrochloride*, propoxyphene hydrochloride, pentazocine, levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, levallorphan tartarate, naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, aspirin, mefenamic acid*, meclofenamate, indomethacin, sulindac, tolmetin, zomepirac, diclofenac, ketorolac, ibuprofen*, naproxen, piroxicam, phenacetin, acetaminophen, antipyrine, phenylbutazone.

Section-C

Drugs acting on central nervous system:

Sedatives and Hypnotics:

Benzodiazepines: SAR of benzodiazepines, chlordiazepoxide, diazepam*, oxazepam, chlorazepate, lorazepam, alprazolam, zolpidem

Barbiturates: SAR of barbiturates, barbital*, phenobarbital, mephobarbital, amobarbital, butobarbital, pentobarbital, secobarbital

Miscellaneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobamate, ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, paraldehyde.

Antipsychotics

Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, chlorpromazine hydrochloride*, trifluorpromazine, thioridazine hydrochloride, piperacetazine hydrochloride, prochlorperazine maleate, trifluoperazine hydrochloride.

Ring analogues of phenothiazines: Chlorprothixene, thiothixene, loxapine succinate, clozapine.

Fluorobutero-phenones: Haloperidol, droperidol, risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

Anticonvulsants: SAR of anticonvulsants, mechanism of anticonvulsant action.

Barbiturates: Phenobarbitone, methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, ethotoin

Oxazolinediones: Trimethadione, paramethadione

Succinimides: Phensuximide, methsuximide, ethosuximide*

Urea and monoacylureas: Phenacemide, carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, valproic acid, gabapentin, felbamate.

Drug metabolism: Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects

Books Recommended:

Beale, J.M., Block, J., Wilson, G. (2010). *Organic medicinal and Pharmaceutical Chemistry*, 12th Ed., Philadelphia: Lippincott Williams and Wilkins.

Lemke, T.L., Williams, D.A., Rocho, V.F., Zito, S.W. (2012). *Foye's Principles of Medicinal Chemistry*, 7th Ed., Philadelphia: Lippincott Williams and Wilkins.

Abraham, D.J., Rotella, R.J. (2010). *Burger's Medicinal Chemistry, Drug Discovery and Development*, 7th Ed., New York: John Wiley and Sons.

Smith, J.H., Williams, H. (2010). *Introduction to principles of drug design*, 3rd Ed., Harwood academic publishers.

Remington, P.J., Beringer, P. (2006). *Remington's Pharmaceutical Sciences*, 21st Ed., Philadelphia: Lippincott Williams and Wilkins.

Finar, I.L. (2002). *Organic Chemistry: Volume 2. Stereochemistry and the Chemistry Natural Products*. 5th Ed., London: Pearson.

Lednicer, D. (1997). *The Organic Chemistry of Drug Synthesis*, 5th Ed., New York: John Wiley and Sons Ltd.

Indian Pharmacopoeia, (2014). Addendum 2016.

Furniss, B.S., Hannaford, A.J., Smith, P.W.G. (2009). *Vogel's Tatchell: Text book of practical organic chemistry*, 5th Ed., London: Pearson.

Suggested e-material:

https://books.google.co.in/books/about/Foye_s_Principles_of_Medicinal_Chemistry.html?id=R0W1ErpsQpkC

[https://www.wiley.com/en-us/Burger%27s+Medicinal+](https://www.wiley.com/en-us/Burger%27s+Medicinal+Chemistry%2C+Drug+Discovery%2C+and+Development%2C+7th+Edition-p-9780470278154)

[Chemistry%2C+Drug+Discovery%2C+and+Development%2C+7th+Edition-p-9780470278154](https://www.wiley.com/en-us/Burger%27s+Medicinal+Chemistry%2C+Drug+Discovery%2C+and+Development%2C+7th+Edition-p-9780470278154)

Medicinal Chemistry - I Lab

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

0 0 4 2

I Preparation of drugs/ intermediates

- 1,3-pyrazole
- 1,3-oxazole
- Benzimidazole
- Benztriazole
- 2,3- diphenyl quinoxaline
- Benzocaine
- Phenytoin
- Phenothiazine
- Barbiturate

II Assay of drugs

- Chlorpromazine
- Phenobarbitone
- Atropine
- Ibuprofen
- Aspirin
- Furosemide

III Determination of Partition coefficient for any two drugs

Pharmacology - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Various principles of pharmacology

Classification and mode of actions of different categories of drugs

Effect of drug action at organ system/sub cellular/ macromolecular level

Transduction mechanism of various receptors

Structure, organization and pharmacology of drugs acting on ANS, PNS and CNS

Applications of basic pharmacological knowledge in the prevention and treatment of various diseases

Section-A

General Pharmacology

- a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.
- b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

Section-B

General Pharmacology

- a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein-coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.
- b. Adverse drug reactions.
- c. Drug interactions (pharmacokinetic and pharmacodynamic)
- d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

Pharmacology of drugs acting on peripheral nervous system

- a. Organization and function of ANS.
- b. Neurohumoral transmission, co-transmission and classification of neurotransmitters.
- c. Parasympathomimetics, parasympatholytics, sympathomimetics, sympatholytics.
- d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
- e. Local anesthetic agents.
- f. Drugs used in myasthenia gravis and glaucoma.

Section-C

Pharmacology of drugs acting on central nervous system

- a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
- b. General anesthetics and pre-anesthetics.
- c. Sedatives, hypnotics and centrally acting muscle relaxants.
- d. Anti-epileptics
- e. Alcohols and disulfiram
- f. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
- g. Drugs used in Parkinson's disease and Alzheimer's disease.
- h. CNS stimulants and nootropics.
- i. Opioid analgesics and antagonists
- j. Drug addiction, drug abuse, tolerance and dependence.

Books Recommended:

- Rang, H., MacEwan, D., Ritter, J., Flower, R., Henderson, G., Loke, Y.K. (2019). *Rang and Dale's Pharmacology*, 9th Ed., London: Churchill Livingstone Elsevier.
- Katzung, B.G., Masters, S.B., Trevor, A.J. (2010). *Basic and clinical pharmacology*, 11th Ed., New York: Mc Graw-Hill.
- Brunton, L.L., Knollmann, B., Dandan, R.H. (2017). *Goodman and Gilman's, The Pharmacological Basis of Therapeutics*, 13th Ed., New York: McGraw-Hill Education.
- Marry, A.K.K., Lloyd, Y.Y., Brian, K. A., Robbin, L.C., Joseph, G.B., Wayne, A.K., Bradley, R.W. (2008). *Applied Therapeutics, The Clinical use of Drugs*, 9th Ed., Philadelphia: Lippincott Williams & Wilkins.

Tripathi, K.D. (2018). *Essentials of Medical Pharmacology*, 8th Ed., New Delhi: Jaypee Brothers Medical Publishers Ltd.

Sharma, H. L., Sharma, K.K. (2012). *Principles of Pharmacology*, 2nd Ed., Ahmedabad: Paras Medical Publisher.

Craig, C.R., Sitzel, R.E. (2003). *Modern Pharmacology with clinical Applications*, 6th Ed., Philadelphia: Lippincott Williams &Wilkins.

Ghosh, M.N. (2012). *Fundamentals of Experimental Pharmacology*, 6th Ed., Kolkata: Hilton & Company.

Kulkarni, S.K. (2005). *Handbook of experimental pharmacology*. 3rd Ed., New Delhi: Vallabh Prakshan.

uggested e-material:

www.cvpharmacology.com

www.treatment4addiction.com

www.medicalnewtoday.com

www.edvivas.com

www.pharmafactz.com

www.ausmed.com

www.medicinenet.com

Physical Pharmaceutics - I Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Determination the solubility of drug at room temperature

Determination of pKa value by half neutralization/ Henderson Hasselbalch equation.

Determination of Partition co-efficient of benzoic acid in benzene and water

Determination of Partition co- efficient of Iodine in CCl₄ and water

Determination of % composition of NaCl in a solution using phenol-water system by CST method

Determination of surface tension of given liquids by drop count and drop weight method

Determination of HLB number of a surfactant by saponification method

Determination of Freundlich and Langmuir constants using activated charcoal

Determination of critical micellar concentration of surfactants

Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method

Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

Pharmacognosy and Phytochemistry - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

History, scope and development of Pharmacognosy

Quality control of natural products

Role of the plant tissue culture in enhancing the production of secondary metabolites

Standardization of crude drug on the basis of different standardization parameters

Section-A

Introduction to Pharmacognosy:

- (a) Definition, history, scope and development of Pharmacognosy
- (b) Sources of Drugs - Plants, Animals, Marine & Tissue culture
- (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

Section-B

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin. Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants. Conservation of medicinal plants

Plant tissue culture: Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines.

Section-C

Pharmacognosy in various systems of medicine: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products: Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens.

Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic uses and commercial utility as Pharmaceutical Aids and/or Medicines for the following primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, romelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs: Novel medicinal agents from marine sources.

Books Recommended:

Evans, W.C. (2009). *Trease and Evans. Pharmacognosy*, 16th Ed., London: W.B. Saunders & Co.

Tyler, V.E., Brady, L.R., Robbers, J.E. (1988). *Pharmacognosy*, 9th Ed., Philadelphia: Lea and Febiger.

Wallis, T.E., Churchill, A. (2005). *Text Book of Pharmacognosy*, 5th Ed., New Delhi: CBS Publishers.

Mohammad, A. (2012). *Pharmacognosy and Phytochemistry*, 2nd Ed., New Delhi: CBS Publishers and Distribution.

Purohit, A.P., Kokate, C.K., Gokhale, S.B. (2007). *Text book of Pharmacognosy*, 37th Ed., Pune: Nirali Prakashan.

Choudhary, R.D. (1996). *Herbal drug industry*, 1st Ed., New Delhi: Eastern Publisher.

Ansari, S.H. (2007). *Essentials of Pharmacognosy*, 2nd Ed. New Delhi: Birla publications.

Gokhale, S.B., Kokate, C.K. (2017). *Practical Pharmacognosy*, 18th Ed. Pune: Nirali Prakashan.

Lyengar, M.A., Nayak, S.G.K. (2017). *Anatomy of Crude Drugs*, 12th Ed., PharmaMed Press.

Suggested e-material:

<http://nsdl.niscair.res.in>

http://www.herbs4youth.eu/files/workbook_processingtransf.pdf

<https://biot202.files.wordpress.com>

<http://www.naturaldatabase.com>. http://www.nlm.nih.gov/medlineplus/druginfo/herb_All.html

<http://dietarysupplements.nlm.nih.gov/dietary/ingred.jsp>

<http://ods.od.nih.gov/>

<http://nccam.nih.gov/>

<http://apps.who.int/medicinedocs/en/d/Js2200e/>

www.fda.gov/medwatch

<http://apps.who.int/medicinedocs/documents/h1791e/h1791e.pdf>

<http://ayush.gov.in/sites/default/files/File779%20%20%204.pdf>

www.ayurveda.hu/api/API-Vol-1.

Pharmacognosy and Phytochemistry - I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Physical Pharmaceutics - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning outcomes

Upon completion of the course, the student shall be able to know

Principles of chemical kinetics & to use them in assigning expiry date for formulation

Rheology principles and their applications on formulations

Various aspects of drug stability

Section-A

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers.

Deformation of solids: Plastic and elastic deformation, Heckel equation, stress, strain, elastic modulus.

Section-B

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

Micromeritics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

Section-C

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

Books Recommended:

Martin, A., Swarbrick, J. (1993). *Physical Pharmacy*, 3rd Ed., Maryland: Lippincott Williams and Wilkins.

Parott, L.E., Saski, W. (1977). *Experimental Pharmaceutics*, 4th Ed., Minneapolis: Burgess Publishers.

Cater, S.J. (2005). *Tutorial Pharmacy*, 6th Ed., India: CBS publishers.

Stocklosam, M.J., Ansel, H.C. (1986). *Pharmaceutical Calculations*, 8th Ed., Philadelphia: Lippincott Williams and Wilkins.

Lieberman, H.A., Lachman, C., Schwartz, J.B. (1990). *Pharmaceutical Dosage forms, Tablets*, 2nd Ed., New York: Marcel Dekkar Inc.

Lieberman, H.A., Lachman, C. (1990). *Pharmaceutical Dosage forms. Disperse systems*. 2nd Ed., New York: Marcel Dekkar Inc.

Ramasamy, C., Manavalan, R. (2015). *Physical Pharmaceutics*. 2nd Ed., Chennai: Vignesh Publisher.

Suggested e-material:

<https://accesspharmacy.mhmedical.com/book.aspx?bookid=513>

<http://www.pharmtech.com/>

<https://www.ncbi.nlm.nih.gov/pmc/>

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<https://www.pdfdrive.com/pharmaceutical-books.html>

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<http://202.74.245.22:8080/xmlui/handle/123456789/39/browse?type=subject>

www.elsevier.com/books/

Physical Pharmaceutics - II Lab

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

0 0 4 2

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using Microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Pharmaceutical Organic Chemistry - III

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of the course, the student shall be able to know

Nomenclature and classification. Synthesis, reactions and medicinal uses of heterocyclic compounds

Stereo chemical aspects of organic compounds and stereo chemical reactions

Section-A

Stereo isomerism:

Optical isomerism - Optical activity, enantiomerism, diastereo-isomerism, meso- compounds, elements of symmetry, chiral and achiral molecules. DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers. Racemic modification and resolution of racemic mixture. Asymmetric synthesis (partial and absolute) & reactions of chiral molecules.

Geometrical isomerism: Nomenclature of geometrical isomers (Cis-Trans, E-Z, Syn-Anti systems), methods of determination of configuration of geometrical isomers. Conformational isomerism in ethane, n-butane and cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions.

Section-B

Heterocyclic compounds: Nomenclature and classification. Synthesis, reactions and medicinal uses of following compounds - Pyrrole, Furan, Thiophene, Pyrazole, Imidazole, Oxazole, Thiazole, Pyridine, Quinoline, Isoquinoline, Acridine, Indole and their derivatives (pyrrolidine, furfural, 2,2'- bithiophene, N-phenyl pyrazole, imidazoline, 2-alkyloxazole, 4-hydroxy-1,3-thiazole, 2-methyl pyridine, 8-hydroxyquinoline, 1,2,3,4- tetrahydroisoquinoline, proflavin, indole-3-acetic acid).

Section-C

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives (6-amino purine, pyrimidine-2,4 (1H, 3H)- dione, benzazepine).

Reactions of synthetic importance: Metal hydride reduction (NaBH_4 and

LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation.

Books Recommended:

Finar, I.L. (2002). *Organic chemistry*, 6th Ed., Pearson Education.

Bahl, B.S., Bahl, A. (2014). *A text book of organic chemistry*, 5th Ed., S. Chand and Company Ltd.

Bansal, R.K. (2017). *Heterocyclic Chemistry*, 5th Ed., New Age International Private Ltd.

Morrison, R.T., Boyd, R.M., Bhattacharjee, S.K. (2011) *Organic Chemistry*, 7th Ed., Pearson Publishers.

Gilchrist, T.L. (1997). *Heterocyclic Chemistry*, 3rd Ed., Prentice Hall.

Suggested e-material:

<http://lib.myilibrary.com?id=527192>

<http://lib.myilibrary.com?id=527161>

<http://www.sciencedirect.com/science/book/978012801699>

PHARMACEUTICAL CHEMISTRY-IV (BIOCHEMISTRY)

4 Hrs/week

Max. Marks: 60

SECTION-A

Enzymes: Nomenclature, classification, characteristics, enzyme kinetics and its mechanism of action, mechanism of enzyme inhibition, enzymes in clinical diagnosis.

Co-enzymes and cofactors: Role of vitamins, metals ions, significance.

Carbohydrates: Classification, structure and properties, glycolysis and fermentation, gluconeogenesis and glycogenolysis, metabolism of galactose, pentosephosphate pathway.

Citric acid cycle: Significance, reactions and energetic of the cycle, amphibolic role of the cycle. Glyoxalic acid cycle

SECTION-B

Lipids: Classification, structure and properties of lipids. Oxidation of fatty acids, α -oxidation and its energetics, β -oxidation of fatty acids, ω -oxidation. Biosynthesis of ketone bodies and their utilization, biosynthesis of saturated and unsaturated fatty acids, control of lipid metabolism, eicosanoids, phospholipids and sphingolipids.

Metabolism of amino acids: Classification, structure and properties of amino acids, biosynthesis of amino acids, catabolism of amino acids.

Biological oxidation: Enzymes and co-enzymes involved in oxidation-reduction and its control. The respiratory chain, its role in energy capture and its control. Energetics of oxidative phosphorylation, inhibitors of respiratory chain and oxidative phosphorylation, mechanism of ATP production in oxidative phosphorylation.

SECTION-C

Metabolism of ammonia and nitrogen containing monomers: Urea cycle, porphyrin biosynthesis, formation of bile pigments, purine biosynthesis, purine nucleotides interconversion, pyrimidine biosynthesis, formation of deoxyribonucleotides.

Nucleic acids: Structure of DNA and RNA, genetic code, transcription and translation, replication of DNA, mutation, physical and chemical mutagenesis / carcinogenesis, DNA repair mechanism.

Books recommended:

1. Principles of Biochemistry: A.L. Lehninger, Nelson and Cox, McMillan Worth Publishers.
2. Biochemistry: Voet and Voet, John Wiley and Sons, Inc. USA.
3. Biophysical Chemistry Vol. I, II & III: Cantor and Schimmel, Freeman.
4. Biochemistry: Zubey, WCB.
5. Biochemistry: Garrett and Grisham, Harcourt.
6. Biochemistry: Stryer, W. H. Freeman.
7. Understanding Enzymes: T. Palmer, Horwood.
8. Harper's review of Biochemistry: R.K. Murray et al., Prentice-Hall International Inc.
9. Fundamentals of Biochemistry: Cohn and Stumpf.

PHARMACEUTICAL CHEMISTRY-IV (BIOCHEMISTRY)

4 Hrs/week

Max. Marks: 30

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by chromatography.
4. The separation of lipids by TLC.
5. Quantitative estimation of amino acids.
6. The determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by alpha, and beta amylases.
8. Effects of temperature to the activity of alpha amylase.
9. Estimation of cholesterol in Blood.
10. Estimation of glucose in blood & urine.
11. Estimation of urea in blood.
12. Estimation of ketone bodies in blood.

Books recommended:

1. D.W. Martin. P.A. Mays & V.M. Redwell, Harpers Review of Biochemistry, Lange Medical Publication.
2. E.E. Conn & P.K. Stumph Outline of Biochemistry, John Willery & Sons. New York.
3. A.L. Lehninger, Biochemistry, CBS Publishers and Distributers.
4. L Streyer, Biochemistry, WH. Freeman & Company. San Francisco.
5. B.Harrow & A. Mazur, Text book of Biochemistry, W.B. Saunders Co. Philadelphia.
6. J. Jayaraman, Laboratory Manual in Biochemistry, Wiley Eastern Limited.
7. David T. Plummer, An Introduction to practical Bio-chemistry, Mc Graw Hill, New Delhi.
8. S.P. Singh, Practical manual to Bio-Chemistry, CBS Publisher, New Delhi.

PHARMACEUTICS-VI (PHARMACEUTICAL TECHNOLOGY-I)

3 Hrs/week

Max. Marks: 45

SECTION-A

Liquid dosage forms: Manufacturing packaging & evaluation of clear liquids, suspensions and emulsions for oral and topical administration. Liquid preparation official in I.P.

Semisolid dosage forms: Definitions, types of semisolid dosage forms, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging.

SECTION-B

Suppositories: Ideal requirements of suppositories bases, manufacturing procedure of suppositories, packaging and evaluation.

Blood products and plasma substitutes: Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam, plasma substitutes PVP, dextran, ideal requirements for control of blood products as per I.P.

Pharmaceutical aerosols: Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications.

SECTION-C

Ophthalmic preparations: Requirements, formulation, methods of preparation, containers and evaluation.

Cosmetology and cosmetic preparations: Structure of skin, formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, protective cream, antiperspirants, face powder. Hair structure, shampoos, conditioner, shaving and after shaving products, dentifrice & mouthwash, lipstick, nail lacquer.

Books recommended:

1. Remington's Pharmaceutical Sciences, Vol. I & Vol. II, Mack Publishing Co., U.S.A.
2. J.W. Cooper, & G. Gunn, Tutorial Pharmacy, Petman Books Ltd., London.
3. L. Lachman, et al, Theory and Practice of Industrial Pharmacy. Lea & Febiger, Philadelphia, USA.
4. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
5. R.L. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
6. Harrys Cosmetology
7. Balsam and Sagarin, Cosmetics: Science and Technology.

PHARMACEUTICS-VI (PHARMACEUTICAL TECHNOLOGY-I)

4 Hrs/week

Max. Marks: 30

1. Preparation of cold cream, vanishing cream, cleansing lotion and creams. Moisturizing creams, skin tonics. Hair creams, Hair conditioners, Shampoos, Shaving creams and sticks. Tooth powder, Tooth pastes, After shave lotion and other cosmetic preparations.
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.
3. Collection, processing, storage and fractionation of blood.

PHARMACOLOGY-I

3 Hrs/week

Max. Marks: 45

SECTION-A

General pharmacology: Introduction to pharmacology, routes of administration, pharmacokinetics and pharmacodynamics, factors modifying drug action. Drug interactions and adverse drug reactions. Bioassay of drugs and their role discovery & development of new drugs.

SECTION-B

Pharmacology of autonomic nervous system: Neurohumoral transmission- autonomic & somatic. Parasympathomimetics, parasympatholytics, sympathomimetics, adrenergic receptor & neuron blocking agents. Ganglionic stimulants & blocking agents.

Drugs acting on peripheral nervous system: Neuromuscular blockers, local anesthetics

SECTION-C

Pharmacology of central nervous system: Neurohumoral transmission in CNS. General anesthetics, alcohol, disulfiram, sedatives, hypnotics, anti-anxiety agents & centrally acting muscle relaxants, psychopharmacological agents (antipsychotics) antidepressants, antimaniacs. Antiepileptic drugs, antiparkinsonians, NSAIDs & anti-gout drugs. Narcotic analgesics and antagonists. Drugs for alzheimer disease.

Books recommended:

1. Barar F.S.K: Text Book of Pharmacology, Interpoint, New Delhi
2. Goodman & Gilman, The Pharmacological basis of Therapeutics; Editors: J.G. Hardman, L.E. Limbird, P.B. Molinos, R.W. Ruddon and A.G. Gil Pergamon press.
3. Katzung, B.g. Basic & Clinical Pharmacology, Prentice Hall, International.
4. Laurence, DR & Bennet PN: Clinical Pharmacology, Churchill Livingstone.
5. Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
6. Tripathi, K.d. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
7. Satoskar & Bhandarkar: Pharmacology & Pharmastheropeuties. Popular Prakshan Pvt. Ltd. Bombay.

PHARMACOLOGY-I

4 Hrs/week

Max. Marks: 30

1. **Introduction to Experimental Pharmacology :** Preparation of different solutions for experiments, drug dilutions, use of molar and w/v solutions in experimental pharmacology, common laboratory animals and anesthetics used in animal studies, commonly used instruments in experimental pharmacology. Some common and standard techniques, bleeding and intravenous injection, intragastric administration. Procedures for rendering animals unconscious-stunning of rodents, chemical euthanasia.
2. **Experiments on intact preparations :** To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice.
3. **Experiments on central nervous system:** Recording of spontaneous motor activity, stereotype, analgesia. anticonvulsant activity, anti-inflammatory activity, and muscle relaxant activity of drugs using simple experiments.
4. Effects of autonomic drugs on rabbits eye with the help of software.

Books recommended:

1. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calutta.
2. Grover, J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
3. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakshan Delhi.

PHARMACOGNOSY-III

3 Hrs/week

Max. Marks: 45

SECTION-A

Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing :

Glycosides

Saponins: Liquorice, ginseng, dioscorea, sarasaparilla, senega.

Cadioactive sterols: Digitils, squill, stropanthus, thevetia.

Anthraquinone cathartics: Aloe, senna, rhubarb, cascara.

Others: Psoralia, Ammi majus, Ammi visnaga, gentian, Saffron, Chirata, Quassia.

Utilization and production of phytoconstituents such as: calcium sennosides, Diosgenin, solasodine, podophylotoxins.

SECTION-B

The Holistic concept of drug administration in traditional system of medicine. Introduction to ayurvedic preparations like: Arishtas, Asavas, Gutikas, Tailas, churnas, lehyas and bhasmas.

SECTION-C

Studies of traditional drugs, Common vernacular name, Biological sources, morphology, chemical nature of chief constituents pharmacology, categories and common uses and marketed formulation of following indigenous: Amla, Kantkari, Satavari, Tylophora, bhilwa, kalijiri, bach, rasna, punarnava, chitrak, Apamarg, gokharu, shankhpuspi, brahmi, methi, Lahsun, palash, Guggal, gymnema, Shilajit, Nagarmotha, Maijith, Malkanguni and Neem.

Books recommended:

1. Trease, G.E.; & Evans, W.C.; "Pharmacognosy" Bailliere Tindall east Baorne, UK.
2. Tyler V.E. et al "Pharmacognosy" Lea & Fibiger, Philadelphia.
3. Wellis T.E." Text Book of Pharmacognosy" J&A Chruchill Ltd. London.
4. Kokate C.K. et al "Pharmacognosy" Nirali Prakashan, Pune.
5. Medicinal plants of India I & II, Indian council of Medical Research, New Delhi.
6. Nadkarni A.K. Indian Materia Medica 1-2, popular Prakashan (P) Ltd. Bombay.
7. Atal C.K. & Kapur BM, "Cultivation & utilization of Medicinal plants, RRL Jammu.
8. Indian Herbal Pharmacopoeia vol. I & II, ICMR & RRL, Jammu.
9. The Wealth of India, Raw Materials (All volumes) council of scientific & Industrial Research, New- Delhi.
10. Compendium of Indian Medicinal Plants I-IV, Rastogi & Malhoatra.

PHARMACOGNOSY-III

4 Hrs/week

Max. Marks: 30

1. Identification of crude drugs listed in theory.
2. Microscopic study of some important glycoside containing drugs as outlined above. Study of powdered drugs.
3. Standardization of some traditional drug formulations.

Books recommended:

1. Kokate C.K. "Pharmacognosy" Vallabh Prakashan New Delhi.
2. Wallis T.E. "Analytical Microscopy" J&A Churchill Ltd. London.

PHARMACEUTICS-VII (HOSPITAL PHARMACY)

3 Hrs/week

Max. Marks: 45

SECTION-A

Organization and Structure: Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist, Budget preparation and implementation. Pharmacy and therapeutic committee.

Hospital Formulary: Contents, Preparation and revision of hospital formulary, Pharmacy procedure manual

SECTION-B

Purchase and Inventory Control: Principles, purchase procedures, purchase order, procurement and stocking.

Drug distribution systems in Hospitals: Out-patient dispensing, methods adopted. Dispensing of drugs to in-patients. Types of drug distribution systems charging policy, labeling. Dispensing of drugs to ambulatory patients. Dispensing of controlled drugs. Central sterile supply unit.

SECTION-C

Drug information service: Sources of information on drugs, treatment schedules, procurement of information, computerized services (e.g. MEDLINE), Retrieval of Information. Medication error.

Records and reports: Prescription filling drug profile, patient medication profile, drug interaction & adverse reactions, idiosyncratic cases etc.

Nuclear pharmacy: Introduction to radiopharmaceutics, radioactive half-life units of radioactivity. Production of radiopharmaceuticals, methods of isotonic tagging, preparation of radioisotopes in laboratory, radiation dosimetry, radio- isotope generators, permissible radiation dose level. Radiation hazards and their prevention, specifications for radioactive laboratory.

Books recommended:

1. Hasan, "Hospital Pharmacy", Lea & Febiger, Philadelphia.
2. Merchant H.S. and Qadry J.S. Text book of Hospital Pharmacy. B.S. Shah Prakashan, Ahmedabad.

PHARMACEUTICAL CHEMISTRY-V (MEDICINAL CHEMISTRY-I)

3 Hrs/week Max. Marks: 45

SECTION-A

Basic principles of medicinal chemistry: Physicochemical aspects (optical, geometric and bioisosterism) of drug molecules and biological action, drug-receptor interaction.

SECTION-B

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only):

Drugs acting at synaptic and neuroeffector junction sites:

Cholinergic, anticholinergic and anticholinesterases: Neostigmine, physostigmine, methacholine, pilocarpine, atropine.

Adrenergic drugs: Ephedrine, isoproterenol, amphetamine, salbutamol, terbutaline, adrenaline.

Antispasmodic and antiulcer drugs: Dicyclomine, ranitidine, omeprazole, pirenzepine.

Neuromuscular blocking agents: Gallamine triethiodide, mephensin.

SECTION-C

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only):

Drugs acting on the central nervous system:

General anaesthetics: Thiopental, ketamine, methohexital, enflurane.

Local anaesthetics: Lignocaine, benzocaine, bupivacaine.

Hypnotics and sedatives: Phenobarbitone, pentobarbitone.

Opioid analgesics: Pethidine, methadone, pentazocine.

Antitussives: Dextromethorphan.

Anticonvulsants: Phenytoin, carbamazepine, ethosuximide, valproic acid.

Antiparkinsonism drugs: Carbidopa, levodopa.

CNS stimulants: Caffeine, nikethimide.

Psychopharmacological agents: Neuroleptics (imipramine, amitriptylene) and antidepressants (doxepin, meprobamate, chlordiazepoxide, diazepam).

Books recommended:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Wolff ME, Ed. Burger's "Medicinal Chemistry". John Wiley & Sons, New York.
3. Delgado J N and Remers W A R, Eds; Wilson and Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, J.Lippincott Co; Philadelphia.
4. Foye W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
5. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Nogrady T, Medicinal Chemistry- A Biochemical Approach, Oxford University Press, New York, Oxford.
7. Finar I.L., Organic Chemistry, Vol I & II, ELBS/ Longman, London.

(MEDICINAL CHEMISTRY-I)

4 Hrs/week

Max. Marks: 30

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeial standards of the drugs synthesized.

Books recommended:

1. Mann P.G. & Saunders B.C. Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss B.S., Hannaford A.J. Smith P.W.G. and Tatehell A.R., Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.

(BIOPHARMACEUTICS & PHARMACOKINETICS)

3 Hrs/week

Max. Marks: 45

SECTION-A

Introduction: Biopharmaceutics and pharmacokinetics, their role in formulation, development and clinical testing.

Biopharmaceutics: Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis). Factors influencing absorption (physicochemical, physiological and pharmaceutical). Drug distribution in the body and plasma protein binding.

SECTION-B

Pharmacokinetics: Significance of plasma drug concentration measurement. Compartment model- definition and scope. Pharmacokinetics of drug absorption - zero order and first order absorption rate constant using Wagner-Nelson, LooReigelman method. Volume of distribution and distribution coefficient. Compartment kinetics - one compartment and two compartment models. Determination pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.

SECTION-C

Clinical pharmacokinetics: Definition and scope. Dosage adjustment in patients with and without renal and hepatic failure. Pharmacokinetic drug interactions and their significance in combination therapy.

Bioavailability and bioequivalence: Measures of bioavailability, C-max and area under the curve (AUC). Review of regulatory requirements for conduction of bioequivalence studies.

Books recommended:

1. Notari, R.E. Biopharmaceutics AND Pharmacokinetics-An Introduction Marcek Dekkar Inc. N.Y.
2. Rowland M. and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.
3. Wagner J.g. Fundamentals of Clinical Pharmacokinetics, Drug Intelligence Publications Hamilton.
4. Wanger J.g. Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.g. Basel Switzerland.

(BIOPHARMACEUTICS & PHARMACOKINETICS)

4 Hrs/week

Max. Marks: 30

1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
2. *In vitro* evaluation of different dosage forms for drug release.
3. Absorption studies- *in vitro*
4. Statistical treatment of pharmaceutical data.

Books recommended:

1. Notari, R.E. Biopharmaceutics AND Pharmacokinetics-An Intoduction Marcek Dekkar Inc. N.Y.
2. Rowland M. and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.
3. Wagner J.G. Fundamentals of Clincial Pharmacokinetics, Drug Intelligence Publications Hamilton.
4. Wanger J.G. Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.g. Basel Switzerland.

PHARMACOLOGY-II

3 Hrs/week

Max. Marks: 45

SECTION-A

Autocoids: Histamine, 5-HT & their antagonists, prostaglandins, thromboxanes & leukotrienes, pentagastrin, cholecystokinin. Angiotensin, bradykinin & substance P.

Pharmacology of CVS : Drugs of congestive heart failure (CHF), antihypertensive drugs, antianginal drugs, antiarrhythmics and antihyperlipidemics.

SECTION-B

Drugs acting on hemopoietic system: Haematinics, vitamin K, anticoagulants, fibrinolytics, anti platelet drugs and plasma volume expanders.

Diuretics.

SECTION-C

Drugs acting on respiratory system: Anti-asthmatic drugs, anti-tussives, expectorants and respiratory stimulants.

Drugs acting on GIT: Antacids and antiulcer drugs, laxatives and antidiarrhoeal agents, emetics and antiemetics.

Books recommended:

1. Barar FSK: Text Book of Pharmacology, Interpoint, New Delhi.
2. Goodman & Gilman, The Pharmacological basis of Therapeutics; Editors:- JG Hardman, Le Limbird, PB Molinoss, RW Ruddon & AG Gil, Pergamon Press.
3. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall, International.
4. Laurence, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
5. Rang MP, Dale MM Riter JM, Pharmacology Churchill Livingstone.
6. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
7. Satoskar & Bhandarkar; Pharmacology & Pharmastherapeutics, Popular Prakashan Pvt. Ltd. Bombay.
8. Craig, C.R. and Stitzel, R.R., Modern Pharmacology, Little Brown and Co., 1994.

PRACTICAL PHARMACOLOGY-II

4 Hrs/week

Max. Marks: 30

1. Experiments on Isolated preparations with the help of software:

- a) To record the concentration response curve (CRC) of Acetyl Choline using rectus abdominis muscle preparation of rat.
- b) To study the effect of physostigmine & d-tubocurarine on the CRC of Acetyl Choline using rat preparation.
- c) To record the CRC of histamine on guinea pig ileum preparation & study the effect of antihistaminics.

2. Pharmacology of urinary & gastrointestinal system:

- a) To evaluate different drugs for diuretic activity.
- b) To evaluate different drugs for laxative potential.

3. Blood pressure of anaesthetized rat

To demonstrate the effects of various drugs on the BP using non- invasive B.P technique.

Books recommended:

- 1. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book agency, Calcutta.
- 2. Grover, J.K; Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
- 3. Kulkarni S.K.; Hand Book of Experimental Pharmacology Vallabh Prakashan Delhi.

PHARMACOGNOSY-IV

3 Hrs/week

Max. Marks: 45

SECTION-A

Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic & Microscopic features & specific chemical tests of following alkaloids containing drugs:

- (A) *Pyridine-piperidine*: Tobacco, areca, lobelia
- (B) *Tropane*: Belladonna, Hyoscyamus, datura, cocca, dubosia, withania.
- (C) *Quinolone & Isoquinoline*: Cinchona, ipecac, opium.
- (D) *Indole*: Ergot, rauwolfia, catheranthus, nux-vomica, physostigma.
- (E) *Imidazole*: Pilocarpus.
- (F) *Steroidal*: Veratrum, kurchi.
- (G) *Alkaloidal amine*: Ephedra, colchicum.
- (H) *Glycoalkaloid*: Solanum.
- (I) *Purines*: Coffee, tea, cola.
- (J) *Quiazoline*: Vasaka.

SECTION-B

Worldwide trade in medicinal plants and derived product: Tropane alkaloids containing drugs, cinchona, ipecac, rauwolfia, taxol, diosgenin, digitalis, liquorice, papain, ginseng, aloe, valerian & plant laxatives.

Role of medicinal and aromatic plants in national economy.

Biological sources, preparation, identification tests and uses of following enzymes: Diastase, papain, pepsin, trypsin and pancreatin.

SECTION-C

Plant bitters and sweeteners.

Application of chromatography in evaluation of herbal drugs.

Historical development of plant tissue culture, type of culture, nutritional requirement, growth and their maintenance. Application of plant tissue culture in pharmacognosy.

Utilization and production of phytoconstituents such as: Tropane alkaloids, isoquinoline and quinoline alkaloids.

Books recommended:

1. Trease, G.E. & Evans, W.C. "Pharmacognosy" Bailliere Tindall East Bourine. U.K.
2. Tyler V.E. et al Parmacognosy Lea & Febiger Piladelphia.
3. Wallis T.E. Text book of Pharmacognosy J&A Churchill Ltd. London.
4. Kokate, C.K. et al Pharmacognosy Nirali Prakashan, Pune.
5. Atal & Kapur, Cultivation & Utilization of Medical Plants, RRL. Jammu.

6. Stahl.E, Thin Layer Chromatography. A laboratory handbook, Springer Verlag, Berlin.
7. Henry TA. The Plant Alkaloids, McGraw Hill, New York.
8. Dixit, V.K., & Vyas. S.P., Text book of pharmaceutical Biotechnology. CBS Publication, ND.
9. Street H.E. Tissue Culture & Plant Science, Academic Press, London.

PHARMACOGNOSY-IV

4 Hrs/week

Max. Marks: 30

1. Identification of crude drugs listed above.
2. Microscopic study of characters of any eight selected drugs given in theory in entire and powder form.
3. Chemical evaluation of powdered drugs & Enzymes.
4. Chromatographic studies of some herbal constituents.
5. Some experiments in plant tissue culture.

Books recommended:

1. Kokate, C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
2. Wallis. T.E. Analytical Microscopy, J&A Churchill Ltd., London.
3. Ganborg & Wetter, Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
4. Clarke ECG, Isolation & Identification of drugs, The pharmaceutical Press, London.

DRUG REGULATORY AFFAIRS

3 Hrs/week

Max. Marks: 45

SECTION-A

An overview of: cGMP, GLP, USFDA, ISO9000 series and WHO guidelines.

SECTION-B

Documentation: Protocols forms and maintenance of records in pharmaceutical industry. Preparation of documents for new drug approval and export registration. GATT and WTO.

Validation: Types of validation, prospective, retrospective and concurrent validation, including equipment validation. Design and development of process validation for pharmaceutical operation involved in production of solid and liquid dosage form.

SECTION-C

Introduction: An introduction to intellectual property and intellectual property right, including research agreements.

Stability: Stabilization and stability testing procedure for various pharmaceutical products calculation of shelf life and expiry date, over age addition. Introduction to ICH guidelines.

Pilot plant scale up techniques.

Books recommended:

1. Remington's Pharmaceutical Sciences, Vol.I & Vol.-II, Mack Publishing Co., U.S.A.
2. J.W. Cooper, & G. Gunn, Tutorial Pharmacy, Petman Books Ltd., London.
3. L. Lachman, et al, Theory and Practice of Industrial Pharmacy. Lea & Febiger, Philadelphia, U.S.A.
4. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
5. GMP for Pharmaceuticals Willing, Tuckerman and Hitching.
6. ISO reports.
7. Indian Patent act.
8. Drug Stability, Principles and Practices, Jens T. Castensen.

PHARMACEUTICAL ANALYSIS-III

3 Hrs/week

Max. Marks: 45

SECTION-A

Ultraviolet and visible spectrophotometry: Beer-Lambert's law theory, instrumentation, single and double and double beam instruments. Step in spectrophotometric measurement. Pharmaceutical applications.

Colorimetric methods: Chemistry of colorimetry, instrumentation, application (direct methods and indirect methods), nephelometry and turbidimetry.

Infra-red spectrophotometry: Theory, mode of vibration, bands of organic functional groups interpretation of infrared absorption spectra, preparation of sample, sample cells, infra-red instrumentation, qualitative and quantitative applications in pharmaceutical analysis.

SECTION-B

Nuclear magnetic resonance spectroscopy: Principles, instrumentation techniques. Shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shifts, deshielding, spin-spin interaction, factors influencing coupling constant 'J'. Spin decoupling. Shift reagents. Applications.

Mass spectrometry: Introduction to mass spectra, molecular ion, isotopic ion peak and their importance, fragmentation peak, mass spectra of some simple compounds.

SECTION-C

Fluorimetric analysis: Theory, quantitative description, experimental factors affecting fluorescence intensity, relationship of fluorescence to molecular structure, instrumentation, interferences, pharmaceutical application.

Flame photometry: Origin of spectra, atomization and ionization, instrumentation, background emission, interference, qualitative and quantitative applications in pharmaceutical analysis.

Atomic absorption and emission spectroscopy: Basic concepts, instrumentation and applications.

PHARMACEUTICAL ANALYSIS-III

4 Hrs/week

Max. Marks: 30

1. Assay of at least 10 official formulation containing single and more active ingredients using instrumental techniques.
2. Study of interpretation of a few spectra.

Books recommended:

1. Chatten L.G. A text book of Pharmaceutical Chemistry Vol. I & II Marcel. Dekkar, New York.
2. Backeet A. H. and Stenlake J.B. Practical Pharmaceutical Chemistry Vol. I & II, The Atholone Press of the University of London.
3. Willard H.H. and Merrit L, Jr and Dean J.A., Instrumental methods of analysis Van Nostrand Renhold, New York.
4. Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekkar Inc. New York, 1970.
5. Parikh V.H. Absorption Spectroscopy of Organic Molecules Addison-Wesley Publishing Co., London 1974.
6. Pharmacopoeia of India, Ministry of Health, Govt. of India.
7. Backeet A.H. and Stenlake J.B. Practical Pharmaceutical Chemistry Vol. I and II The Atholone Press of the University of London.

PHARMACEUTICS-IX (PHARMACEUTICAL TECHNOLOGY-II)

3 Hrs/week

Max. Marks: 45

SECTION-A

Tablets: Types of tablets, formulation, various granulation techniques, tablet making process and tablet cycle, various parts of tablet compression machine, Defects of tablet and various evaluations test of tablets.

Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, introduction to equipments for coating process, evaluation of coated tablet.

Micro-encapsulation: Importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-acervation, multi orifice spray

drying spray congealing, polymerization, air suspension technique, pan coating and other techniques.

SECTION-B

Capsules: Advantages and disadvantages of the capsule as dosage form, Formulation of hard gelatin capsule, size of capsules, method of capsule filling.

Soft gelatin capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsule, quality control and storage of capsule dosage forms.

Parenteral Products

(A) Preformulation factors, routes of administration, water for injection.

(B) Formulation, containers and closures and their selection.

Prefilling treatment, washing of containers and closures. Preparation of solution and suspensions, filling and sealing of ampoules vial, infusion fluids, lyophilization & preparation of sterile powders, evaluation of parenteral products.

SECTION-C

Surgical Products: Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc, bandages, adhesive tape, protective cellulosic hemostastics, official dressing, absorbable and non absorbable sutures, ligatures and catguts.

Packaging of Pharmaceutical Products: Packaging component types. Specifications and methods of evaluation, stability aspects of packing equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

Books recommended:

1. Osol, Remington's Pharmaceutical Sciences, Mack Publishing Company, U.S.A.
2. R.E. Avis, Pharmaceutical Dosage Forms : Parenteral Medication, Vol-I, Marcel Dekkar Inc, New York & Basel.
3. H.C. Ansel, Introduction to dosage forms.
4. R.C. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
5. Herbert A.Liebermann & Leon Lachman, Theory & Practice of Industrial Pharmacy.

PHARMACEUTICS-IX (PHARMACEUTICAL TECHNOLOGY-II)

4 Hrs/week

Max. Marks: 30

1. Experiments to illustrate preparation, stabilization, physical evaluation of pharmaceutical products like powders, capsules, tables, parenterals and microcapsules.
2. Evaluation of Materials used in pharmaceutical packaging.

PHARMACOLOGY-III

3 Hrs/week

Max. Marks: 45

SECTION-A

Pharmacology of endocrine system: Hypothalamic and pituitary hormones. Thyroid hormones and thyroid drugs, parathormone, calcitonin and vitamin D. Insulin, oral hypoglycemic agents and glucagon. Adrenocorticotrophic hormone, corticosteroids, androgens, anabolic steroids, estrogen, progesterone, oral contraceptives and drugs acting on uterus.

SECTION-B

Chemotherapy: General principles of chemotherapy. Sulfonamides, cotrimoxazole, quinolones, penicillins, cephalosporins, chloramphenicol, tetracyclins, macrolides, vancomycin, bacitracin. Chemotherapy of tuberculosis, leprosy, fungal infections and antimalarials.

SECTION-C

General principles of chemotherapy of viral diseases, gonorrhoea, lymphogranuloma venereum, cancer. Immunosuppressants, immunostimulants and helminthiasis.

Books recommended:

1. Barar F.S.K : Text Book of Pharmacology, Interpoint, New Delhi.
2. Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors: - JG Hardman, LeLimbird, PB Molinoss, RW Ruddon & AG Gil, Pergamon, Press.
3. Katzung, B.G. Basic & Clinical Pharmacology, Prentice Hall, International.
4. Laurence, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
5. Rang MP, Dale MM, Riter JM, Pharmacology Churchill lingstone.
6. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
Satoskar & Bhandarkar; Pharmacology & Pharstheropeutics. Popular Prakashan Pvt. Ltd., Bombay.
8. Paul. L., Principles of Pharmacology, Chapman and Hall.

PHARMACOLOGY-III

4 Hrs/week

Max. Marks: 30

1. To calculate the pA₂ value of atropine and chlorpheniramine.
2. Bioassay of acetylcholine, histamine and oxytocin on suitable isolated preparation using matching assay, bracketing assay, three point assay & four point assay.

Books recommended:

1. Ghosh, M.N. Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
2. Grover, J.K., Experiments in Pharmacy & Pharmacology, CBS Publishers, New Delhi.
3. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan Delhi.

PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-II)

3 Hrs/week Max. Marks: 45

SECTION-A

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drug only)

Steroid and related drugs: Introduction, classification, nomenclature and stereochemistry of: Androgens and anabolic steroids (testosterone, stanozolol), estrogens and progestational agents (progesterone, estradiol) and adrenocorticoids (prednisolone, dexamethasone, betamethasone).

SECTION-B

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drug only):

Autocoids

Antihistaminics: H₁-antagonists (Diphenhydramine, mepyramine, promethazine, cyproheptadine, cetirizine) and H₂-antagonists (Ranitidine, famotidine).

Analgesics and antipyretics: Aspirin, mefenamic acid, ibuprofen, diclofenac, piroxicam.

Sulphonamides: Sulfamethoxazole, sulfadiazine, sulfacetamide.

Antibiotics: Penicillins, semi-synthetic penicillins, streptomycin, tetracyclines, cephalosporins, chloramphenicol, fluoroquinolones (Penicillin G, ampicillin, tetracycline)

SECTION-C

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drug only):

Antimycobacterial agents: Ethambutol, *p*-aminosalicylic acid, isoniazid, Dapsone.

Antimalarials: Chloroquine, primaquine, pyrimethamine.

Antiprotozoals: Metronidazole, tinidazole, diloxanide.

Antineoplastics: Chlorambucil, thiopeta, flurourcil, methotrexate, busulphan.

Antiseptics/disinfectants: Benzalkonium, nalidixic acid

Antihelmintics: Mebendazole.

Antifungals: Nystatin, chlorphenesin.

Books recommended:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
3. Delgado JN and Remers W A R, Eds., Wilson And Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, J.Lippincott Co., Philadelphia.
4. Foye WC, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
5. Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Nogrady T, Medicinal Chemistry - A Biochemical Approach, Oxford University Press, New York, Oxford.
7. Finar I L Organic Chemistry, Vol I&II, ELBS/Longman, London.

PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-II)

4 Hrs/week

Max. Marks: 30

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Establishing the pharmaceutical standards of the drugs synthesized.
3. Spectral analysis of the drugs synthesized.

Books recommended:

1. Mann PG & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
2. Furniss B S, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/Longman, London.

PHARMACEUTICAL INDUSTRIAL MANAGEMENT

3 Hrs/week

Max. Marks: 45

SECTION-A

Concept of management: Administrative management (planning, organizing staff directing and controlling), entrepreneurship development, operative management (personnel, material, production, financial, marketing, time/space, margin/morale)

Principles of management: Co-ordination, communication, motivation, decision-making leadership, innovation, creativity, delegation of authority/responsibility. Record keeping, identification of key points to give maximum thrust for development and perfection.

Accountancy: Principles of accountancy, ledger posting and book entries preparation of trial balance, columns of cash, bank reconciliation statement. Rectification of errors, profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques bills of exchange, promissory notes and bundles documentary bills.

SECTION-B

Economics: Principles of economics with special reference to the Laws of demand and supply, demand schedule, demand curves labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

Pharmaceutical marketing: Functions, buying, selling, transportation, storage finance feedback information, channels of distribution, wholesale, retail, department store, multiple shop and mail order business.

Salesmanship: Principles of sales promotion, advertising ethics of sales, merchandising, literature, detailing, Recruitment, training evaluation compensation to the pharmacist.

SECTION-C

Market research: Measuring & forecasting market demand, major concept in demand measurement, estimating current demand, geodemographic analysis. Estimating industry sales. Market share and future demand. Market segmentation and market targeting.

Materials management: A brief exposure of basic principles of management major areas, scope, purchase, store inventory control and evaluation of materials management.

Production management: A brief exposure of the different aspects of production management-visible and invisible inputs, methodology of activities, performance evaluation technique, process-flow, maintenance management.

Books recommended:

1. Market research-Beri-Tata Mc Graw Hill
2. Production and operative management- S. N. Chary/ Tata Mc Graw Hill
3. Material management/A. K. Data/PHI-II Edition
4. The Essence of Management Accounting / Leslie Chadwick/PHI
5. Essentials of Management - IV Edition /L. Joseph Massie/PHI
6. Industrial economics- R.R.Barthwal /New Age International
7. An introduction to industrial management - K. R. Shreenivasan/vikas
8. Salesmanship and publicity-rustam s.davar/vikas.
9. Drug store management/Mohammad Ali. CBS Publishers
10. Pharmaceutical Selling, Sekhar Mukopadhyay. Sterling Publishers

PHARMACEUTICS-X (DOSAGE FORM DESIGN)

3 Hrs/week

Max. Marks: 45

SECTION-A

Preformulation studies: Study of physical properties of drugs like physical form, particle size, shape, density, wetting dielectric constant, solubility dissolution and organoleptic property and their effect on formulation, stability and bioavailability. Study of chemical properties of drugs like hydrolysis, oxidation-reduction, racemisation, polymerization and their influence on formulation and stability of products. Study of prodrug in solving problems related to stability, bioavailability and elegance of formulation

SECTION-B

Performance evaluation methods: *In vitro* dissolution studies for solid dosage forms, methods of interpretation of dissolution data. Bioavailability studies, bioavailability testing protocol and procedures. *In vivo* methods of evaluation and statistical treatment

SECTION-C

Quality assurance and quality control of pharmaceuticals.

New drug delivery system: Transdermal system, formulation of oral and parental prolonged action dosage form. *In vitro* method of evaluation of dosage forms.

Books recommended:

1. Banker G.S. and rhode C.T.Modern Pharmaceutics Marcel Dekkar Inc.N.Y.
2. Bean H.S., Beckett A.H. and careless A.H. Advances in pharmaceutical sciences, Vol. I, II, III & IV, Academic Press London
3. Gibaldi M & Perrier D Pharmacokinetics Marcel Dekkar Inc .N.Y
Remington's the science and practice of pharmacy Mack Publishing Co. Easton Pennysylvannia
4. Lachmen Llieberman H. A. Ang Kanig J. L. The theory and practice of industrial pharamacy, Lea and Febiger, Philadelphia
5. Lea and Fibiger Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics, Philadelphia

PHARMACEUTICS-X (DOSAGE FORM DESIGN)

4 Hrs/week Max. Marks: 30

1. Preformulation studies including drug excipient compatibility studies, effect of stabilizers, preservatives etc. in dosage form design
2. Experiments demonstrating improvement in bioavailability through prodrug concept.
3. Stability evaluation of various dosage forms and their expiration dating
4. Dissolution testing and data evaluation for oral solid dosage forms
5. Evaluation of bioequivalence of some marketed products
6. In vivo bioavailability evaluation from plasma drug concentration and urinary excretion curves
7. Design development and evaluation of controlled release formulations.

Books recommended:

1. Glibaldi M & Perrier D Pharmacokinetics Marcel Dekkar Inc .N.Y
2. Remington's the science and practice of pharmacy Mack Publishing Co. Easton Pennysylvannia
3. Lachmen Lieberman H. A. Ang Kanig J.L. The theory and practice of industrial pharamacy, Lea and Febiger, Philadelphia
4. Lea and Fibiger Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics, Philadelphia

PHARMACOGNOSY-V (NATURAL PRODUCTS)

3 Hrs/week

Max. Marks: 45

SECTION-A

Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation including quantitative microscopy. Chemical and spectral approaches to simple molecules of natural origin. WHO guidelines.

Concept of stereoisomerism taking examples of natural products.

SECTION-B

Chemistry, biogenesis and pharmacological activities of medicinally important monoterpenes, sesquiterpenes, diterpenes and triterpenoids. Chemistry, biogenesis, isolation and extraction and pharmacological activity of:

Carotenoids: b-carotenoids, a-carotene, vitamin A, xanthophylls of medicinal importance.

Glycosides: Digitoxin, digoxin, hecogenin, sennoside, diosgenin and sarsapogenin alkaloids.

Atropine and related compounds: Quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids and medicinally important quassinoids and flavonoids.

SECTION-C

Biosynthesis and therapeutic activity of penicillin, tetracycline and streptomycin.

Natural allergens and photosensitizing agents and fungal toxins. Herbal cosmetics of commercial scales.

Books recommended:

1. I.L. Finar Organic Chemistry Vol. I & II ELBS London.
2. O. P. Agarwal Chemistry of organic natural products Vol. I & II Goel Publication House, Merrut.
3. Trease E. & Evan. W.C. Pharmacognosy Bailleire Tindall East Bourne, UK.
4. Tyler V.E. Etal Pharmacognosy, Lea and Febeger Philadelphia.
5. Sim Medicinal Plant Glycosides.
6. Kokate C. K. Pharmacognosy, Nirali Prakashan, Pune.
7. Pridham J. B.& Swain T. Biosynthetic Pathway higher plants, Academic Press New York.

PHARMACOGNOSY-V (NATURAL PRODUCTS)

4 Hrs/week

Max. Marks: 30

1. Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.
2. Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents.
3. Extraction of volatile oils and their chromatographic profiles.
4. Experiments based on lycopodium spore method.

Books recommended:

1. Brain K.R. & Turner T.D. the practical evaluation of Phytopharmaceutical Wright,Bristol.
2. Sim Medicinal Plant Glycosides.
3. Kokate C.K., Pharmacognosy, Nirali Prakashan, Pune.
4. Stahl E Thin Layer Chromatography, A laboratory hand book , Springer Verlag Berlin.
5. Harborne. J. B. Phytochemical methods Chapman and Hall. International Ed. London.
6. Pharmacopoeia of India 1985.1996.govt of India, Ministry of Health & Family Welfare, New Delhi.

PHARMACOLOGY-IV (CLINICAL PHARMACOLOGY AND TOXICOLOGY)

3 Hrs/week

Max. Marks: 45

SECTION-A

Introduction to clinical pharmacy.

Basic concepts of pharmacotherapy, clinical pharmacokinetics and individualization of drug therapy. Drug delivery systems, their biopharmaceutics and therapeutic considerations. Drug use during infancy and in the elderly (pediatrics & geriatrics). Drug used during pregnancy. Drug induced diseases, the basics of drug interactions, general principles of clinical toxicology. Interpretation of clinical laboratory tests.

SECTION-B

Important disorders of organ systems and their management: Cardiovascular disorders (Hypertension, congestive heart failure, angina, acute myocardial infarction, cardiac arrhythmias), CNS disorders (Epilepsy, parkinsonism, schizophrenia, depression), Respiratory disease (Asthma), Gastrointestinal disorders (Peptic ulcer, ulcerative colitis, hepatitis, cirrhosis), Endocrine disorders (Diabetes mellitus and thyroid disorders).

SECTION-C

Infectious diseases: Tuberculosis, urinary tract infection, enteric infections, upper respiratory infections, haematopoietic disorders (Anemias), joint and connective tissue disorders (Rheumatic diseases, gout and hyperuricemia), neoplastic diseases (Acute leukaemias, Hodgkin's diseases)

Therapeutic drug monitoring.

Toxicology: Definitions, sub disciplines, types and scope of toxicology. Principles of toxicology, inhalation toxicology, cyanide, carbon monoxide, heavy metals, organophosphate poisoning, overdose of narcotics. Concept of essential drugs and rational drug use.

Books recommended:

1. Barar F. S. K. Text book of Pharmacology, Interpoint, New Delhi
2. Goodman and Gilman, The pharmacological basis of therapeutics.
3. Editors:-J.G. Hardman, J.E. Limbird, P.B. Molinoss, R.W. Ruddon & A.G. Gil, Pergamon Press.
4. Katzung, B. G. Basic & clinical Pharmacology, Prentice Hall International, Laurence, Dr & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
5. Rang MP, Dale M.M., Ritter J.M., Pharmacology Churchill Livingstone.
6. Tripathi, K. D. Essentials of Medical Pharmacology and Pharmacotherapeutics. Popular Prakashan Pvt. Ltd. Bombay.
7. Davidson's Principles and Practice of Medicine, ELBS/Churchill Livingstone.
8. Herfindal Etal. Clinical Pharmacy and Therapeutics.

PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY-III)

3 Hrs/week

Max. Marks: 45

SECTION-A

Principles of drug design (Theoretical Aspects): Traditional analogs (QSAR) and mechanism based approaches, introduction to graph theory, application of quantum mechanics, computer aided drug designing (CADD) and molecular modeling.

Drug metabolism and concepts of prodrugs, soft drugs, stereochemical aspects of drug-receptor interactions.

SECTION-B

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only):

Cardiovascular agents, antianginal, vasodilators, antiarrhythmics, antihypertensives, anticoagulants, antihyperlipidemics, cardiotonics (Nifedipine, procainamide, propranolol, atenolol, methyldopa, guanetidine, captopril, pentolamine, clofibrate, warfarin, phenidione).

Diuretics: Acetazolamide, chlorthiazide, furosemide, triamterene, spironolactone.

SECTION-C

Anti-HIV agents: Zidovudine, zalcitabine, saquinavir.

Antivirals: Amantadine, acyclovir, lamivudine.

Prostaglandins: Misoprostol, carboprost.

Diagnostic agents: Lipoic acid.

Thyroid and antithyroids: Carbimazole.

Insulin and oral hypoglycaemics: Chlorpropamide, metformin, tolbutamide, glibenclamide.

Books recommended:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Wolff ME Ed Burger's Medicinal Chemistry, John Wiley and Sons, New York.
3. Delgado JN and Remers War, Eds, Wilson and Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
4. Foye WC, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
5. Singh Harkrishan and Kapoor, V.K. Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY-III)

4 Hrs/week

Max. Marks: 30

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeial standards of the drugs synthesized.
3. Exercises based of QSAR: Hansch & Free-Wilson methods
4. Determination of partition, coefficient, dissociation constant and molar refractivity of compounds for QSAR analysis.

Books recommended:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Wolff ME, Ed. Burger's Medicinal Chemistry. John Wiley & Sons, New York.
3. Delagado J N and Remers W A R, Eds; Wilson and Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, J.Lippincott Co; Philadelphia.
4. Foye W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
5. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

PHARMACEUTICAL BIOTECHNOLOGY

3 Hrs/week

Max. Marks: 45

SECTION-A

Immunology and immunological preparations: Principles of immunology, antigens, antigen-antibody reactions and their applications, immune system and immune responses.

Genetics: Structure, function and replication of DNA, mutation, transmission of genetic material, application of genetic engineering and pharmaceutical field, its present status and future prospectus, recombinant DNA technology.

SECTION-B

Industrial biotechnology: Fermentative production of penicillin, semi synthetic penicillin, streptomycin, riboflavin, ascorbic acid, amylase, lysine, glutamic acid.

Hybridoma technology: Production and application of monoclonal antibodies.

SECTION-C

Microbial transformation: Introduction, types of reactions mediated by microorganisms, design of biotransformation process, selection of organisms, biotransformation process and its improvements with special reference to steroids.

Enzyme immobilization: Techniques of immobilization of enzymes, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, penicillinase, streptokinase and proteases immobilization of bacteria and plant cells.

Books recommended:

1. S. P. Vyas and V. K. Dixit, Pharmaceutical Biotechnology.
2. Prescott and Dunn's Industrial Microbiology IV Ed. 1987 CBS Publishers and Distributors, Delhi.
3. P. F. Stanbury & A. Ahhtar Principles of Fermentation Technology.
4. K. Kieslich Ed. Biotechnology Vol. 69 Verlag Chemie Switzerland 1984.
5. P. F. Standury & A. Whitaker Principles of Fermentation Technology Fergmon Press Oxford, 1987.

Modern Pharmaceutical Analytical Techniques

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Significance of Pharmaceutical Analysis in the profession.

Various tools and techniques available for the analysis of drugs.

Principles of various conventional analytical techniques.

Application of Pharmacopoeial purity and identity tests for samples.

Interpretation of spectra and correlation with sample.

SECTION-A

UV-visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV Visible spectroscopy.

Infra-red spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy.

Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy.

SECTION-B

Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy

Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Affinity chromatography

Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing

SECTION-C

X-ray crystallography: Production of X rays, Different X ray diffraction methods, Bragg's law, Rotating crystal technique, X-ray powder technique, Types of crystals and applications of X-ray diffraction.

Immunological assays: RIA (Radio immuno assay), ELISA, Bioluminescence assays.

Potentiometry: Principle, working, Ion selective electrodes and application of potentiometry.

Thermal techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications.

Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). **TGA:** Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

Books recommended:

1. Silverstein, R.M. (2004). *Spectrometric Identification of Organic compounds*, 6th Ed., John Wiley & Sons.
2. Skoog, D.A, Holler, F.J., Nieman, T.A. (1998). *Principles of Instrumental Analysis*, 5th Ed., Bangalore: Eastern press, Bangalore.
3. Beckett, A.H., Stenlake, J.B. (1987). *Practical Pharmaceutical Chemistry*, 4th Ed., New Delhi: CBS publishers.
4. Kemp, W. (1991). *Organic Spectroscopy*, 3rd Ed., ELBS.
5. Sethi, P.D. (1987). *Quantitative Analysis of Drugs in Pharmaceutical formulation*, 3rd Ed., New Delhi: CBS Publishers.
6. Munson, J.W. (2012). *Pharmaceutical Analysis- Modern methods – Part B*, Informa Health care Publishers.

Suggested e-material:

<http://www.sciencedirect.com/science/book/9780123869845> (Infrared and Raman spectroscopy Larkin, Peter)

<http://www.sciencedirect.com/science/book/9780124115897> (Solving problems with NMR spectroscopy Atta-ur-Rahman, Muhammad Iqbal)

<http://lib.myilibrary.com/?id=543351> (Quantum Chemistry and Spectroscopy: Pearson New International Edition Engel, Thomas)

Chemistry of Natural Products

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

The role and applicability of lead molecules of natural origin in the field of drug research

Isolation, purification and characterization of medicinal compounds from natural origin.

Application of rDNA technology in the field of drug discovery.

Types and uses of various reagents and reactions involved in the structural elucidation of natural compounds.

SECTION-A

Study of natural products as leads for new pharmaceuticals for the following class of drugs:

- Drugs Affecting the Central Nervous System: Morphine Alkaloids
- Anticancer Drugs: Paclitaxel and Docetaxel, Etoposide, and Teniposide
- Cardiovascular Drugs: Lovastatin, Teprotide and Dicoumarol
- Neuromuscular Blocking Drugs: Curare alkaloids
- Anti-malarial drugs and Analogues
- Chemistry of macrolid antibiotics (Erythromycin, Azithromycin, Roxithromycin, and Clarithromycin) and β - Lactam antibiotics (Cephalosporins and Carbapenem)

Active constituent of certain crude drugs used in Indigenous system: Diabetic therapy – *Gymnema sylvestre*, *Salacia reticulata*, *Pterocarpus marsupium*, *Swertia chirata*, *Trigonella foenum graecum*; Liver dysfunction – *Phyllanthus niruri*; Antitumor – *Curcuma longa* Linn.

SECTION-B

Alkaloids: General introduction, classification, isolation, purification, molecular modification and biological activity of alkaloids, general methods of structural determination of alkaloids, structural elucidation and stereochemistry of ephedrine, morphine, ergot, emetine and reserpine.

Flavonoids: Introduction, isolation and purification of flavonoids, General methods of structural determination of flavonoids; Structural elucidation of quercetin.

Steroids: General introduction, chemistry of sterols, sapogenin and cardiac glycosides. Stereochemistry and nomenclature of steroids, chemistry of contraceptive agents male & female sex hormones (Testosterone, Estradiol, Progesterone), adrenocorticoids (Cortisone), contraceptive agents and steroids (Vit – D).

SECTION-C

Terpenoids: Classification, isolation, isoprene rule and general methods of structural elucidation of Terpenoids; Structural elucidation of drugs belonging to mono (citral, menthol, camphor), di (retinol, Phytol, taxol) and tri terpenoids (Squalene, Ginsenoside) carotinoids (β carotene).

Vitamins: Chemistry and Physiological significance of Vitamin A, B1, B2, B12, C, E, Folic acid and Niacin.

Recombinant DNA technology and drug discovery rDNA technology, hybridoma technology, New pharmaceuticals derived from biotechnology; Oligonucleotide therapy. Gene therapy: Introduction, Clinical application and recent advances in gene therapy, principles of RNA & DNA estimation.

Structural characterization of natural compounds: using IR, ^1H -NMR, ^{13}C -NMR and MS spectroscopy of specific drugs e.g., Penicillin, Morphine, Camphor, Vit-D, Quercetin and Digitalis glycosides.

Books recommended:

- Peech, Tracey, M.V. (1955). *Modern Methods of Plant Analysis*, 1st Ed., Springer-Verlag- Berlin- Heidelberg.
- Runeckles, V.C. (1975). *Recent advances in Phytochemistry*, vol I-IV, Springer Science & Business Media
- Nakanishi, G. Goto, T. Natori, S. (1984). *Natural Product Chemistry, California: University Science Books.*
- IKan, R. (2014). *Natural Product: A laboratory guide*, 2nd Ed., Academic Press.
- Manske, R.H.F. (1965). *The Alkaloids :Chemistry and Physiology*, vol 5, 1st Ed., Academic Press.
- Wells, C.H.J. (1972). *Introduction to molecular Phytochemistry*, Chapman and Hall.
- Chatwal, G.R. (2015). *Organic Chemistry of Natural Products*, vol I-II, 4th Ed., Himalaya Publishing House.
- Agarwal, O.P. (2019). *Organic Chemistry of Natural Products*, vol I-II, 4th Ed., Krishan Prakashan media.
- Finar, I.L. (2011). *Organic Chemistry*, ELBS, Pearson Education Lts, vol I-II, Dorling Kindersley.
- Gupta, P.K. (2005). *Elements of Biotechnology*, Rastogi Publishers.
- Vyas, S.P. Dixit, V.K. (2012). *Pharmaceutical Biotechnology*, CBS Publishers.
- Purohit, Mathur, (2009). *Biotechnology*, 13th Ed., Agro-Bios.

Suggested e-material:

- Wiert, Christophe: Lead compounds from medicinal plants for the treatment of neurodegenerative diseases: (<http://www.sciencedirect.com/science/book/9780123983732>)
- medicinal chemistry of bioactive natural products - Koissk: (<https://www.pdfdrive.com/medicinal-chemistry-of-bioactive-natural-products-koissk-e8027117.html>)
- <https://www.pdfdrive.com/pharmaceutical-biotechnology-concepts-and-applications-d38535075.html>

Advanced Medicinal Chemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Various aspects of drug designing and methods for their analysis.

Factor to design new drug against particular biochemical.

Characterization and interpretation of data

SECTION-A

Drug discovery: Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets.

Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonists vs antagonists.

Stereochemistry and drug action: Realization that stereo selectivity is a pre-requisite for evolution. Role of chirality in selective and specific therapeutic agents. Case studies, Enantio selectivity in drug adsorption, metabolism, distribution and elimination.

Analog Design: Introduction, Classical & Non classical, Bioisosteric replacement strategies, rigid analogs, alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance.

SECTION-B

Drug biotransformation: Drug biotransformation and its role in development of new drug molecules.

Prodrug design: Basic concept, Carrier linked prodrugs/ Bioprecursors, Prodrugs of functional group, Prodrugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design.

Enzyme Inhibitors: Rational design of enzyme inhibitors, enzyme kinetics & principles of enzyme inhibitors, enzyme inhibitors in medicine, enzyme inhibitors in basic research, rational design of non-covalently and covalently binding enzyme inhibitors.

SECTION-C

An overview of target discovery and validation.

Combating drug resistance: Causes for drug resistance, strategies to combat drug resistance in antibiotics and anticancer therapy, Genetic principles of drug resistance.

Peptidomimetics: Therapeutic values of Peptidomimetics, design of peptidomimetics by manipulation of the amino acids, modification of the peptide backbone, incorporating conformational constraints locally or globally.

Computational prediction of protein structure: Threading and homology modeling methods. Application of NMR and X-ray crystallography in protein structure prediction

Books recommended:

Beale, J.M. (2010). Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th Ed., New Delhi: Lppincott Williams & Wilkins, Wolter Kluwer Pvt. Ltd.

Corwin, H., Samuel, C. Rotella, D. Ward, S. (2017). Comprehensive Medicinal Chemistry, 3rd Ed., Elsevier.

Martin, Y.C. (2010). Quantitative Drug Design: A critical Introduction, 3rd Ed., CRC Press.

Lemke, T.S. Williams, D.A. Roche, V.F. Zito, S.W. (2013). Foye's Principles of Medicinal Chemistry, 7th Ed., New Delhi: Lippincott Williams & Wilkins.

Arienes, E.J. (1975). Drug Design, 1st Ed., Academic Press.

Smith, W. (2005). Introduction to the Principles of Drug Design and Action, 4th Ed., CRC Press.

Silverman, R.B. (2012). The Organic Chemistry of the Drug Design and Drug action, 2nd edition, Elsevier.

Patrick, G.L. (1995). An Introduction to Medicinal Chemistry, 1st Ed., Oxford University Press.

Brahmankar, D.M. Jaiswal, S.B. (2014). Biopharmaceutics and pharmacokinetics, 2nd Ed., New Delhi: Vallabh Prakashan.

Guarna, A. Trabocchi, A. (2014). Peptidomimetics in Organic and Medicinal Chemistry, 1st Ed., New York: Wiley.

Advanced Organic Chemistry-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Basic reaction mechanisms involved in an organic synthesis.

Design organic synthesis by using different techniques in the field of drug discovery and process chemistry.

SECTION-A

Basic aspects of organic chemistry: Organic intermediates: Carbocations, carbanions, free radicals, carbenes and nitrenes. Their method of formation, stability and synthetic applications. Types of reaction mechanisms and methods of determining them, Detailed knowledge regarding the reactions, mechanisms and their relative reactivity and orientations.

Addition reactions: Nucleophilic uni- and bimolecular reactions (SN1 and SN2), Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule), Rearrangement reaction

Study of mechanism and synthetic applications of following named reactions: Ugi reaction, Brook rearrangement, Ullmann coupling reactions, Dieckmann Reaction, Doebner-Miller Reaction, Sandmeyer Reaction, Mitsunobu reaction, Mannich reaction, Vilsmeier-Haack Reaction, Sharpless asymmetric epoxidation, Baeyer-Villiger oxidation, Shapiro & Suzuki reaction, Ozonolysis and Michael addition reaction

SECTION-B

Synthetic reagents & applications: Aluminium isopropoxide, N-bromosuccinamide, diazomethane, dicyclohexylcarbodiimide, Wilkinson reagent, Wittig reagent. Osmium tetroxide, titanium chloride, diazopropane, diethyl azodicarboxylate, Triphenylphosphine, (Benzotriazol-1-yloxy)tris(dimethylamino)phosphonium hexafluorophosphate (BOP).

Protecting groups: Role of protection in organic synthesis, protection for the hydroxyl group, including 1,2- and 1,3-diols, ethers, esters, carbonates, cyclic acetals & ketals. Protection for the carbonyl group, acetals and ketals. Protection for the carboxyl group, esters and hydrazides. Protection for the amino group and amino acids, carbamates and amides.

Synthon approach and retrosynthesis applications: Basic principles, terminologies and advantages of retrosynthesis; guidelines for dissection of molecules. Functional group interconversion and addition (FGI and FGA). C X disconnections; C C disconnections – alcohols and carbonyl compounds; 1,2 , 1,3 , 1,4 , 1,5 , 1,6 difunctionalized compounds. Strategies for synthesis of three, four, five and six membered ring.

SECTION-C

Heterocyclic Chemistry: Organic Name reactions with their respective mechanism and application involved in synthesis of drugs containing five, six membered and fused heterocyclics such as Debus-Radziszewski imidazole synthesis, Knorr Pyrazole Synthesis Pinner Pyrimidine Synthesis, Combes Quinoline Synthesis, Berntsen Acridine Synthesis, Smiles rearrangement and Traube purine synthesis.

Synthesis of few representative drugs containing these heterocyclic nucleus such as Ketoconazole, Metronidazole, Miconazole, celecoxib, antipyrin, Metamizole sodium, Terconazole, Alprazolam, Triamterene,

Sulfamerazine, Trimethoprim, Hydroxychloroquine, Quinine, Chloroquine, Quinacrine, Amsacrine, Prochlorperazine, Promazine, Chlorpromazine, Theophylline, Mercaptopurine and Thioguanine.

Books recommended:

Smith, M.B. (2013). *Jerry March's Advanced Organic chemistry: Reaction, Mechanisms and Structure*, 7th Ed., New York: John Wiley and Sons.

Gould, E.S., Rinchart, H. W. (1959). *Mechanism and Structure in Organic Chemistry*, New York: Holt, Rinehart and Winston.

Clayden, Greeves, Warren, Wothers. (2001). *Organic Chemistry*, 2nd Ed., Oxford University Press.

Finar, I.L. (2011). *Organic Chemistry*, India: ELBS, Pearson Education Ltd, Dorling Kindersley (India) Pvt. Ltd.

Peter, Skyes. (2011). *A guide to mechanisms in Organic Chemistry*, 6th Ed., New Delhi: Orient Longman.

Wilson, S.R. Czarnik, A.W. (1997). *Combinational Chemistry: Synthesis and applications*: Wiley– Blackwell.

Carey, F.A. Sundberg, R.A. (2007). *Advanced Organic Chemistry*, 5th Ed., Springer.

Warren, S. Waytt, P. (2008). *Organic Synthesis: The Disconnection Approach*, 2nd Ed., Wiley.

Norman, R.O.C. Coxan, J.M. Thorns, N. (1993). *Principles of Organic Synthesis*, 3rd Ed., Nelson Thornes Ltd.

Ahluwalia, V.K. Agarwal, R. (2001). *Organic Synthesis: Special Techniques*, 3rd Ed., New Delhi: Narosa Publishers.

Ahluwalia, V.K. Parashar, R.K. (2007). *Organic Reaction Mechanisms*, 4th Ed., New Delhi: Narosa Publishers.

Suggested e-material:

1. Singh, Maya Shankar: Advanced Organic Chemistry : Reactions and Mechanisms:
<http://lib.myilibrary.com?id=475867>

2 Bruice, Paula Y: Organic Chemistry: Pearson New International Edition:
<http://lib.myilibrary.com?id=527161>

<https://www.organic-chemistry.org>

<https://www.masterorganicchemistry.com/resource-guide>

<https://www.organicdivision.org/links/>

Pharmaceutical Chemistry Lab-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning outcomes

Upon completion of this course student will have an understanding of:

handling various equipments

performing the synthesis of drugs

extraction techniques used in various natural resources

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer, RNA & DNA estimation
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on Column chromatography
4. Experiments based on HPLC
5. Experiments based on Gas Chromatography
6. Estimation of riboflavin/quinine sulphate by fluorimetry
7. Estimation of sodium/potassium by flame photometry

To perform the following reactions of synthetic importance

1. Purification of organic solvents, column chromatography
2. Claisen-schmidt reaction.
3. Benzyllic acid rearrangement.
4. Beckmann rearrangement.
5. Hoffmann rearrangement
6. Mannich reaction
7. Synthesis of medicinally important compounds involving more than one step along with purification and Characterization using TLC, melting point and IR spectroscopy (4 experiments)
8. Estimation of elements and functional groups in organic natural compounds.
9. Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis, co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data.
10. Some typical degradation reactions to be carried on selected plant constituents

Advanced Spectral Analysis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

various hyphenated analytical instrumental techniques

Different analytical data from different principle instrument.

Interpretation skills of different analytical data like LC-MS, GC-MS, ATR-IR, DSC etc. theoretically and practically.

Handling of different analytical data to predict the unknown structures.

SECTION-A

UV spectroscopy: Wood ward – Fieser rule for 1,3- butadienes, cyclic dienes and α, β -carbonyl compounds and interpretation compounds of enones.

IR spectroscopy: ATR-IR, IR Interpretation of organic compounds.

NMR spectroscopy: 1-D and 2-D NMR, NOESY and COSY, HECTOR, INADEQUATE techniques, Interpretation of organic compounds.

SECTION-B

Mass spectroscopy: Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Mc Lafferty rearrangement, ring rule, interpretation of organic compounds.

Chromatography: Principle, instrumentation and applications of the following:

- a) GC-MS
- b) GC-AAS
- c) LC-MS
- d) LC-FTIR
- e) LC-NMR
- f) CEMS (Capillary Electrophoresis-Mass Spectrometry)
- g) High performance thin layer chromatography
- h) Super critical fluid chromatography
- i) Ion chromatography
- j) I-EC (Ion-Exclusion Chromatography)
- k) Flash chromatography

SECTION-C

Microscopy: Introduction, principle, instrumentation and applications of light, phase contrast, fluorescence, confocal and electron (SEM & TEM) microscopy.

Small angle X-ray scattering (SAXS): Introduction, principle, instrumentation, applications.

Raman spectroscopy: Introduction, principle, instrumentation and applications.

Books recommended:

Silverstein, R.M. (2004). *Spectrometric Identification of Organic compounds*, John Wiley & Sons.

Doglas, A. Skoog, F.J. (1998). *Principles of Instrumental Analysis*, Bangalore: Eastern press.

Willards, (2004). *Instrumental methods of analysis*, CBS publishers.

William, K. (1991). *Organic Spectroscopy*, ELBS.

Sethi, P.D. (1997). *Quantitative Analysis of Drugs in Pharmaceutical formulation*, New Delhi: CBS Publishers.

Munson, J.W. (1981). *Pharmaceutical Analysis- Modern methods – Part B*, Marcel Dekker.

Suggested e-material:

<http://www.sciencedirect.com/science/book/9780123869845> (Infrared and Raman spectroscopy Larkin, Peter)

<http://www.sciencedirect.com/science/book/9780124115897> (Solving problems with NMR spectroscopy Atta-ur-Rahman, Muhammad Iqbal)

<http://lib.myilibrary.com/?id=543351> (Quantum Chemistry and Spectroscopy: Pearson New International Edition Engel, Thomas)

Intellectual Property Rights

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Patent and copyright for innovative works.

Selected IP issues that might arise in practice.

Federal and state IP protection.

Tools and activities of IP practitioners such as the Copyright, Patent, and Trademark websites, searching, reading patents, and more.

SECTION-A

Intellectual property rights (IPR): Definition, scope, objectives, Concepts and fundamentals: intellectual property (IP), intellectual property protection (IPP) and intellectual property rights (IPR); economic importance, mechanism for protection of intellectual property.

Patents: Criteria for patentability, Indian patent act. 1970, filing of a patent application, precautions before patenting-disclosures/non-disclosures, publication-article/ thesis, prior art search – published patents search, internet search patent sites, specialized service search requests, costs, patent application forms and guidelines, fee structure, time frames, jurisdiction aspects, types of patent application- provisional, non-provisional, PCT and convention patent applications, international patenting requirement procedures and costs.

Patent infringement: Meaning, scope, litigation, drug related patents infringements, case studies and examples, patenting by research students.

SECTION-B

Copyright, Trademarks: (Introduction, meaning of trademark, criteria for eligibility, filling application for trademark registration).

Trade secrets: Scope modalities and protection case studies. Role of IP in pharmaceutical industry.

Trade related aspects of intellectual property rights: Intellectual property and international trade, concept behind WTO (World Trade Organization), WIPO (World Intellectual Property Organization), GATT (General Agreement on Tariff and Trade), TRIMS (Trade Related Investment Measures) and GATS (General Agreement on Trades in Services).

WTO-objectives, scope, functions, structure, status, membership and withdrawal, dispute settlement, impact on globalization

SECTION-C

Technology development/transfercommercialization related aspects: Meaning, drug related technology development, bioequivalence (BE), scale-up, semi-commercialization and commercialization– practical aspects and problems, significance of transfer of technology (TOT), bottlenecks, managing technology transfer, guidelines for

research students, scientists and related personnel, TOT agencies in India APCTD, NRDC, TIFAC, IBCIL, TBSE/SIDBI.

TOT related documentation: Confidentiality agreements, licensing, MOUs, legal issues, compulsory licensing and issuing of access to medicines, DOHA declaration.

Related quality systems: Objectives and brief review of US-FDA, UK-MCA, and TGA guidelines.

Standard institutes and certification agencieslike: ISI, BSS, ASTM.

Books recommended:

1. Treece, D.J. (2003). Managing Intellectual Capital: Organizational, Strategic and Policy Dimension. London: Oxford University Press.
2. Wadedhra, B.L. (2004). Law Relating to Patents, Trademarks, Copyright Design and Geographical Indications. New Delhi: Universal Law Publishing.
3. Bansal, P. (2008) IPR Handbook for Pharma Students and Researchers. Hyderabad: Pharma Book Syndicate.
4. Trivedi, P.R. (2008). Encyclopedia of Intellectual Property Rights. New Delhi: Jnanada Prakashan.
5. Willig, S.H. (1982). Good Manufacturing Practices for Pharmaceuticals. vol 78, New York: Marcel Dekker,.
6. Das, P., Das, G. (2008). Protection of Industrial Property Rights Kolkata: Kamal Law House.
7. Katju, S.N. (2002). Law and Drugs. Delhi: Delhi Law House.

Suggested e-material

1. Copyright Protection in India [<http://copyright.gov.in>].
2. Information on orange book [www.fda.gov/cder/ob/default.htm].
3. World Trade Organization [www.wto.org].

Advance Organic Chemistry-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Nomenclature, reaction mechanism, kinetics, order of reaction, factors affecting reaction, name reactions of alkanes, alkenes, conjugated dienes, alkyl halides, alcohols, carbonyl compounds, carboxylic acids and aliphatic amines.

SECTION-A

Green Chemistry: Introduction, principles of green chemistry

Microwave assisted reactions: Merit and demerits of its use, increased reaction rates, mechanism, superheating effects of microwave, effects of solvents in microwave assisted synthesis, microwave technology in process optimization, its applications in various organic reactions and heterocycles synthesis

Ultrasound assisted reactions: Types of sonochemical reactions, homogenous, heterogeneous liquid-liquid and liquid-solid reactions, synthetic applications.

Continuous flow reactors: Working principle, advantages and synthetic applications.

SECTION-B

Chemistry of peptides: Coupling reactions in peptide synthesis, Principles of solid phase peptide synthesis, t-BOC and Fmoc protocols, various solid supports and linkers, Activation procedures, peptide bond formation, deprotection and cleavage from resin, low and high HF cleavage protocols, formation of free peptides and peptide amides, purification and case studies, site-specific chemical modifications of peptides. Segment and sequential strategies for solution phase peptide synthesis with any two case studies.

Side reactions in peptide synthesis: Deletion peptides, side reactions initiated by proton abstraction, protonation, over activation and side reactions of individual amino acids.

Photochemical reactions: Basic principles of photochemical reactions. Photo-oxidation, photo-addition and photo-fragmentation.

Pericyclic reactions: Mechanism, Types of pericyclic reactions such as cyclo addition, electrocyclic reaction and sigmatropic rearrangement reactions with examples

SECTION-C

Catalysis: Types of catalysis, heterogeneous and homogenous catalysis, advantages and disadvantages. Heterogeneous catalysis – preparation, characterization, kinetics, supported catalysts, catalyst deactivation and regeneration, some examples of heterogeneous catalysis used in synthesis of drugs. Homogenous catalysis, hydrogenation, hydroformylation, hydrocyanation, Wilkinson catalysts, chiral ligands and chiral induction, Ziegler Natta catalysts, some examples of homogenous catalysis used in synthesis of drugs.

Transition-metal and Organo-catalysis in organic synthesis: Metal-catalyzed reactions.

Biocatalysis: Use of enzymes in organic synthesis, immobilized enzymes/cells in organic reaction.

Phase transfer catalysis: Theory and applications

Stereochemistry & asymmetric synthesis: Basic concepts in stereochemistry – optical activity, specific rotation, racemates and resolution of racemates, the Cahn, Ingold, Prelog (CIP) sequence rule, meso compounds, pseudo asymmetric centres, axes of symmetry, Fischers D and L notation, cis-trans isomerism, E and Z notation. Methods of asymmetric synthesis using chiral pool, chiral auxiliaries and catalytic asymmetric synthesis, enantiopure separation and Stereo selective synthesis with examples.

Books recommended:

March, J. (2013). *Advanced Organic chemistry, Reaction, mechanisms and structure*, 7th Ed., New York: John Wiley and sons.

Gould, E.S. (1962). *Mechanism and structure in organic chemistry*, 1st Ed., New York: Rinchart and Winston.

Clayden, J. Warren, S. (2001). *Organic Chemistry*, 2nd Ed., Oxford University Press.

Finar, I.L. (1995). *Organic Chemistry*, 6th Ed., London: Pearson Education

Francis, A. Richaard, A. (2007). *Organic chemistry*, 5th Ed., Springer.

Warren, S. (2008). *Organic synthesis-the disconnection approach* 2nd Ed., New York: Wiley.

Suggested e-material:

<http://www.sciencedirect.com/science/book/9781890661403>

(Organic Synthesis by Michael Smith)

<http://www.sciencedirect.com/science/book/9780124114753> (Writing reaction mechanisms in organic chemistry by Kenneth Savin)

Computer Aided Drug Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

- Different CADD techniques and their applications in drug discovery.
- Use of software in identifying drug receptor interactions and pharmacophore mapping.
- Applicability of *in silico* virtual screening protocols in drug research.

Section A

Introduction to Computer Aided Drug Design (CADD): History, different techniques and applications.

Quantitative Structure Activity Relationships: Basics

History and development of QSAR: Physicochemical parameters and methods to calculate physicochemical parameters: Hammett equation and electronic parameters (sigma), lipophilicity effects and parameters (log P, pi-substituent constant), steric effects (Taft steric and MR parameters) Experimental and theoretical approaches for the determination of these physicochemical parameters.

Section B

Quantitative Structure Activity Relationships: Applications Hansch analysis, Free Wilson analysis and relationship between them, Advantages and disadvantages; Deriving 2D-QSAR equations. 3D-QSAR approaches and contour map analysis. Statistical methods used in QSAR analysis and importance of statistical parameters.

Molecular Modeling and Docking:

- a) Molecular and Quantum Mechanics in drug design.
- b) Energy Minimization Methods: comparison between global minimum conformation and bioactive conformation
- c) Molecular docking and drug receptor interactions: Rigid docking, flexible docking and extra-precision docking. Agents acting on enzymes such as DHFR, HMG-CoA reductase and HIV protease, choline esterase (AChE & BchE).

Section C

Molecular Properties and Drug Design:

- a) Prediction and analysis of ADMET properties of new molecules and its importance in drug design.
- b) De novo drug design: Receptor/enzyme-interaction and its analysis, Receptor/enzyme cavity size prediction, predicting the functional components of cavities, Fragment based drug design.
- c) Homology modeling and generation of 3D-structure of protein.

Pharmacophore Mapping and Virtual Screening: Concept of pharmacophore, pharmacophore mapping, identification of Pharmacophore features and Pharmacophore modeling; Conformational search used in pharmacophore mapping.

In Silico Drug Design and Virtual Screening Techniques Similarity based methods and Pharmacophore based screening, structure based In-silico virtual screening protocols.

Books recommended:

Robert, M. (2007). *Computational and structural approaches to drug discovery*, 1st Ed., Italy: RCS Publishers.

Martin, Y.C. (2010). *Introduction to Quantitative Drug Design*, 2nd Ed., New York: CRC Press, Taylor & Francis group.

Ariens (1975). *Drug Design*, Academic Press, Elsevier Publishers, 1975.

Smith, H.J., Williams, H. (2005). *Smith Principles of Drug Design*. CRC Press, Taylor & Francis.

Silverman, R.B. (2010). *The Organic Chemistry of the Drug Design and Drug action*, United States: Elsevier Publishers.

Abraham, D.J., Rotella, D.P (2010). *Burger's Medicinal Chemistry*, 7th Ed., England: Wiley Publishing Co.

Patrick, G.L. (1995). *An Introduction to Medicinal Chemistry*, Oxford University Press.

Gisvold's, W. (2004). *Text book of Organic Medicinal and Pharmaceutical Chemistry*, 11th Ed., Lippincott Williams & Wilkins.

Suggested e-material:

<https://www.pdfdrive.com/computational-methods-in-drug-discovery-e24068030.html>

<https://www.pdfdrive.com/textbook-of-drug-design-and-discovery-d33454550.html>

<https://www.pdfdrive.com/drug-design-and-discovery-methods-and-protocols-methods-in-e36557495.html>

Pharmaceutical Process Chemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Synthetic strategy used in process chemistry for scaling up of API from a small scale to a larger scale.

The role of a process chemist in developing synthetic routes that is safe, cost-effective, environmentally friendly and efficient.

SECTION-A

Process chemistry: Introduction, Synthetic strategy Stages of scale up process: Bench, pilot and large scale process. In-process control and validation of large scale process. Case studies of some scale up process of APIs. Impurities in API, types and their sources including genotoxic Impurities

Unit operations: Extraction, Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction. Filtration, theory of filtration, pressure and vacuum filtration, centrifugal filtration. Distillation, azeotropic and steam distillation. Evaporation, Types of evaporators, factors affecting evaporation. Crystallization, crystallization from aqueous, nonaqueous solutions factors affecting crystallization, nucleation. Principle and general methods of Preparation of polymorphs, hydrates, solvates and amorphous APIs.

SECTION-B

Nitration: Nitrating agents, Aromatic nitration, kinetics and mechanism of aromatic nitration, process equipment for technical nitration, mixed acid for nitration.

Halogenation: Kinetics of halogenations, types of halogenations, catalytic halogenations. Case study on industrial halogenation process.

Oxidation: Introduction, types of oxidative reactions, Liquid phase oxidation with oxidizing agents. Nonmetallic Oxidizing agents such as H₂O₂, sodium hypochlorite, Oxygen gas, ozonolysis.

Reduction: Catalytic hydrogenation, Heterogeneous and homogeneous catalyst; Hydrogen transfer reactions, Metal hydrides. Case study on industrial reduction process.

SECTION-C

Fermentation: Aerobic and anaerobic fermentation. Production of Antibiotics; Penicillin and Streptomycin.

Vitamins: B2 and B12

Statins: Lovastatin, Simvastatin

Reaction progress kinetic analysis: Streamlining reaction steps, route selection,

Characteristics of expedient routes, characteristics of cost-effective routes, reagent selection, families of reagents useful for scale-up.

Industrial Safety: MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal Protection Equipment (PPE), Fire hazards, types of fire & fire extinguishers, Occupational Health & Safety Assessment Series 1800, (OHSAS-1800) and ISO-14001(Environmental Management System), Effluents and its management.

Books recommended:

Gadamasetti, K. (2004). *Process Chemistry in the Pharmaceutical Industry: Challenges in an Ever-Changing Climate-An Overview*, CRC Press.

Burger (2003). *Medicinal Chemistry*, John Wiley & Sons.

McCabe, W.L. Smith, J.C. Harriott, P. (2004). *Unit operations of chemical engineering*, McGraw Hill.

Brittain, H.G. (1999). *Polymorphism in Pharmaceutical Solids*, Marcel Dekker series.

Regina, M. Murphy, (2005). *Introduction to Chemical Processes: Principles, Analysis, Synthesis*, Mc Grawhil Publication.

Harrington, P.J. (2011). *Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up*. Wiley Publisher.

Groggins, P.H. (1938). *Unit processes in organic synthesis*, Mc Grawhil.

Hanglein, F.A. (2013). *Chemical Technology*, Pergamon Publisher.

Gopal, M. (2006). *Dryden's Outlines of Chemical Technology*, WEP East-West Press.

Mattson, C. (1978). *Principle of Industrial Chemistry*, Wiley Publishing Co.

Suggested e-material

<http://lib.myilibrary.com?id=527416> (Geankoplis, Christie John : Transport Processes and Separation Process Principles)

<http://lib.myilibrary.com?id=267515> (Wankat : Separation Process Engineering)

<http://lib.myilibrary.com?id=267500> (Crowl; Louvar: Chemical Process Safety: Fundamentals with Applications)

<http://www.sciencedirect.com/science/book/9780124114753> (Savin, Kenneth: Writing reaction mechanisms in organic chemistry).

Pharmaceutical Chemistry Lab-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning outcomes

Upon completion of this course student will have an understanding of:

various organic reactions

spectral analysis

handling of various analytical instruments

calibration of instruments

computational software

1. Synthesis of organic compounds by adapting different approaches involving (3 experiments) a) Oxidation b) Reduction/hydrogenation c) Nitration
2. Comparative study of synthesis of APIs/intermediates by different synthetic routes (2 experiments)
3. Assignments on regulatory requirements in API (2 experiments)
4. Comparison of absorption spectra by UV and Wood ward – Fieser rule
5. Interpretation of organic compounds by FT-IR
6. Interpretation of organic compounds by NMR
7. Interpretation of organic compounds by MS
8. Determination of purity by DSC in pharmaceuticals
9. Identification of organic compounds using FT-IR, NMR, CNMR and Mass spectra
10. To carry out the preparation of following organic compounds
11. Preparation of 4-chlorobenzhydrylpiperazine. (an intermediate for cetirizine HCl).
12. Preparation of 4-iodotoluene from p-toluidine.
13. NaBH₄ reduction of vanillin to vanillyl alcohol
14. Preparation of umbelliferone by Pechhman reaction
15. Preparation of triphenyl imidazole
16. To perform the Microwave irradiated reactions of synthetic importance (Any two)
17. Determination of log P, MR, hydrogen bond donors and acceptors of selected drugs using softwares
18. Calculation of ADMET properties of drug molecules and its analysis using Softwares Pharmacophore modeling
19. 2D-QSAR based experiments
20. 3D-QSAR based experiments
21. Docking study based experiment
22. Virtual screening based experiment

Modern Pharmaceutics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

The concept of pre-formulation and its effect on formulation, efficacy and stability of pharmaceutical products at industry.

Formulation, evaluation and stability aspect of emulsion, suspension, SMEDDS, and parenteral at large scale production.

Aspects related to compression and compaction of tablets.

Better way of application of pharmaceutical and statistical tools.

SECTION-A

Preformation Concepts – Drug Excipient interactions - different methods, kinetics of stability, Stability testing.

Dissolution parameter: Similarity factors – f2 and f1, Higuchi and Peppas plot.

Theories of dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation and stability

Large and small volume parental – physiological and formulation consideration, Manufacturing and evaluation.

SECTION-B

Compression and compaction: Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles, Heckel plots.

Validation: Introduction to Pharmaceutical Validation, Scope & merits of Validation, Validation and calibration of Master plan, ICH & WHO guidelines for calibration and validation of equipments, Validation of specific dosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & PQ of facilities.

cGMP& Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenance.

SECTION-C

Production management: Production organization, materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Concept of Total Quality Management.

Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation

Linearity, Concept of significance, Standard deviation, Chi square test, students T-test, ANOVA test.

Books Recommended:

1. Lachmann, L., Libermann, H.A., Kanig, J.L. (2013). Theory and practice of industrial pharmacy. 4th Ed., Bombay: Varghese Publishing House.
2. Lachmann, L., Libermann, H.A., Joseph, B. (1989). Pharmaceutical dosage forms: Tablets. 2nd Ed., vol. I-III. New York: Marcel Dekker.

3. Lachmann, L., Libermann, H.A., Martin, M.R., Banker, G.S. (1996). Pharmaceutical dosage forms: disperse systems. vol. I-II, CRC press.
4. Avis, K.E., Lachmann, L., Libermann, H.A. (1984). Pharmaceutical dosage forms: parenteral medications. vol.1. New York: Marcel Dekker.
5. Gillbert, S.B., Christopher, T.R. (1996). Modern Pharmaceutics.4th Ed., CRC press.
6. Remington, J.P. (2005). Remington: The science and practice of pharmacy. 21st Ed., Lippincott Williams and Wilkins.
7. Bean, H.S., Beckett, A.H., Carless, J.E. (1964). Advances in pharmaceutical sciences.vol. I-V, London, Berkeley: Academic press.
8. Sinko, P.J. (2011). Martin's physical pharmacy and pharmaceutical sciences.6th Ed., Lippincott Williams and Wilkins.
9. Rawlins, E.A. (2012). Bentley's textbook of pharmaceutics. 8th Ed., Elsevier.
10. Willing, S.H. (2001). Good manufacturing practices for pharmaceuticals: a plan for total quality control. 5th Ed., New York: Marcel Dekker, Inc.
11. Quality Assurance Guide, By Organization of Pharmaceutical producers of India.
12. Kohli, D.P.S., Shah, D.H. (2008). Drug formulation manual. New Delhi: Eastern publishers.
13. Sharma, P.P. (2015). How to practice GMPs. 7 th Ed., Agra: Vandhana publications.
14. Nash, R.A., Watcher, A.H. (2003). Pharmaceutical process validation.3rd Ed., vol. 129. New York: Marcel Dekker Inc.
15. Wells, J.I. (1990). Pharmaceutical preformulation: The physiochemical properties of drug substances. vol. 79.Chichester: Ellis Horwood.
16. Evans, J.R., Anderson, D.R., Sweeny, D.J., Williams, T.A. (1990). Applied production and operations management. 3rd Ed
17. Swarbrick, J. (2006). Encyclopaedia of pharmaceutical technology.3rd Ed., CRC press.

Suggested e-material:

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<https://www.pdfdrive.com/pharmaceutical-books.html>

<http://www.statsoft.com/Textbook>

<http://202.74.245.22:8080/xmlui/handle/123456789/39/browse?type=subject>

<https://accesspharmacy.mhmedical.com/books.aspx?view=library>

<https://www.managementstudyguide.com/elements-of-total-quality-management.htm>

Drug Delivery Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

The criteria for selection of drugs and polymers for the development of novel dosage forms

Need of different approaches for preparation of novel drug delivery systems.

Formulation and evaluation of novel drug delivery systems.

SECTION-A

Sustained Release (SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, mechanism of drug delivery from SR/CR formulation.

Polymers: Introduction, definition, classification, properties and application.

Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, categories of patients for personalized medicines, customized drug delivery systems, bioelectronic medicines, 3D printing of pharmaceuticals, telepharmacy.

SECTION-B

Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals.

Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations.

SECTION-C

Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.

Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation.

Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules.

Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.

Books recommended:

Chien, Y.W. (1992). Novel drug delivery systems. 2nd Ed., New York: Marcel Dekker, Inc.

Robinson, J.R., Lee, V.H.L. (1992). Controlled drug delivery systems. New York: Marcel Dekker, Inc.

Mathiowitz, E. (1999). Encyclopedia of controlled delivery. New York: Wiley Interscience Publication, John Wiley and Sons, Inc.

Jain, N.K. (1997). Controlled and novel drug delivery. 1st Ed., New Delhi: CBS Publishers & Distributors.

Vyas, S.P., Khar, R.K. (2002). Controlled drug delivery-concepts and advances. 1st Ed., New Delhi: VallabhPrakashan.

Suggested e materials:

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian drugs (IDMA)
3. Journal of controlled release (Elsevier Sciences) desirable
4. Drug Development and Industrial Pharmacy (Marcel & Decker) desirable

Regulatory affairs

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

concepts of innovator and generic drugs, drug development process

The Regulatory guidance's for filing and approval process

preparation of dossiers and their submission to regulatory agencies in different countries

post approval regulatory requirements for actives and drug product

clinical trials requirements for approvals for conducting clinical trials

SECTION-A

Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction , Hatch-Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION) ,drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in –vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO.

SECTION-B

Regulatory requirement for product approval: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs

CMC, post approval regulatory affairs.Regulation for combination products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.

SECTION-C

Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB).

Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, pharmacovigilance safety monitoring in clinical trials.

Books recommended:

1. Shargel, L, Kaufer, I. (2005). Generic Drug Product Development, Solid Oral Dosage forms. Vol.143. New York: Marcel Dekker Inc.
2. Berry, I.R., Martin, R.P. (2008). The Pharmaceutical Regulatory Process.2nd Ed., vol. 185.Drugs and the Pharmaceutical Sciences. New York: CRC press.
3. Guarino, R.A. (2004). New Drug Approval Process: Accelerating Global Registrations. 5th Ed., vol. 190, New York: Marcel Dekker Inc.

4. Weinberg, S. (2009). Guidebook for drug regulatory submissions.1st Ed., John Wiley & Sons Inc.
5. Pisano, D.J., Mantus, D. (2005). FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics. 2nd Ed., New York: CRC press.
6. Rozovsky, F.A., Adams, R.K. (2003). Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance. 1st Ed., Washington: John Wiley and Sons.

Suggested e-material:

1. www.ich.org/
2. www.fda.gov/
3. europa.eu/index_en.htm
4. <https://www.tga.gov.au/tga-basics>

Pharmaceutics Lab – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning outcomes

Upon completion of this course the student will develop skills of:

Developing new analytical method

Designing pre-formulation study for new drug

Formulation and characterization of dosage forms

1. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. To perform In-vitro dissolution profile of CR/ SR marketed formulation
8. Formulation and evaluation of sustained release matrix tablets
9. Formulation and evaluation osmotically controlled DDS
10. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS
11. Formulation and evaluation of Muco adhesive tablets.
12. Formulation and evaluation of trans dermal patches.
13. To carry out preformulation studies of tablets.
14. To study the effect of compressional force on tablets disintegration time.
15. To study Micromeritic properties of powders and granulation.
16. To study the effect of particle size on dissolution of a tablet.
17. To study the effect of binders on dissolution of a tablet.
18. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.

Computer Aided Drug Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Computational modeling of drug for its pharmacokinetic evaluation.

Usage of software in designing and optimizing pharmaceutical formulations.

Application of artificial intelligence and robotics in pharmaceutical automation.

Implementation of computational fluid dynamics (CFD) to overcome challenges in pharmaceutical product development.

SECTION-A

Computers in Pharmaceutical Research and Development: A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modeling in Pharmaceutical research and development: Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modeling

Quality-by-Design in Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application.

SECTION-B

Computational Modeling of Drug Disposition: Introduction, Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution, Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter.

Computer-aided Formulation Development: Concept of optimization, Optimization parameters, Factorial design, Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, micro-emulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis

Computer-aided Biopharmaceutical Characterization: Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in vitro in vivo correlation, Biowaiver considerations

SECTION-C

Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes.

Computers in Clinical Development: Clinical Data Collection and Management, Regulation of Computer Systems

Artificial Intelligence (AI), Robotics and Computational fluid dynamics: General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions.

Books recommended:

1. Ekins, S. (2006). Computer Applications in Pharmaceutical Research and Development, John Wiley & Sons.
2. Djuris, J. (2013). Computer-Aided Applications in Pharmaceutical Technology, 1st Ed. Cambridge: Woodhead Publishing.

3. Swarbrick, J., Boylan, J.G. (1996). Encyclopedia of Pharmaceutical Technology.vol 13. New York: Marcel Dekker Inc.
4. Bolton, S., Bon, C. (2010). Pharmaceutical Statistics.5th Ed.,vol 203. New York: Informa

Suggested e-material:

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.710.2898&rep=rep1&type=pdf>

[http://file.zums.ac.ir/ebook/235-Drug%20Design%20and%20Discovery%20-%20Methods%20and%20Protocols%20\(Methods%20in%20Molecular%20Biology\)-Seetharama%20D.pdf](http://file.zums.ac.ir/ebook/235-Drug%20Design%20and%20Discovery%20-%20Methods%20and%20Protocols%20(Methods%20in%20Molecular%20Biology)-Seetharama%20D.pdf)

Cosmetics and Cosmeceuticals

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Various key ingredients and basic science involve to develop cosmetics and Cosmeceuticals

Scientific knowledge to develop cosmetics and cosmeceuticals with desired safety, stability and efficacy with compliance to Indian Regulatory Authority.

SECTION–A

Cosmetics – Regulatory: Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import of cosmetics, Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties.

Cosmetics - Biological aspects :Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm.

SECTION–B

Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants – Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste. Soaps and syndetbars.

Perfumes: Classification of perfumes. Perfume ingredients listed as allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane.

SECTION–C

Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor, dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.

Herbal Cosmetics: Herbal ingredients used in Hair care, skincare and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics.

Books recommended:

1. Harry, R.G., Reiger, M.M. (2000). Harry's Cosmeticology. 8th Ed. New York: Chemical publishing company.
2. Butler, H. (2000). Poucher's perfume cosmetics and Soaps, 10th Ed. London: Kluwar academic publishers.
3. Sharma, P.P. (2008). Cosmetics - Formulation, Manufacture and quality control. 4th Ed. New Delhi: Vardhan publishing pvt ltd.
4. Barel, A.O., Paye M, Maibach H.I. (2001). Handbook of cosmetic science and Technology. 3rd Ed. New York: Marcel Decker Inc.

5. Cosmetic and Toiletries recent suppliers catalogue.

6. CTFA directory.

Suggested e-material:

<http://202.74.245.22:8080/xmlui/handle/123456789/39/browse?type=subject>

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<https://www.pdfdrive.com/pharmaceutical-books.html>

Molecular Pharmaceutics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

The criteria for selection of drugs and polymers for the development of Targeted drug delivery.

The various approaches for development of novel drug delivery systems.

The formulation and evaluation of novel drug delivery systems.

SECTION-A

Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery.

Targeting Methods: Introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.

SECTION-B

Micro Capsules / Micro Spheres: Types, preparation and evaluation, Monoclonal Antibodies; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes.

Pulmonary Drug Delivery Systems : Aerosols, propellents, Containers Types, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.

SECTION-C

Nucleic acid based therapeutic delivery system: Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems.

Biodistribution and Pharmacokinetics: Knowledge of therapeutic antisense molecules and aptamers as drugs of future.

Books recommended:

1. Chien, Y.W. (1992). Novel Drug Delivery Systems. 2nd Ed. revised and expanded. New York: Marcel Dekker.
2. Vyas, S.P., Khar R.K. (2002). Controlled Drug Delivery - concepts and advances. New Delhi: VallabhPrakashan.
3. Jain, N.K. (2001). Controlled and Novel Drug Delivery. 1st Ed. New Delhi: CBS Publishers & Distributors.

Suggested e-material:

<http://202.74.245.22:8080/xmlui/handle/123456789/39/browse?type=subject>

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<https://www.pdfdrive.com/pharmaceutical-books.html>

Advanced Biopharmaceutics and Pharmacokinetics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

The basic concepts in biopharmaceutics and pharmacokinetics.

The critical evaluation of biopharmaceutical studies involving drug product performance.

compartment modelling and nonlinear

Bioavailability – bioequivalence (BA-BE) study.

PK-PD.

SECTION-A

Drug Absorption from the Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form, Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form, Dissolution methods, Formulation and processing factors. Physiological factors related to drug absorption.

SECTION-B

Biopharmaceutic considerations in drug product design and in vitro drug product performance: Introduction, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing, meeting dissolution requirements, problems of variable control in dissolution testing performance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability, considerations in the design of a drug product.

Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion, extra-vascular. Multi compartment model: two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimation of k_{max} and V_{max} .

Drug interactions: introduction, the effect of protein binding interactions, the effect of tissue-binding interactions, cytochrome p450-based drug interactions, drug interactions linked to transporters.

SECTION-C

Bioavailability and Bioequivalence: Drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example. Biopharmaceutics classification systems. In-vitro, in-situ and In-vivo permeability methods. Clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies.

Introduction to Pharmacokinetics and pharmacodynamic (PK-PD)

Pharmacokinetics and pharmacodynamics of biotechnology drugs: Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies.

Books recommended:

1. Gibaldi, M. (1991). Biopharmaceutics and Clinical Pharmacokinetics. 4th Ed. Philadelphia: Lea and Febiger.
2. Treatise, A., Brahmanekar, D.M., Jaiswal, S.B. (2015). Biopharmaceutics and Pharmacokinetics. Delhi: VallabhPrakashan.
3. Shargel, L., Yu, A., Pong, S.W. (2012). Applied Biopharmaceutics and Pharmacokinetics. 6th Ed. New York: McGraw Hill Publication.
4. Rani, S., Hiremath R. (2012). Textbook of Biopharmaceutics and Pharmacokinetics. 2nd Ed. Delhi: Prism Publications.
5. Gibaldi, M., Perrier, D. (1982). Pharmacokinetics. 2nd Ed. Revised and expanded. New York: CRC press.
6. Swarbrick, J. (1970). Current Concepts in Pharmaceutical Sciences: Biopharmaceutics. Philadelphia: Lea and Febiger.
7. Rowland, M. Tozer, T.N. (1995). Clinical Pharmacokinetics, Concepts and Application, 3rd edition, Philadelphia: Lippincott Williams and Wilkins.
8. Mack, H.M. (1989). Dissolution, Bioavailability and Bioequivalence, Pennsylvania: Mack Publishing Company.
9. Notari, R.E. (1987). Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition, revised and expanded, New York: Marcel Dekker.
10. Wagner, J.G. Pamarowski, M. (1971). Biopharmaceutics and Relevant Pharmacokinetics, 1st edition, Illinois: Drug Intelligence Publications.
11. Swarbrick, J. Boylan, J.G. (1996). Encyclopedia of Pharmaceutical Technology, New York: Marcel Dekker.
12. Jambhekar, S.S. Breen, P.J. (2009). Basic Pharmacokinetics, 1st edition, Pharmaceutical press.
13. Avdeef, A. (2003). Absorption and Drug Development- Solubility, Permeability, and Charge State, New York: John Wiley & Sons Inc.

Suggested e-material

<http://202.74.245.22:8080/xmlui/handle/123456789/39/browse?type=subject>

<https://pharmaclub.in/free-pharmacy-ebooks-pharmaceutics/>

<https://www.pdfdrive.com/pharmaceutical-books.html>

Pharmaceutics Lab – II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning outcomes

Upon completion of this course student will have an understanding of:

Formulation and characterization of NDDS.

Various pharmacokinetic and statistical softwares.

Clinical and nonclinical data collection.

1. To study the effect of temperature change, non-solvent addition, incompatible polymer addition in microcapsules preparation
2. Preparation and evaluation of Alginate beads
3. Formulation and evaluation of gelatin /albumin microspheres
4. Formulation and evaluation of liposomes/niosomes
5. Formulation and evaluation of spherules
6. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.
7. Comparison of dissolution of two different marketed products /brands
8. Protein binding studies of a highly protein bound drug & poorly protein bound drug
9. Bioavailability studies of Paracetamol in animals.
10. Pharmacokinetic and IVIVC data analysis by WinnolineR software
11. In vitro cell studies for permeability and metabolism
12. DoE Using Design Expert® Software
13. Formulation data analysis Using Design Expert® Software
14. Quality-by-Design in Pharmaceutical Development
15. Computer Simulations in Pharmacokinetics and Pharmacodynamics
16. Computational Modeling of Drug Disposition
17. To develop Clinical Data Collection manual
18. To carry out Sensitivity Analysis, and Population Modeling.
19. Development and evaluation of Creams
20. Development and evaluation of Shampoo and Toothpaste base
21. To incorporate herbal and chemical actives to develop products
22. To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff.

Pharmacological and Toxicological Screening Methods

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Preclinical evaluation of drugs and recent experimental techniques in the drug discovery and development.

Maintenance of laboratory animals as per the guidelines, basic knowledge of various *in-vitro* and *in-vivo* preclinical evaluation processes

Regulations and ethical requirement for the usage of experimental animals.

the various screening methods involved in the drug discovery process

SECTION-A

Laboratory Animals: Common laboratory animals: Description, handling and applications of different species and strains of animals. Transgenic animals: Production, maintenance and applications. Anaesthesia and euthanasia of experimental animals. Maintenance and breeding of laboratory animals. CPCSEA guidelines to conduct experiments on animals

Good laboratory practice.

Bioassay: Principle, scope and limitations and methods.

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models.

General principles of preclinical screening. CNS Pharmacology: behavioral and muscle co-ordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti-epileptics and nootropics. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimers and multiple sclerosis. Drugs acting on Autonomic Nervous System.

SECTION-B

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models.

Respiratory Pharmacology: anti-asthmatics, drugs for COPD and anti allergics. Reproductive Pharmacology: Aphrodisiacs and antifertility agents Analgesics, anti-inflammatory and antipyretic agents. Gastrointestinal drugs: anti-ulcer, anti-emetic, antidiarrheal and laxatives.

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models.

Cardiovascular Pharmacology: antihypertensives, antiarrhythmics, antianginal, antiatherosclerotic agents and diuretics. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents.

SECTION-C

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models.

Immunomodulators, Immunosuppressants and immunostimulants

General principles of immunoassay: theoretical basis and optimization of immunoassay, heterogeneous and homogenous immunoassay systems. Immunoassay methods evaluation; protocol outline, objectives and preparation.

Immunoassay for digoxin and insulin.

Anti-cancer agents. Hepatoprotective screening methods.

Limitations of animal experimentation and alternate animal experiments.

Extrapolation of in vitro data to preclinical and preclinical to humans

Books recommended (Latest edition):

Kulkarni, S.K. (2013). *Handbook of Experimental Pharmacology*, Vallabh Prakashan.

Ghosh, M.N. (2008). *Fundamentals of Experimental Pharmacology*, 5th Ed., Kolkata: Hilton & Company Publishers.

Handbook on GLP, Quality Practices for Regulated Non-Clinical Research and Development, World Health Organization, 2nd Ed., 2008.

Schedule Y, Guideline: Drugs and cosmetics (second amendment) Rules, CDSCO, 1945.

Annual Report to the People on Health, Ministry of Health and Family Welfare, New Delhi, 2005

Rick, N.G. (2015). *Drugs from Discovery to Approval*, 3rd Ed., United States: Wiley-Blackwell Publishers.

Gad, C.S. (2015). *Animal Models in Toxicology*, 3rd Ed., New York: CRC Press.

OECD (452) guidelines for the Testing of Chemicals, 2018

Stine, E.R., Brown, M.T. (2015). *Principles of toxicology*, 3rd Ed., New York: CRC Press.

Guidance for Industry M3(R2) Nonclinical Safety Studies for the Conduct of Human Clinical Trials and Marketing Authorization for Pharmaceuticals, U.S. Department of Health and Human Services, ICH, 2010.

Guidance for Industry Patient-Reported Outcome Measures: Use in Medical Product Development to Support Labeling Claims, U.S. Department of Health and Human Services Food and Drug Administration, 2009.

Suggested e-material:

(<http://www.fda.gov/downloads/drugs/guidancecompliance> regulatory information /guidances/ucm073246.pdf)

Hand book on GLP, Quality practices for regulated non-clinical research and development
(<http://www.who.int/tdr/publications/documents/glphandbook.pdf>).

Cellular and Molecular Pharmacology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Fundamental knowledge on the structure and functions of cellular components

Interaction of these components with drugs.

Drug discovery and receptor signal transduction processes.

Molecular pathways affected by drugs.

Applicability of molecular pharmacology and biomarkers in drug discovery process.

Molecular biology techniques as applicable for pharmacology.

SECTION-A

Cell biology: Structure and functions of cell and its organelles, Genome organization. Gene expression and its regulation, importance of siRNA and micro RNA, gene mapping and gene sequencing, Cell cycles and its regulation.

Cell death: events, regulators, intrinsic and extrinsic pathways of apoptosis. Necrosis and autophagy.

Cell signaling: Intercellular and intracellular signaling pathways. Classification of receptor family and molecular structure ligand gated ion channels; G-protein coupled receptors, tyrosine kinase receptors and nuclear receptors. Secondary messengers: cyclic AMP, cyclic GMP, calcium ion, inositol 1,4,5-trisphosphate, (IP3), NO, and diacylglycerol. Detailed study of following intracellular signaling pathways: cyclic AMP signaling pathway, mitogen-activated protein kinase (MAPK) signaling, Janus kinase (JAK)/signal transducer and activator of transcription (STAT) signaling pathway.

SECTION-B

Principles and applications of genomic and proteomic tools DNA electrophoresis, PCR (reverse transcription and real time), Gene sequencing, micro array technique, SDS page, ELISA and western blotting, Recombinant DNA technology and gene therapy Basic principles of recombinant DNA technology-Restriction enzymes, various types of vectors. Applications of recombinant DNA technology. Gene therapy- Various types of gene transfer techniques, clinical applications and recent advances in gene therapy.

Immunotherapeutics: Types of immunotherapeutics, humanisation antibody therapy, Immunotherapeutics in clinical practice

SECTION-C

Cell culture techniques: Basic equipments used in cell culture lab. Cell culture media, various types of cell culture, general procedure for cell cultures; isolation of cells, subculture, cryopreservation, characterization of cells and their application. Principles and applications of cell viability assays, glucose uptake assay, Calcium influx assays Principles and applications of flow cytometry. Biosimilars

Pharmacogenomics: Gene mapping and cloning of disease gene. Genetic variation and its role in health/ pharmacology Polymorphisms affecting drug metabolism. Genetic variation in drug transporters. Genetic variation

in G protein coupled receptors. Applications of proteomics science: Genomics, proteomics, metabolomics, functionomics, nutrigenomics.

Books recommended(Latest edition):

Cooper, M.G., Hausman, E.R. (2013). *The Cell: A Molecular Approach*, 6th Ed., Sinauer Associates.

Licinio, J., Wong, Li. (2002). *Pharmacogenomics: The Search for Individualized Therapies*, 1st Ed., Weinheim: Wiley VCH Publishers.

Bradshaw, A.R., Dennis, A.E. (2003). *Handbook of Cell Signaling*, 2nd Ed., Cambridge: Academic Press.

Dickenson, J., Freeman, F., Mills, L.C, Thode, C (2012). *Molecular Pharmacology: From DNA to Drug Discovery*, 1st Ed., Wiley-Blackwell Publishers.

Helgason, D.C., Miller, L.C. (2005). *Basic Cell Culture protocols*, 3rd Ed., New York: Humana Press.

Davis, M.J. (1995). *Basic Cell Culture: A Practical Approach*, OUP Oxford Press.

Masters, J. (2000). *Animal Cell Culture: A Practical Approach*, 3rd Ed., OUP Oxford Publishers.

Ausubel, M.F. (1987). *Current Protocols in Molecular Biology*, Hoboken: John Wiley & Sons Inc Publishers.

Suggested e-material:

Pharmacology (Miles Hacker, William S. Messer) <http://www.sciencedirect.com/science/book/9780123695215>

Therapeutic drug monitoring Dasgupta, Amitava <http://www.sciencedirect.com/science/book/9780123854674>

A comprehensive guide to toxicology in preclinical drug development Faqi, Ali S.
<http://www.sciencedirect.com/science/book/9780123878151>

Biomarkers in toxicology Gupta, Ramesh C. <http://www.science-direct.com/science/book/9780124046306>

Biased signaling in physiology, pharmacology and therapeutics Arey, Brian
<http://www.sciencedirect.com/science/book/9780124114609>

Drug-induced liver disease Kaplowitz, Neil <http://www.science-direct.com/science/book/9780123878175>

Principles of Drug Discovery

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

- Different CADD techniques and their applications in drug discovery.
- The use of software in identifying drug receptor interactions and pharmacophore mapping.
- The applicability of *in silico* virtual screening protocols in drug research.

SECTION-A

Introduction to Computer Aided Drug Design (CADD): History, different techniques and applications.

Quantitative Structure Activity Relationships: Basics

History and development of QSAR: Physicochemical parameters and methods to calculate physicochemical parameters: Hammett equation and electronic parameters (sigma), lipophilicity effects and parameters (log P, pi-substituent constant), steric effects (Taft steric and MR parameters) Experimental and theoretical approaches for the determination of these physicochemical parameters.

Section B

Quantitative Structure Activity Relationships: Applications Hansch analysis, Free Wilson analysis and relationship between them, Advantages and disadvantages; Deriving 2D-QSAR equations. 3D-QSAR approaches and contour map analysis. Statistical methods used in QSAR analysis and importance of statistical parameters.

Molecular Modeling and Docking:

- a) Molecular and Quantum Mechanics in drug design.
- b) Energy Minimization Methods: comparison between global minimum conformation and bioactive conformation
- c) Molecular docking and drug receptor interactions: Rigid docking, flexible docking and extra-precision docking. Agents acting on enzymes such as DHFR, HMG-CoA reductase and HIV protease, choline esterase (AChE&BChE).

Section C

Molecular Properties and Drug Design:

- a) Prediction and analysis of ADMET properties of new molecules and its importance in drug design.
- b) De novo drug design: Receptor/enzyme-interaction and its analysis, Receptor/enzyme cavity size prediction, predicting the functional components of cavities, Fragment based drug design.
- c) Homology modeling and generation of 3D-structure of protein.

Pharmacophore Mapping and Virtual Screening: Concept of pharmacophore, pharmacophore mapping, identification of Pharmacophore features and Pharmacophore modeling; Conformational search used in pharmacophore mapping.

In Silico Drug Design and Virtual Screening Techniques Similarity based methods and Pharmacophore based screening, structure based In-silico virtual screening protocols.

Books recommended (Latest edition):

- Robert, M. (2007). *Computational and structural approaches to drug discovery*, 1st Ed., RCS Publishers.
- Martin, Y.C. (2010). *Introduction to Quantitative Drug Design*, 2nd Ed., New York: CRC Press.
- Ariens (1975). *Drug Design*, Academic Press, Elsevier Publishers.
- Smith, H.J., Williams, H. (2005). *Smith Principles of Drug Design*. CRC Press.
- Silverman, R.B. (2010). *The Organic Chemistry of the Drug Design and Drug action*, Elsevier Publishers.
- Abraham, D.J., Rotella, D.P (2010). *Burger's Medicinal Chemistry*, 7th Ed., Wiley Publishing Co.
- Patrick, G.L. (1995). *An Introduction to Medicinal Chemistry*, Oxford University Press.
- Gisvold's, W. (2004). *Text book of Organic Medicinal and Pharmaceutical Chemistry*, 11th Ed., Lippincott Williams & Wilkins.

Suggested e-material:

- <https://www.pdfdrive.com/computational-methods-in-drug-discovery-e24068030.html>
- <https://www.pdfdrive.com/textbook-of-drug-design-and-discovery-d33454550.html>
- <https://www.pdfdrive.com/drug-design-and-discovery-methods-and-protocols-methods-in-e36557495.html>

Advanced Pharmacology - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

The basic knowledge in the field of pharmacology pertaining to the drugs and its therapeutic applications

Recent advances in the drugs used for the treatment of various diseases.

Concepts of drug action and mechanisms involved.

Pathophysiology and pharmacotherapy of certain diseases

Underlying mechanism of drug actions at cellular and molecular level.

Adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

SECTION-A

Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Concepts of linear and non-linear compartment models. Significance of Protein binding.

Pharmacodynamics: Mechanism of drug action and the relationship between drug concentration and effect. Receptors, structural and functional families of receptors, quantitation of drug receptors interaction and elicited effects.

Neurotransmission: General aspects and steps involved in neurotransmission.

Neurohumoral transmission in autonomic nervous system (Detailed study about neurotransmitters: Adrenaline and Acetylcholine).

Neurohumoral transmission in central nervous system (Detailed study about neurotransmitters: histamine, serotonin, dopamine, GABA, glutamate and glycine). Non adrenergic non cholinergic transmission (NANC). Cotransmission.

SECTION-B

Systemic Pharmacology: A detailed study on pathophysiology of diseases, mechanism of action, pharmacology and toxicology of existing as well as novel drugs used in the following systems.

Autonomic Pharmacology: Parasympathomimetics and lytics, sympathomimetics and lytics, agents affecting neuromuscular junction.

Central nervous system Pharmacology: General and local anesthetics, Sedatives and hypnotics, drugs used to treat anxiety. Depression, psychosis, mania, epilepsy, neurodegenerative diseases. Narcotic and non-narcotic analgesics.

SECTION-C

Cardiovascular Pharmacology: Diuretics, antihypertensives, antiischemics, anti- arrhythmics, drugs for heart failure and hyperlipidemia. Hematinics, coagulants, anticoagulants, fibrinolytics and antiplatelet drugs.

Autocoid Pharmacology: The physiological and pathological role of Histamine, Serotonin, Kinins Prostaglandins Opioid autocoids. Pharmacology of antihistamines, 5HT antagonists.

Books recommended(Latest edition):

- Brunton, L., Chabner, A.B., Knollman, B. (2011). *Goodman & Gillman's The Pharmacological Basis of Therapeutics*, 3rd Ed. Mc Graw-Hill Education.
- Golan, D.E., Tashjian, A.H., Armstrong, E.J., Armstrong, A.W., Kluwer, L.W. (2011). *Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy*, 3rd Ed., Kluwer-Lippincott Williams & Wilkins Publishers.
- Katzung, B.G. (2017). *Basic and Clinical Pharmacology*, 14th Ed., McGraw-Hill Education Publishers.
- Gibaldi, M., Prescott, L. (1983). *Hand book of Clinical Pharmacokinetics*, New York: ADIS Health Science Press.
- Yu, A., Shargel, L. (2016). *Applied Biopharmaceutics and Pharmacokinetics*, 8th Ed., New York: McGraw-Hill Education Publishers.
- Smith, G., Aronson, J. (2002). *Oxford Textbook of Clinical Pharmacology and Drug Therapy*, 3rd Ed., OUP Oxford Publishers.
- Speight, M.T. (2011). *Holford HGN Avery's Drug Treatment*, 4th Ed., Wiley India Pvt Ltd.
- Dipiro, T.J., Talbert, L.R., Yee, C.G., Matzke, R.G., Wells, G.B., Posey, M. (2011). *Pharmacotherapy: A Pathophysiologic Approach*, 10th Ed., New York: Mc Graw-Hill Education Publishers.
- Zdanowicz, M.M. (2002). *Essentials of Pathophysiology for Pharmacy*, 3rd Ed., Routledge Publishers.
- Kumar, V., Abbas, K.A., Aster, C.J. (2014). *Robbins & Cortan Pathologic Basis of Disease*, 9th Ed., Amsterdam: Elsevier.
- Srivastava, S.K. (2017). *A Complete Textbook of Medical Pharmacology*, New Delhi: Avichal Publishing Company.
- Tripathi, K.D. (2018). *Essentials of Medical Pharmacology*, 8th, New Delhi: Jaypee Brothers Medical Publishers.
- Craig, R.C., Stitzel, R.E (2004). *Modern Pharmacology with Clinical Applications*, Lippincott Publishers.
- Rowland, M., Tozer, N.T. (2010). *Clinical Pharmacokinetics & Pharmacodynamics: Concepts and Applications*, 4th Ed., Philadelphia: Lippincott Williams & Wilkins Publishers.
- Yu, A., Shargel, L. (1999). *Applied Biopharmaceutics and Pharmacokinetics*, 4th Ed., New York: Appleton & Lange Publishers.
- Craig, C.R., Stitzel, R.E. (1990). *Modern Pharmacology*, 3rd Ed., Boston: Little Brown and Company.

Suggested e-material:

- Pharmacology (Miles Hacker, William S. Messer) <http://www.sciencedirect.com/science/book/9780123695215>
- Therapeutic drug monitoring Dasgupta, Amitava <http://www.sciencedirect.com/science/book/9780123854674>
- A comprehensive guide to toxicology in preclinical drug development Faqi, Ali
[S.http://www.sciencedirect.com/science/book/9780123878151](http://www.sciencedirect.com/science/book/9780123878151)
- Biomarkers in toxicology Gupta, Ramesh C. <http://www.science-direct.com/science/book/9780124046306>
- Biased signaling in physiology, pharmacology and therapeutics Arey, Brian
<http://www.sciencedirect.com/science/book/9780124114609>
- Drug-induced liver disease Kaplowitz, Neil <http://www.science-direct.com/science/book/9780123878175>

Pharmacology Lab - I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

1. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry

Handling of laboratory animals.

1. Various routes of drug administration.
2. Techniques of blood sampling, anesthesia and euthanasia of experimental animals.
3. Functional observation battery tests (modified Irwin test)
4. Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity.
5. Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity.
6. Evaluation of diuretic activity.
7. Evaluation of antiulcer activity by pylorus ligation method.
8. Oral glucose tolerance test.
9. Isolation and identification of DNA from various sources (Bacteria, Cauliflower, onion, Goat liver).
10. Isolation of RNA from yeast
11. Estimation of proteins by Bradford/Lowry's in biological samples.
12. Estimation of RNA/DNA by UV Spectroscopy
13. Gene amplification by PCR.
14. Protein quantification Western Blotting.
15. Enzyme based in-vitro assays (MPO, AChEs, α amylase, α glucosidase).
16. Cell viability assays (MTT/Trypan blue/SRB).
17. DNA fragmentation assay by agarose gel electrophoresis.
18. DNA damage study by Comet assay.
19. Apoptosis determination by fluorescent imaging studies.
20. Pharmacokinetic studies and data analysis of drugs given by different routes of administration using softwares Enzyme inhibition and induction activity
22. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (UV)
23. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (HPLC)

Clinical Research and Pharmacovigilance

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

- The clinical research.
- Regulatory requirements for conducting clinical trial.
- Responsibilities of key players involved in clinical trials
- Safety monitoring, reporting and close-out activities.
- Principles of pharmacovigilance

SECTION-A

Regulatory Perspectives of Clinical Trials: Origin and Principles of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines.

Ethical Committee: Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant- Schedule Y, ICMR.

Informed Consent Process: Structure and content of an Informed Consent Process Ethical principles governing informed consent process.

Clinical Trials: Types and Design, Experimental Study- RCT and Non RCT. Observation Study: Cohort, Case Control, Cross sectional.

Clinical Trial Study Team: Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management.

SECTION-B

Clinical Trial Documentation: Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report Clinical Trial Monitoring- Safety Monitoring in CT.

Adverse Drug Reactions: Definition and types. Detection and reporting methods, Severity and seriousness assessment, Predictability and preventability assessment, Management of adverse drug reactions, Terminologies of ADR. Pharmacoepidemiology, pharmacoeconomics, safety pharmacology.

SECTION-C

Basic aspects, terminologies and establishment of pharmacovigilance: History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring programme, WHO and Regulatory terminologies of ADR, evaluation of medication safety, Establishing pharmacovigilance centres in Hospitals, Industry and National programmes related to pharmacovigilance. Roles and responsibilities in Pharmacovigilance

Methods, ADR reporting and tools used in Pharmacovigilance: International classification of diseases, International Nonproprietary names for drugs, Passive and Active surveillance, Comparative observational studies, Targeted clinical investigations and Vaccine safety surveillance. Spontaneous reporting system and Reporting to

regulatory authorities, Guidelines for ADRs reporting. Argus, Aris G Pharmacovigilance, VigiFlow, Statistical methods for evaluating medication safety data.

Books recommended (Latest edition):

Central Drugs Standard Control Organization- *Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India*. New Delhi: Ministry of Health: 2001.

International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.

Ethical Guidelines for Biomedical Research on Human Subjects, Indian Council of Medical Research, New Delhi: 2006.

Machin, D., Day, S., Green, S. (2006). *Textbook of Clinical Trials* edited by David Machin, Simon Day and Sylvan Green, John Wiley and Sons, 6th Ed., England: John Wiley & Sons Ltd.

Rondels, R.K., Varley, S.A., Webbs, C.F. (2000). *Clinical Data Management*, 2nd Ed., England: Wiley Publications.

Lloyd, J., Raven, A. (1994). *Handbook of clinical Research*, 2nd Ed., New York: Churchill Livingstone.

Giovanna, D.L., Haynes, G. (2001). *Principles of Clinical Research*, 1st Ed., Routledge publisher.

Suggested e-material:

<https://www.who-umc.org/> (Global Pharmacovigilance)

https://www.who.int/medicines/areas/quality_safety/safety_efficacy/pharmvigi/en (WHO Pharmacovigilance)

Pharmacological and Toxicological Screening Methods-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

Preclinical safety and toxicological evaluation of drug & new chemical entity.

Regulatory aspects for the toxicological evaluation of drugs and chemicals.

Types of toxicity studies and their procedure.

Importance of ethical and regulatory requirements for toxicity studies.

Practical skills required to conduct the preclinical toxicity studies.

Use of experimental animals for the different toxicological studies.

SECTION-A

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. General principles of preclinical screening. CNS Pharmacology: behavioral and muscle coordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti-epileptics and nootropics. Drugs for neurodegenerative diseases like Pam, Alzheimers and multiple sclerosis. Drugs acting on Autonomic Nervous System.

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Respiratory Pharmacology: anti-asthmatics, drugs for COPD and anti allergics. Reproductive Pharmacology: Aphrodisiacs and antifertility agents Analgesics, antiinflammatory and antipyretic agents. Gastrointestinal drugs: anti-ulcer, anti -emetic, antidiarrheal and laxatives.

SECTION-B

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Cardiovascular Pharmacology: antihypertensives, antiarrhythmics, antianginal, antiatherosclerotic agents and diuretics. Drugs for metabolic disorders like anti-diabetic antidyslipidemic agents. Anti-cancer agents.

Hepatoprotective screening methods.

Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. immunomodulators, Immunosuppressants and immunostimulants.

SECTION-C

General principles of immunoassay: theoretical basis and optimization of immunoassay, heterogeneous and homogenous immunoassay systems. Immunoassay methods evaluation; protocol outline, objectives and preparation. Immunoassay for digoxin and insulin Limitations of animal experimentation and alternate animal experiments. Extrapolation of in vitro data to preclinical and preclinical to humans

Reproductive toxicology studies: Male reproductive toxicity studies, female reproductive studies (segment I and segment III), teratogenicity studies (segment II) Genotoxicity studies (Ames Test, in vitro and in vivo Micronucleus and Chromosomal aberrations studies) In vivo carcinogenicity studies.

Books recommended (Latest edition):

Burn, D.J., Finney, D.J., Goodwin, I.G. (1952). *Biological standardization*. London: Oxford University Press.

Turner, A.R. (2013). *Screening methods in Pharmacology*, Cambridge: Academic Press.

Laurence, R.D., Bacharach, L.A (2013). *Evaluation of drugs activities: Pharmacometrics*, Cambridge: Academic Press.

Schwartz, A. (2013). *Methods in Pharmacology*, 1st Ed., New York: Springer.

McLeod, J.L. (1970). *Pharmacological experiment on intact preparations*, London: Churchill Livingstone.

Vogel, H. (2008). *Drug Discovery and Evaluation: Pharmacological assays*, 3rd Ed., New York: Springer.

Goyal, R.K. (2017). *Practical In Pharmacology*, B.S.Shah Prakashan.

Gupta, S.K. (2009). *Drug Screening Methods (Preclinical Evaluation of New Drugs)*, Jaypee Brothers Medical Publishers (P) Ltd .

Kulkarni, S.K. (2008). *Practical Pharmacology and Clinical Pharmacy*, Delhi: Vallabh Pub.

David, R.G. (2009) *Animal Models in Cardiovascular Research*, New York: Springer.

Robert, A.T. (2013) *Screening Methods in Pharmacology*, Elsevier Publishers.

Chatterjee, T.K. (2018) *Rodents for Pharmacological Experiments*, Pharma Med Publication.

Medhi, B., Prakash, A. (2010). *Practical Manual of Experimental and Clinical Pharmacology*, 1st Ed., New Delhi: Jaypee Medical Publishers.

Suggested e-material:

Pharmacology (Miles Hacker, William S. Messer) <http://www.sciencedirect.com/science/book/9780123695215>

Therapeutic drug monitoring Dasgupta, Amitava <http://www.sciencedirect.com/science/book/9780123854674>

A comprehensive guide to toxicology in preclinical drug development Faqi, Ali S.
<http://www.sciencedirect.com/science/book/9780123878151>

Biomarkers in toxicology Gupta, Ramesh C. <http://www.sciencedirect.com/science/book/9780124046306>

Biased signaling in physiology, pharmacology and therapeutics Arey, Brian
<http://www.sciencedirect.com/science/book/9780124114609>

Drug-induced liver disease Kaplowitz, Neil <http://www.sciencedirect.com/science/book/9780123878175>

Advanced Pharmacology - II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

Upon completion of this course student will have an understanding of:

The basic knowledge in the field of pharmacology pertaining to the drugs and its therapeutic applications

Recent advances in the drugs used for the treatment of various diseases.

Concepts of drug action and mechanisms involved.

The pathophysiology and pharmacotherapy of certain diseases

Underlying mechanism of drug actions at cellular and molecular level.

Adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

SECTION-A

GIT Pharmacology: Antiulcer drugs, Prokinetics, antiemetics, anti-diarrheals and drugs for constipation and irritable bowel syndrome.

Endocrine Pharmacology: Molecular and cellular mechanism of action of hormones such as growth hormone, prolactin, thyroid, insulin and sex hormones Anti-thyroid drugs, Oral hypoglycemic agents, Oral contraceptives, Corticosteroids. Drugs affecting calcium regulation

SECTION-B

Chemotherapy: Cellular and molecular mechanism of actions and resistance of antimicrobial agents such as β -lactams, aminoglycosides, quinolones, Macrolide antibiotics. Antifungal, antiviral and anti-TB drugs.

Chemotherapy: Drugs used in Protozoal Infections, Drugs used in the treatment of Helminthiasis. Chemotherapy of cancer, **Immunopharmacology:** Cellular and biochemical mediators of inflammation and immune response.

Allergic or hypersensitivity reactions: Pharmacotherapy of asthma and COPD.

Immunomodulator: Immunosuppressants and Immunostimulants

SECTION-C

Chronopharmacology: Biological and circadian rhythms, applications of chronotherapy in various diseases like cardiovascular disease, diabetes, asthma and peptic ulcer

Free radicals Pharmacology: Generation of free radicals, role of free radicals in etiopathology of various diseases such as diabetes, neurodegenerative diseases and cancer.

Protective activity of certain important antioxidant Recent Advances in Treatment: Alzheimer's disease, Parkinson's disease, Cancer, Diabetes mellitus

Books recommended (Latest edition):

Brunton, L., Chabner, A.B, Knollman, B. (2017). *Goodman & Gilman's: The Pharmacological Basis of Therapeutics*, 3rd Ed., McGraw-Hill Education.

Golan, D.E., Tshjian, A.H., Armstrong, E.J., Armstrong, A.W. (2016). *Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy*, 3rd Ed., Wolters Kluwer Health/Lippincott Williams & Wilkins: 2016.

Katzung, B.G. (2017), *Basic and Clinical Pharmacology*, 14th Ed., McGraw-Hill Companies.

Ritter, J., Flower, R., Henderson, R., Rang, H. (2015). *Rang & Dale's Pharmacology*, 8th Ed., Churchill Livingstone.

Gibaldi, M., Prescott, L. (1983). *Handbook of Clinical Pharmacokinetics*, New York: ADIS Health Science.

Herfindal, E.T., Hirschman, J.L., Gourley, D.R. (2000), *Textbook of therapeutics: drug and disease management*, 7th Ed., Philadelphia: Lippincott Williams & Wilkins.

Shargel, L., Yu, A. (2016). *Applied Biopharmaceutics & Pharmacokinetics*, 8th Ed., New York: McGraw-Hill Companies.

Younggil K. (2002). *Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists*, New York: Springer.

Kumar, V., Abbas, A., Aster, J. (2014). *Robbins & Cotran Pathologic Basis of Disease*, 9th Ed., Amsterdam: Elsevier.

Srivastava, S.K. (2017). *A Complete Textbook of Medical Pharmacology*, New Delhi: Avichal Publishing Company.

Tripathi, K.D. (2018). *Essentials of Medical Pharmacology*, 8th Ed., New Delhi: Jaypee Brothers Medical Publishers.

Suggested e-material:

Pharmacology (Miles Hacker, William S. Messer) <http://www.sciencedirect.com/science/book/9780123695215>

Therapeutic drug monitoring Dasgupta, Amitava <http://www.sciencedirect.com/science/book/9780123854674>

A comprehensive guide to toxicology in preclinical drug development Faqi, Ali
[S.http://www.sciencedirect.com/science/book/9780123878151](http://www.sciencedirect.com/science/book/9780123878151)

Biomarkers in toxicology Gupta, Ramesh C. <http://www.sciencedirect.com/science/book/9780124046306>

Biased signaling in physiology, pharmacology and therapeutics Arey, Brian
<http://www.sciencedirect.com/science/book/9780124114609>

Drug-induced liver disease Kaplowitz, Neil <http://www.sciencedirect.com/science/book/9780123878175>

Pharmacology Lab – II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

1. To record the DRC of agonist using suitable isolated tissues preparation.
2. To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation.
3. To determine to the strength of unknown sample by matching bioassay by using suitable tissue preparation.
4. To determine to the strength of unknown sample by interpolation bioassay by using suitable tissue preparation
5. To determine to the strength of unknown sample by bracketing bioassay by using suitable tissue preparation
6. To determine to the strength of unknown sample by multiple point bioassay by using suitable tissue preparation.
7. Estimation of PA₂ values of various antagonists using suitable isolated tissue preparations.
8. To study the effects of various drugs on isolated heart preparations
9. Recording of rat BP, heart rate and ECG.
10. Recording of rat ECG
11. Drug absorption studies by averted rat ileum preparation.
12. Acute oral toxicity studies as per OECD guidelines.
13. Acute dermal toxicity studies as per OECD guidelines.
14. Repeated dose toxicity studies- Serum biochemical, haematological, urine analysis, functional observation tests and histological studies.
15. Drug mutagenicity study using mice bone-marrow chromosomal aberration test.
16. Protocol design for clinical trial. (3 Nos.)
17. Design of ADR monitoring protocol.
18. In-silico docking studies. (2 Nos.)
19. In-silico pharmacophore based screening.
20. In-silico QSAR studies.
21. ADR reporting

Sociology of Deviance and Crime

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students will be able to

Elucidate the crime as a form of deviant behaviour.

Apply theoretical approaches to understand changing patterns of crime and criminal behavior.

Understand the correctional homes and different perspectives of punishment.

Section A

Concept of Deviance, Factors Fostering Deviance, Crime as a Form of Deviance. Types of Crime: Economic, Violent, White Collar Crime, Organized Crime, Cyber crime.

Section B

Theories of Crime: Classical & Neo-classical, Biological, Physiological, Geographical, Sociological Theories (Sutherland, Cloward & Ohlin, Merton), Multiple Factors Theory.

Section C

Crime and Victimological Perspective. Punishment: Concept & Theories: Retributive, Restitutive, Reformative. Prison Reforms in India. Probation and Parole Role of Police in Crime Prevention.

Recommended Books:

Barlow, H.D. (1987). *Introduction to criminology*. Boston: Little Brown & Co.

Reckless, W.C. (1967). *The crime problems*. London: Vikils Teffer and Simon.

डी. एस. बघेल : अपराध शास्त्र, नई दिल्ली, रजत प्रकाशन गृह, 1983.

Ahuja, R. (2002). *Criminology*. Jaipur: Rawat Publication.

5. Caldwell, R.G. (1977). *Foundations of law enforcement & criminal justice*. Indianapolis: Bobbs Merrill.

6. Cohen, A. (1955). *Delinquent boys: The culture of the gang*. New York: Free Press.

Suggested E-Resources :

Criminology, Sociology and Criminology, Platform :open access. Link : <https://www.omicsonline.org/sociology-and-criminology.php>

Criminological Theory. Platform: UCI libraries.

Link-<https://guides.lib.uci.edu/c.php?g=333256&p=4992386>

Criminal Justice System, Crime and Theory, Platform: Sage Pub. Link : <http://sk.sagepub.com/books/key-concepts-in-crime-and-society/i261.xml>

Indian Society: Structure and Change

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After completion of this course, students will be able to
Acquaint with the characteristics of Indian society and historical importance of culture unity and diversity.
Explain the changing trends in basic institutions of Indian society.
Develop sociological knowledge and solving the contemporary problems of Indian society.

Section A

Indian Society: Basic Characteristics, Historical Moorings of Indian Society and Culture.
Unity and Diversity Factors in Continuity and Change Basic Institutions of Indian Society : Family, Marriage and Kinship System. Social Stratification among Hindus, Muslim and Christians.

Section B

Changing Patterns in Indian Society: Family, Marriage and Their Impact on Status of Women. Political and Economic Development in Indian Society Problems of Economic Development
Secularization, Construction of Elite Class & their Role in Indian Politics, Criminalization of Politics.

Section C

Current Problems: Casteism, Communalism, Terrorism, Problems of Minorities & Backward Classes.

Recommended Books:

Ahuja, R. (1993). *Indian social system*. Jaipur: Rawat Publication.
Bose, N. (1967). *Culture and society in India*. Bombay: Asia Publishing House.
Dube, S. C. (1990). *Indian society*. New Delhi: National Book Trust.
Karve, I. (1961). *Hindu society: An interpretation*. Poona: Deccan College.
Prabhu, P. (1991). *Hindu social organization: A study in socio- psychological and ideological foundation*. Bombay: Popular Book Depot.
Srinivas, M. N. (1965). *India: social structure*. New Delhi: Hindustan Publishing Cooperation.
Altekar, A. (1959). *Position of women in ancient India*. Delhi: M.B. Publication.
Desai, I. (1964). *Some aspects of family in Mahua: A sociological study of jointness in a small town*. Bombay: Asia Publishing House.
Dube, L. (1997). *Women and kinship*. Tokyo: U.N. University Press.
Dube, S. C. (1974). *Contemporary India and its modernization*. Delhi: Vikas Publishing House.
Ghurye, G. (1961). *Caste, class and occupation*. Bombay: Popular Book Depot.
Kannan, C. (1963). *Intercaste & intercommunity marriage in India*. Bombay: Allied Publishers.
Kapadia, K. (1968). *Marriage and family in India*. London: Oxford University Press.
Kothari, R. (1970). *Caste in Indian politics*. New Delhi: Orient Longman Ltd.
Mandelbaum, D. (1972). *Society in India*. Bombay: Popular Prakashan.

Suggested e-Resources:

Relevance of Continuity and Change in Indian Society, Platform: IGNOU, Link-

<http://egyankosh.ac.in/handle/123456789/37840>

Indian society, continuity and change, social inequality and exclusion. Platform: insightsonindia, Link :

<http://www.insightsonindia.com/content/uploads/2013/08/indian-society.pdf>

Religion, Caste, Class, Marriage, Family, Kinship Platform: scholarship, Link :

<https://cloudfront.escholarship.org/dist/prd/content/qt5qb5z783/qt5qb5z783.pdf?t=lpbjt3>

Science, Technology and Social Change

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

5 0 0 5

Learning Outcomes:

After the completion of this course, students will be able to

Explain interrelations of science, technology and social change

Develop an understanding of policy formulation regarding technology and society

Critically analyse the role of technology in development of society

Section A

The Study of Science : Importance. Relationship between Society and Science and vice-versa. Relationship between Science and Technology, Pure and Applied Science. Science as a Social System.

Section B

History & Nature of Science and Technology Education in India : Primary to Research level. Performance of Universities in Development of Technology Role of Science Policy in Development. Brain Drain and Brain Gain Indian Social Structure and Science.

Section C

Political economy of Science and Technology at National and International Levels. Contest between Development of Science in Western and Non-Western Societies.

Recommended Books :

Appleyard, R. (1989). *The impact of international migration on developing countries*. OECD.

Barber, B. (1978). *Science and the social order*. New York: Free Press.

Choubey, K. (1974). *Science policy and national development*. New Delhi: Wiley Eastern.

Rahman, A. (1972). *Science, technology & society: A collection of essays*. New Delhi: People's Publishing House.

Storer, N. W. (1966). *The social system of science*. Holt, Rinehart and Winston.

UNCTAD/CSIR. (2001). *Case study in reverse transfer to technology: A survey of problems and policy in India*. Geneva.

Crane, D. (1965). Scientists at major and minor Universities : A Study of productivity and recognition. *American Sociological Review*. 30 (53). 699-714.

Coler, M.A. (1963). *Essays on the creativity in the sciences*. New York: New York University Press.

Debroy, B. (1996). *Beyond the Uruguay round: The Indian perspective on GATT*. New Delhi: Sage.

Gilpin, R., & Christopher, W. (1964). *Scientists and national policy making*. New York: Columbia University Press.

Suggested E-Resources:

Science, technology and society. Platform: Sage Journal _____ Link-<https://us.sagepub.com/en-us/nam/science-technology-and-society/journal200804>

Theoretical Approaches. Platform: Jstor.

Link-https://www.jstor.org/stable/24492678?seq=1#metadata_info_tab_contents

Impact of changing technology. Platform: Economic and Political weekly

Link-<https://www.epw.in/journal/1961/11/special-articles/impact-changing-technology-society.html>

Sociology of Health and Medicine

Max. Marks : 100

L T P C

Learning Outcomes:

After the completion of this course, students will be able to

Understand the concept of health and its dimensions from sociological perspective.

Develop a proper understanding of the evolution of social medicine.

Identify the role of hospital as a social organization, its types and functions

Explain concept of community health and social service

Gain insights regarding rehabilitation agencies working in both public and private sector

Section A

Sociology of Health : Concept, Four Dimensions of Health Evolution of Social Medicine in India Concept of Public Health Epidemiology of Disease Attitudes, Beliefs and Values Associated with Diseases. The Sick Role and Patient Role.

Section B

Hospital as a Social Organization, Types of Hospital : General, Speciality Hospital, Sanatoria Hospital, Dispensaries, Corporate Hospital, Functions of Hospitals Medical Social Services in Hospital

Section C

Community Health : The Concept Primary Health Centers : Organization and Functioning. Community Health Problems in India Health Policies of India : Health Insurance. Rehabilitation Agencies : Govt. and Primary sector

Recommended Books :

Col. Rodney, M. (1970). *Sociology of Medicine*. New York: McGraw Hill.

Cockerham, W.C. (1997). *Medical Sociology*. London: Prentice Hall.

Dasgupta, R. (1989). *Nutritional planning in India*. New Delhi: Navrang.

Nayar, K.R. (1998). *Ecology & health: A System approach*. New Delhi. APH Publishing Corporation.

Venkataraman, R. (1979). *Medical sociology in an Indian setting*. Madras: MacMillan.

Albrecht, G.L. (1944). *Advances in medical sociology*. Mumbai: Jai Press.

Rao, M. (1999). *Disinvesting in health, The world bank's prescription for health*. New Delhi: Sage Pub.

Schwartz, H. (1994). *Dominant issues in medical sociology*. New York: McGraw Hill.

Scambler, G., & Higgs, P. (1998). *Modernity, medicine, and health: medical sociology towards 2000*. London: Psychology Press.

Suggested E-Resources:

Critical perspectives of Sociology of health and medicine. Platform: Sage Journal.

<https://us.sagepub.com/en-us/nam/the-sociology-of-health-and-illness/book258978>

Medicine, state and society. Platform: Economic and political weekly.

<https://www.epw.in/journal/2009/16/indigenous-systems-medicine-special-issues-specials/medicine-state-and-society.html>

3. Public Health (general), Sociology of Health & Illness, Platform: Sage Publications.

<http://sk.sagepub.com/books/a-sociology-of-health>

Social Psychology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of this course, students will be able to

Explain the concepts of social psychology.

Understand the self and its development with reference to society.

Identify the influence of various factors on development of personality.

Apply social psychological perspective to understand human behavior

Section A:

Social Psychology: Meaning, Nature, Goals and Scope of Social Psychology and its relation with other Social Sciences. Methods of Social Psychology: Experimental and Non Experimental.

Personality: Meaning, Types and Factors of Personality – Biological, Social and Cultural Factors.

Theories: Mead, Cooley and Freud.

Section B:

Attitude: Meaning, Nature and Function of Attitude, Attitude and Behaviour. Social Perception: Perceiving Ourselves, Self Concept, Self Esteem, Self Perception, Perceiving Others, Forming Impressions, Verbal and Non verbal Cues. Leader and Leadership: Meaning, Traits, Functions and Types. Propaganda and Public opinion

Section C:

Collective Behaviour: Meaning and Types of Collective Behaviour – Crowd and Audience.

Social Prejudice: Meaning and Determinant Factors of Prejudice. Learning: Meaning and Factors – Biological, Psychological and Social. Theories: Pavlov & Kohler.

Motivation: Concept and Classification.

Recommended Books:

Young, K. (2016). *Handbook of social psychology*. Routledge.

Klineberg, O. (1948). *Social Psychology Revised*. New York: Henry Holt Pub.

Newcomb, T. M. (1953). *Social psychology and group processes*. Annual Review of Psychology, 4(1): 183-214.

Kuppuswamy, B. (1980). *An introduction to Social Psychology*. New Delhi: Asia Publishing House.

Ginsberg, M. (1921). *The psychology of society*. Bombay: Asia Publishing House.

Crutchfield, R. S. (1948). *Theory and Problems of Social Psychology*. New York: McGraw-Hill Book Company.

Lindgren, H. C. (1969). *An introduction to social psychology*. London: Wiley.

Lindzey, G., & Aronson, E. (2006). *Handbook of Social Psychology*. London: Addison Wesley Publishing Company.

Asch, S.E. (1987). *Social Psychology*. London: Oxford University Press.

Emerson, R. M., Rosenberg, M., & Turner, R. H. (1981). *Social psychology: Sociological perspectives*. New York: Basic Books Inc. Publishers.

Myers, D. G. (1999). *Social psychology*. London: McGraw-Hill.

Brehm, S. S., and Saul M. Kassin. (1990). *Social psychology*. Boston: Houghton Mifflin Company.

Worchel, S., Cooper, J., & Goethals, G. R. (1991). *Understanding social psychology*. London: Thomson Brooks/Cole Publishing Co.

Suggested E-Resources :

Social Psychology Teaching Resources, Platform- Wesleyan University, Link-
<https://www.socialpsychology.org/teaching.htm>

Products- Psychology Database, Platform- Proquest, Link-
https://www.proquest.com/products-services/pq_psychology_journ.html

3. Introducing Social Psychology, Self, Social Learning, Social Cognition, Attitudes, Behavior, Perceiving Others, Stereotype, Prejudice, Platform: 2012books.lardbucket Link : <https://2012books.lardbucket.org/pdfs/social-psychology-principles.pdf>

Family: Issues and Concerns (Women, Child and Elderly)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this Course student will be able to

Understand the status of Women, Child and Elderly in the contemporary society.

Develop an insight on dynamics of gender relationship and an understanding on changing perspective of women.

Apply their skills in intervening social work practice.

Section-A

Women in Society: Patriarchy and Gender relations in India. Demographic Profile of Women in India in terms of Health and Education. Women and work Issues and Challenges before Women's development

Section B

Child and Childhood: Concept, Stages of Child Development (Theories of Sigmund Freud, Eric Erickson & Piaget) Developmental Need of Children –Physical, Social, Emotional and Cognitive with reference to life cycle approach.

Problems of Growing up: Adjustment and Maladjustment.

Social Work Intervention with Children.

Section-C

Problems and issues related to elderly

Ageing: Concept and Demographic Profile of the ageing population in India.

Perception of the role of the aged in India and situation of elderly in contemporary Indian Society.

Biological and Health aspects of ageing.

Psycho - Social Aspects: Changing roles and functions of family in the society, alienation, Lowering Self –esteem.

Legal Aspect of ageing.

Recommended Books:

Conger, P. C. (1984). *Adolescence and youth: Psychological development in a changing world*. Cambridge : Harper & Row Publishers.

Devadas, R. P., Jaya, N. (1984). *A text book on child development*. Delhi : Macmillan India.

Bee, H. (1989). *The developing child*. (5th Ed.). New York : Harper Collins Publishers.

Hurlock, E. (1968). *Developmental psychology*. New York : McGraw Hill. Publishing Company Limited.

Hurlock, E. B. (1978). *Child development*. Tokyo : Kogokusha: McGraw- Hill. Publishing Company Limited.

Johnson, RC.& Medinnus, G.R. (1974). *Child psychology: behaviour development*. New York : John Wiley and Sons.

Mussen, P.H., Conger, J.J. Kagan, Jermoe, Huston,& Aletha Carol (1984). *Child development and personality*. (6th ed.).New York : Harper & Row Publishers.

Newman, B. M. & Newman P.R. (2012). *Development through life: a psychological approach*. (4th ed.). Belmont : Brooks/Cole Wadsworth.

Papalia, D. E. & Wendkosolds, S. (1994). *Human development*. New Delhi : Tata McGraw-Hill Publishing Company Ltd.

Saraswathi, T.S. (Ed.) (1999). *Culture, socialization, human development*. New Delhi : Sage Publication Pvt. Ltd.

Thompson, G. (2000). *Child psychology: growth trends in psychological adjustment*. New Delhi : Surjeet Publication.

Borgall, E.F. & Mc. Cluskey N.G. (2009). *Ageing and society: current research and policy perspectives*. Bristo : Policy Press.

Desai, K.G. (1982). *Ageing in india: Problems and potentialities*. Mumbai: TISS.

- Lowy, L. (1979) . *Social work with the ageing – The challenge and promise of later years*. New York : Harper & Row
- Pathak, J.D. (1978). *Our elderly: some effects of ageing in Indian subjects*. Bombay : Medical Research Center of the Bombay Hospital Trust.

Suggested E-resources:

Women in Society, Child & Childhood

Platform: Wilder Research, ICRC, Economic and political Weekly.

Link: <https://www.epw.in/journal/2012/35/letters/women-koodankulam.html>

Adjustment & Maladjustment: Characteristics and Causes

Platform: EduGyan.

Link: <http://www.edugyan.in/2017/03/adjustment-maladjustment.html>

Elderly in India, 2016

Platform: GOI, Ministry of Statistics and Programme Implementation.

Link: http://mospi.nic.in/sites/default/files/publication_reports/ElderlyinIndia_2016.pdf

Perspectives on Old Age in India

Platform: Researchgate

Link: https://www.researchgate.net/publication/273125389_Perspectives_on_Old_Age_in_India

Marginalized Groups: Issues and Concerns

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Develop understanding on concepts and status of marginalized groups, their problems and rehabilitation process.

Get acquainted with constitutional provisions related to scheduled castes and tribes, minorities for further practical interventions.

Develop proficiency regarding various government programmes and role of government and NGOs in promoting their overall status.

Take responsibilities as social work professionals in inculcating status of minorities and other backward classes.

Section – A

Concepts of Disabilities : Impairment and Handicap, Causes of disability.

Types: Deafness, Blindness, Mental retardation and Orthopaedic Handicap, Extent of disability in India

Relationship with Family: Needs and difficulties of families with disabled person at different stages.

Role of government in rehabilitation, Role of social work professional in the field of disabilities.

Section–B

Caste System:

Concept, Schedule Caste and Schedule Tribe: Concept, Problems and Constitutional Provisions.

Social Movement related to Schedule Castes and Scheduled Tribes.

Exclusion and Inclusion Patterns of Schedule Caste and Scheduled Tribes.

Role of NGOs and responsibilities of Social Work Professionals in reference to Schedule Castes and Scheduled Tribes.

Section-C

Minorities:

Concept and dimensions of minorities in India. Emergence of OBCs.

Problems of Minorities.

National Minorities Commissions, Sachar Committee: major recommendations and their implementations.

Role of government and NGOs and responsibilities of Social Work Professionals in reference to Minorities and Other Backward Classes.

Recommended Books:

Government of India. (1987-89). *Annual report of the commissioner for Scheduled Caste and Scheduled Tribe*. New Delhi : Shilu Ao Study Team.

Government of India. (1966). *Annual report of the Committee on Customary Rights to Scavengers*. New Delhi : Department of Social welfare.

Kanchnaikil, J. (1985). *Seventh Plan and Development of Weaker Sections (Questions, Challenges and Alternatives)*. New Delhi : Indian Social Institute

Kananaikil, J. (1983). *Scheduled castes and the struggle against inequality*. New Delhi : Indian Social Institute.

Khan, M. A. (1980). *Scheduled castes and their status in India*. New Delhi : Uppal Publishing House.

Kshirsagar, R.K. (1986). *Untouchables in India – Implementation of the law and abolition*. New Delhi : Deep and Deep Publication.

Galaner, M. (1984). *Competing equalities: Law and the backward classes in India*. New Delhi : Oxford University Press.

Nair, T.K. (ed.). (1975). *Social work education and development of weaker sections*. Madras, Association of Schools of Social work.

Suggested E- resources:

Schedule Tribes & Scheduled Caste , Minority

Platform: Asian Centre for Human Right, Sage Publication.

Link:<https://us.sagepub.com/en-us/nam/product/tribe>

Scope of Social Work Practice, Social Work in Disability

Platform: Australian Association of Social Workers.

Link:<https://www.aasw.asn.au/document/item/8665>

Indian Tribes and Issue of Social Inclusion and Exclusion

Platform: Stud Tribes Tribals.

Link:<https://pdfs.semanticscholar.org/86fb/8a5749e7cc297dd7c233fd4d53fc1e08c737.pdf>

Three Models of Affirmative action through the Less of Separation of Powers: South Africa, Canada and India

Platform: National Commission for Backward Classes, India.

Link:<http://www.ncbc.nic.in/Writereaddata/AR%20201213%20Pandey635705824205955927.pdf>

Social Work Profession: Philosophy and Concept

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Acquaint with concept of Social Work, Social Services, Social Welfare, Social Reform, Social Development, Charity, and Philanthropy – various aspects of Social Work.

Develop understanding on Social work profession as well as its existing and emerging role of social work in contemporary society.

Recognize the need and importance of Social Work Education, Training and Practice.

Section – A

Introduction to Social Work:

Concept: Social Work, Social Services, Social Welfare, Social Reform, Social Development, Charity, Philanthropy
Social Work as a Profession, Characteristics of a Profession, Basic Assumption, Values and Functions, Philosophy and Ethics of Social Work, Code of Ethics for Professional Social Workers.

Existing and Emerging Role of Social Work Professionals in Contemporary Society.

Section – B

History of Social Work:

Historical development of Social Work in U.K and U.S.A

Social Reform Movement in India:

Contribution of Different Reformers, Emergence of Social Work in India.

Human Right and Social Justice: Human Right Concern of the Profession in the Background of the Emerging Issues (Natural Disasters, Riots, and Terrorism)

Section – C

Theories of Social Work :

Ecological System and Radical Approach

Marxian Theory and Gandhian Theory

Voluntary Action and Social Work

Emerging Trends in Voluntary Action and Role of Social Work.

Recommended Books:

Chatterjee, P. (1996). *Approaches to the welfare state*. Washington D.C : National Association of Social Workers (NASW).

Diwakar, V.D.(Ed). (1991). *Social reform movements in India: A historical perspectives*. Bombay, Popular Prakashan.

Ganguly, B.N. (1973). *Gandhi's social philosophy, perspective and relevance*. New Delhi : Vikash Publishing House.

Vice, G. & Paul W. (1979). *Ideology and Social Welfare*. London, Routledge and Kegan Paul.

Gore, M.S. (1973). *Some aspects of social development*. Bombay, Tata Institute of Social Sciences.

Gore, M.S. (1993). *The social context of ideology: Ambedkar's social and political thought*. New Delhi : Sage Publications.

Haw & J. (1975). *Towards a new social work*. London : Routledge and Kegan Paul.

Jain, P. (1985). *Gandhian ideas, social movements and creativity*. Jaipur: Rawat Publications.

Lobsie, C. Johnson (1989). *Social work practices*. London: Allyn and Bacon.

Dcacon, L. & Mocdonald. S. J. (2017). *Social work theory and proctice*. UK : Sunderland Sage Publications.

Shastri, R.R. (1996). *Social work tradition in India*. Varanasi, Welfare Forum and Research Organization.

Sinha, S. (1962). *Social thinking of Rabindranath Tagore*. Calcutta, Asia Publishing House.

Timms, Noel & Timms, R. (1997). *Perspectives in social work*. London : Routledge and Kegan Paul.

Wadia, A.R. (1961). *History and philosophy of social work in India*. Bombay: Allied Publishers.

University Grants Commission (1980). *Review of social work education in India: Retrospect and prospect*, New Delhi : University Grants Commission.

Suggested E -resources:

Introduction to Social Work

Platform: NASW.

Link: https://www.socialworkers.org/Careers/Career-Center/Explore-Social-Work/Choose-the-Social-Work-Professionwcd.nic.in/gbsummary/GBppr_AG.pdf

Origin and Development of Social Work in India

Platform: Egyankosh.

Link: <http://egyankosh.ac.in/bitstream/123456789/30212/1/MSW-002.pdf>

Nationalism and Social Reform in India

Platform: The Economic Weekly, EPW.

Link: https://www.epw.in/system/files/pdf/1965_17/38/nationalism_and_social_reform_in_in_dia.pdf

Social Change and Development in India

Platform: NCERT.

Link: <http://ncert.nic.in/ncerts/l/lesy208.pdf>

Theoretical Foundation of Social Work

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this Course, students will be able to

Develop capability on concepts of Social Structure, Norms, Values, Religion, Education, personality, attitude, social perceptions and social prejudices.

Understanding on Basic Economic Problems, National Income and Economic Welfare.

Develop proficiency and ability to adopt a multi-dimensional approach in assessment and interventions.

Section –A

Concept related to Sociology and Psychology:

Society: Concept and Types, Social Structure, Concept of Norms, Values, Religion, Education.

Socialization: Concept and Process

Personality: Meaning, Types and Factors of Personality – Biological, Social and Cultural Factors,

Attitude: Meaning, Nature and Functions of Attitude, Attitude and Behaviour.

Social Perception: Perceiving ourselves, Self concept, Self Esteem, Self perception, Perceiving others, forming impressions, Verbal and Non Verbal cues.

Social Prejudice: Meaning and Determinant Factors of Prejudice.

Relationship of Sociology and Psychology with Social Work.

Section –B

Concept Related to Political Science:

Concept of Welfare State: Right, Liberty, Justice and Equality.

Concept of Power and Authority.

Relationship of Political Science with Social work.

Section -C

Concept Related to Economics:

Economy and Basic Economic Problems, Concept of National Income, National Income and Economic Welfare, Concept of market and Properties of Different market structure, Relationship of Economics with Social Work

Recommended Books:

Johnson, H.M. (1995). *Sociology: A systematic Introduction*. New Delhi : Allied Publishers.

Macionis, J. J. (2006). *Sociology*. (10th ed.). New Delhi : Pearson Education.

Giddins, A. (2001). *Sociology*. (4th Ed.). Cambridge : Polity Press.

Choudhary, M. (2003). *The Practice of Sociology*. New Delhi : Orient Longman.

Oberoi, P. (1993). *Family, Kinship and marriage in India*. New Delhi : Oxford University Press.

Pant,A.D. *Rainiti Shastra Ke Mool Adhar* Allhabad : Kitab Mahal.

Ramaswamy, S. (1995) *Political theory: Ideas and concept*. New Delhi : Macmillan.

Johari, J. C. (1995). *Principles of modern political science*. New Delhi : Sterling Publishers Pvt. Ltd.

Sandhu, G. S. (2018). *Rajniti siddnant*. New Delhi : Mirris Publications.

Agarwal, R.C. (1976). *Political theory (Principles of political science)*. New Delhi : S. Chand and Co. Ltd.

Das, H. H. & Choudhary, B.C. (2005). *Political theory: traditional and modern theory*. Jaipur : National Publishing House.

Held, D. (1989). *Political theory and modern state: Essay on state, power, and democracy*. Cambridge : Polity Press.

Reddy, Y.V. & Goel, S.K. (ed.). (1985). *National income accounting*. New Delhi : IIPA

Sundharam, K.P.M. (1966). *National income accounting*. Kolkata, Niraj Prakashan.

Asrivatham (1998). *Political Theory* (Hindi and English Ed.). New Delhi : S. Chand & Co.

Suggested E-resources:

Social work & Social Science journal

Platform: Oxford academic journals.

Link: https://academic.oup.com/journals/searchresults?page=1&q=social%20science&fl_SiteID=5567&SearchSourceType=1&allJournals=1

Trait and Type Theories of Between Trait and Type Personality, Differences between Trait and Type

Platform: Egyankosh.

Link: <http://egyankosh.ac.in/bitstream/123456789/23532/1/Unit-1.pdf>

The Idea of Welfare and Welfare State

Platform: Researchgate.

Link: https://www.researchgate.net/publication/239531781_The_Idea_of_Welfare_and_the_Welfare_State

Social Work and Its Relationship to other Disciplines

Platform: Egyankosh.

Link: <http://egyankosh.ac.in/bitstream/123456789/30213/1/MSW-003.pdf>

Community Work and Social Action

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to
Be acquainted with Community work as a primary method of social work as well as the process of social action.
Learn skills on application of community work, Community profile, Need assessment, Resource mapping.
Apply Gandhian Perspective of social action, Paulo Friere's techniques of Conscientisation in field work practicum.
Be proficient in understanding model of Community work.

Section – A

Community:
Systems and Characteristics, community as a social system.
Framework to understand the community: Social system, Power system and Ecological system.
Community work as a method of social work, Community development, community organization and Social planning.

Section – B

Community work:
Values, Assumption, Goals and Principles, Stages of community work and role of social worker.
Models of Community Work:
Neighborhood development approach, Area development approach, Local and Economic development approach.
Accountability mechanism.
Strategy for understanding Community and Developing Intervention: Community profile, Need assessment, Resource mapping.

Section – C

Social action:
Concept and Need, Goals and Principle, Social action as a method of social work, Process of social action, Gandhian Perspective of social action, Paulo Friere's techniques of Conscientisation.

Recommended Books:

Ross, M.G. (1967). *Community organisation: theory, principles and practice*. New York : Harper & Row.
Gangrade, K.D. (1971). *Community organisation in India*. Bombay : Popular Prakashan.
Murphy, C.G. (1954). *Community organisation practice*. Boston: Houghton Mifflin Co.
Dayal, R. (1970). *Panchayati raj India*. Delhi : Metropolitan Books Co.
Panda, S. (1985). *Community power, elites and political modernisation*. Delhi : B.R. Publication Company.
Dandekar, V.M. (1977). *Nature of class conflict in the Indian society*. Bombay : Bharat Foundation.
Development Support Team, (1987) *Development support community development: An attempt by people's team: Multipurpose development society*. Pune : DST

Suggested E-resources:

Fieldwork tutorial & guidance

Platform: UCEA, The University of Nottingham.

Link: <https://www.mswguide.org/schools/the-ultimate-field-education-guide/>

The 'Community' in 'Community Social Work'

Platform: Researchgate.

Link: https://www.researchgate.net/publication/319662330_The_'Community'_in_'Community_Social_Work'

The Role of Social Worker in Community Development

Platform: Researchgate.

Link: <https://www.researchgate.net/publication/312297019> The Role of Social Worker in Community Development

The Paulo Freire Literacy Method: A Critical Evaluation

Platform: McGill Journal of Education.

Link: <http://mje.mcgill.ca/article/viewFile/7044/4986>

Methods of Social Work - I: Working with Individuals

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to
Develop theoretical knowledge for practical implications.
Application of Social Case Work process, its tools and techniques and skills as well as its theories.
Play an effective role as trainee social worker in different settings.

Section –A

Introduction to Case Work:
Introduction of the Individuals and family in Society.
Case Work as a method of social work: Historical development of Social Case Work, Scope, Nature, Assumptions, Objectives, Principle of case work. Counselling: Meaning and Nature

Section-B

Case Work in Practice:
Components of Case Work- Person, Place, Problem and Process
Phases of Social case work and Counseling Process.Termination of Counselling
Role of Social case worker and Counsellor in each phase.
Difference and similarities in case work and counseling
Client worker's relationship, use of authority, transference and counter transference.
Tools of Case work Techniques: Interview, Home visit, Recording and Observation relationship &Technique of Case Work Counselling, Supportive, Helping, resource Mobilization, Evaluation, and Exploring Skills of case work.

Section-C

Theoretical approaches to Case work and Counselling:
Behaviour-Modification, Crisis Intervention, Counseling Theories Person-Centered, Rational-Emotive, Cognitive Behavioral Theory .
Social Case Work Practice in different Settings: Family & Child welfare, Correctional, Medical & Psychiatric, School and Occupation.

Recommended Books:

Perlman, H. H. (1973). *Social Case Work-A problem solving process*. Chicago; IL, U.S.A. : University of Chicago Press.
Benerje, G.R. (1973). *Papers on social work-An Indian perspective*. Bombay : Tata Institute of Social Sciences.
Garrett, A. (1972). *Interviewing – Its principles and methods*, New York : Family Service Association of America.
Meyer, C. H. (1924). *Assessment in social work practice*. New York: Columbia University Press.
Hepworth, D. H. (ed.). *Direct social work practice: Theory & Skills*. 8th (ed.). Belmont : Brooks /Cole Carnage Learning.
Kadushin, A. (1997). *The social work interview*. (5th ed.). Australia : Columbia University Press.
Zastrow, C. (1995). *The practice of social work*. (5th ed.). Australia : Brooks/Cole Pub. Co.
Robert & Nee (1970). *Theories of social case work*. Chicago : University of Chicago Press

Suggested E- resources:

What is Social Case Work?
Platform: Social Work Series, The Russell Sage Foundation.

Link: https://www.russellsage.org/sites/default/files/Richmond_What%20is%20Social_0.pdf

Practice of Social Work

Platform: IGNOU.

Link: <http://www.ignou.ac.in/upload/bswe-02-block1-unit-3-small-size.pdf>

The casework techniques used by the social worker in a medical setting, Gordon Nancy

Platform: Boston University. Link: <https://open.bu.edu>

The theoretical foundation of social case work

Platform: Researchgate.

Link: https://www.researchgate.net/publication/280737672_The_Theoretical_Foundation_of_Social_Case_Work

Methods of Social Work - II: Working with Groups

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Proficiently apply Social Group Work method in field work intervention.

Understand group work process, tools and techniques, skills as well as various roles of a social group worker.

Understand the applicability of group work theories in working proficiently with different groups namely children, youth, elderly.

Section – A

Concept of Group:

Importance of groups in society, Types of group, Group work as a method of social work, Scope of group work, Objective, Assumption and Principles of group work.

Section – B

Models of group work :

Social group work process and Role of group workers, Group dynamics and Leadership, Team Work and Mentoring. Supervision, Training groups (T. Groups).

Techniques of group work: Group discussion and Recording. Monitoring and evaluation.

Section – C

Theoretical Approaches:

Gestalt therapy, Transactional analysis, Group therapy, Comparison between group work and group therapy.

Group Work with Different Groups : Children, Person with Disability (P.W.D.), Youth, Older.

Recommended Books:

[Hartman](#), A. & [Laird](#), J. (1983). *Family – Centered social work practice*. Michigan : Free Press

Kanopka, G. (1971). *Social group work – A helping process*. Englewood Cliffs : Prentice-Hall.

Trecker, H.B. (1955). *Social group work – Principles & practice*. New York : Association Press.

Wilson, G. & Ryland, G. (1949). *Social group work practice: The creative use of social process*. Boston : Houghton Mifflin.

Bernard, D. (1975). *The use of group in social work practice*. London : Routledge & Kegan Paul.

Pallassana, R. B. & [Thomas V. Vassil](#) (1983). *Groups in social work: An ecological perspective*. Canada : Macmillan Publishing Company, Incorporated,

Allen, Pincus Anne (1975). *Social work practice: Model and method*. (Itasca) Illinois : FE Minahan Peacock Publishers, Inc.

Compton, B. & Galaway, B. (1984). *Social work process*. (3rd ed.). Homewood Illinois : The Dorsey Press.

Suggested E- resources:

Principles, skills and models of group work practice

Platform: IGNOU.

Link: <http://www.ignou.ac.in/upload/bswe-02-block1-unit-9-small%20size.pdf>

The social group worker's role in group work process

Platform: IGNOU.

Link: <http://www.ignou.ac.in/upload/bswe-02-block1-unit-11-small%20size.pdf>

Group work

Platform: Technical University of Denmark.

Link: <http://www.imm.dtu.dk/~rvvv/CPPS/4Chapter4groupwork.pdf>

Group dynamics

Platform: University of North Florida.

Link: <http://www.unf.edu/~gbaker/Man4240/Chap010a-Group%20Dynamics.pdf>

Quantitative Research Methods in Social Work

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this Course students will be able to
Practically apply quantitative Research method in social work research.
Develop analytical capability in practical application of Quantitative Research Design.
Develop proficiency in preparing reports as well as application of SPSS for data analysis.

Section-A

Research:

Nature, Concept & Types Social Research - Meaning, Characteristics, Purpose, Importance.
Basic Elements of Research - Concept, Theory and Research, Variable, Hypothesis,
Types of Research- Pure, Applied and Action, Qualitative and Quantitative Research.
Ethics in Quantitative Research: Need & Ethical Guidelines in Social Science Research
Steps of Quantitative research

Section –B

Planning and Preparation:

Quantitative Orientation towards Research, Quantitative Research Design: Types & Issues
Sampling: Probability and Non-Probability Sampling
Quantitative Measurement: Index and scaling techniques & its types

Section-C

Quantitative Data Collection and Analysis:

Coding, Tabulation & Analysis of Univariate, Bivariate, Trivariate and Multivariate
Measures of Central Tendency: Mean, Mode, Median and Dispersion
Tests of Significance (Chi square, t Tests)
Quantitative Report Writing: Structure of reports for different readers
Analysis of Variance: Use of SPSS through Practical demonstrations.

Recommended Books:

Alston, M. & Bocoles, W. (2003). *Research for social workers-An introduction to methods*. (Indian ed.). Jaipur : Rawat publications.
Bailey, K. D. (1978). *Methods of social research*. New York : McNeil Publications.
Goode & Hatt (1965). *Methods in social work Research*. New York : Tata Mc Graw Hill. Publishing Company Ltd.
Kothari, C.R. (2004). *Research methodology: Methods and techniques*. (2nd ed.). New Delhi : New Age International.
Padgett, D., K (1998). *Qualitative method in social work research*. New Delhi : Sage Publication.
Polanski, N.A. (ed.) (1960). *Social work research*. Chicago: University of Chicago.
Ramchandran, P. (1990). *Issues in social work research in India*. Bombay : Institute for Community Origination Research.

Suggested E -resources:

Quantitative research methods

Platform: NOVA South Eastern University.

Link:https://education.nova.edu/Resources/uploads/app/35/files/arc_doc/quantitative_research_methods.pdf

Introduction to quantitative research methods

Platform: Researchgate.

Link: <https://www.researchgate.net/publication/265793712>
[Introduction to Quantitative Research Methods](#)

Quantitative data gathering techniques

Platform: Researchgate.

Link: <https://www.researchgate.net/publication/301553608>
[Quantitative Data Gathering Techniques](#)

Student guide to SPSS

Platform: Barnard College.

Link: https://barnard.edu/sites/default/files/inline/student_user_guide_for_spss.pdf

Social Work Practice Skills

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale:

Through this paper, students are expected to develop their practice skills like interpersonal communication, documentation, supervision, there by make them able to do social work research effectively.

Section – A

Introduction to Social Work Practice Skills, Skills used in Micro, Mezzo and Macro Level Practice,
Inclusive Skills: Skills Used With Diverse Population Such as Women and Disabled

Section – B

Communication: Concept, Definition and Process, Verbal and Non Verbal Communication, Self Awareness and Interpersonal Communication, Barriers to Communication

Section – C

Team Work and Mentoring, Documentation, Supervision, Training groups (T. Groups).

Reference:

1. Clueterbuck, D., (1984) : Every needs a mentor, 2nd Edition, London: Institute of Personnel Management.
2. Cournoyer, B., (2000) : The Social Work Skills Workbook, Belmont: Thompson Brooks/Cole
3. Kadushin, A. & Harknass, D., (1985): Supervision in Social Work, 4th Edition, New York: Columbia University Press.
4. Kim, Strom Gottfried, (1999) : Social Work Practice: Cases Activities and Exercises, London: Pine Forge Press.
5. Morales, A.T. & Sheafor, B.W., (1995): Social Work: A Profession of Many Faces, Boston: Allyn and Bacon
6. Robert, R.W. & Nee, R.H., (1970) : Theories of Social Casework, Chicago: The University of Chicago Press.
7. Sevel, J., Cummins L. & Madrigal, C., (1999) : Social Work Skills Demonstrated: Beginning Direct Practice, Boston: Allyn and Bacon

Women Empowerment

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale:

The objective of the paper is to develop students' understanding of the concept of women's empowerment, its historical perspective, its different aspects and institutional support systems to help women empower.

Section A

Introduction to Women's Empowerment: Women Empowerment: Concept and Philosophy, Women Development to Empowerment in India: A Historical Perspective, National Effort and Movements.

Section B

Women and Development: Women and Health- Maternal and Reproductive Health Care.

Women and Education: Rural and Urban.

Women and Employment: Organized and Unorganized Sectors.

Women and Political Participation: Rural and Urban.

Section C

Women and Support System: Constitutional Provisions and Legal Support, Policies on Empowerment of Women 2001, Gender Budgeting, Partnering with Civil Society.

Reference:

1. Anand, U.K. (2001): Working Women and Retirement, New Delhi: Anmol Publication Pvt. Ltd.
2. Bathla, S. (1998): Women Democracy and the Media, New Delhi: Sage Publication
3. Bhaskara Rao, D. (2000): Status of Advancement of Women and Other (ed.), New Delhi: APH Publication Corporation
4. Claire, M., Ranzetti, J. L.L. Edleson, R.K.B. (2001): Source Book on Violence against Women (ed.), New Delhi: Sage Publication
5. Majumdar, M. (2001): Protecting Our Women (3 Volumes), New Delhi: Dominant Publishers and Distributors
6. Nussbaum, Martha, C. (2001): Women, Human Development, New Delhi: Kali for Women
7. Powell, G., N. (ed), (1999): Handbook of Gender Work, New Delhi: Sage Publications.
8. Tripathy, P.C. (2000): Crime against Workforce Women, New Delhi: APH Publishing Corporation

Counseling Theories and Practices

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale:

This paper helps students to develop a holistic understanding of counseling as a problem (both physical and emotional) solving tool and to make them know various theoretical approaches, underpinning goals, values, processes and techniques of counseling the clients. It intends to develop skills and its application to real life situation.

Section A

Counseling: Meaning and Nature Distinction between Counseling and Guidance, Goal of counseling, Basic assumptions and Ethical issues of counseling. Types of Counseling: Individual counseling, Peer counseling, Group counseling, Counselling Theory of Ellen Carni, Family Counselling as a Techique of Social Work.

Qualities of Counselor : Roles and Functions of Counselors in the counseling process.

Section B

Counseling Process: Phases of Counselling

Termination of Counselling:

Skills and Techniques of Counselling

Client/ Clientele System: As Individual or as Unit, Client Behavior and Communication, Voluntary and Non Voluntary Clients, Clients Expectations.

Section C

Approaches and Theories: Background, Thrust, Goals, Key Concepts and Techniques in Approaches: Person-Centered, Psychoanalysis, Rational-Emotive, Existential, Cognitive And Behavioral.

Reference:

1. Bessell, R. (1971) : Interviewing and Counseling. London. B.T. Botsford Ltd.
2. Brammer, L. M. and Macdonald, G. (1996) : Helping Relationship: Process and Skills, Boston: Allyn and Bacon
3. Corey, G. (2000): Theory and Practice of Group Counseling, 5th Edition, Australia: Brooks/Cole.
4. Currie, Fr. (1976) : Barefoot Counselor: A Primer in Building Relationships, Bangalore: Asian Trading Corporation.
5. Dave, I (1983) : The Basic Essentials of Counseling, New Delhi: Sterling Publisher Private Limited
6. Egan, G. (1998) : The Skilled Helper: A Problem Management Approach to Helping, 6th Edition, Pacific Grove, CA: Brooks/Cole.
7. Geldard, K. and Geldard, D. (2000) : Counseling Children: A Practical Introduction, 2nd Edition, London: Sage Publication
8. Maclean, D. and Grould, S. (1988): The Helping Process: An Introduction London: Croom Helm Ltd.
9. Patterson, L. E. and Welfel, E.R. (2000): The Counseling Process, 5th Edition, Australia: Books/Cole.
10. Seden, J. (1999): Counseling Skills in Social Work Practice, Buckingham: Open University Press.

NGOs, Social Advocacy and Networking

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale:

Through this paper the students are acquainted with the concepts relating to social advocacy, its needs and importance for the society. Students are made aware regarding relevant constitutional provisions and legal support systems meant for solving various issues. Students also become aware regarding the role of NGOs, Media, towards social advocacy.

Section A

Concept of Non Government Organization- Societies, Trust, Co- operatives, Civil Society and Voluntary Organization.

Social Advocacy: Concept, Need, Principles, Steps and Means.

Legal Support Mechanism: P.I.L., Lok Adalat, R.T.I., Legal Aid Programme.

Advocacy Issues: Displacement, Water and Forest, Unorganized Sector, Child Abuse.

Section B

Lobbying and Propaganda: Political System and Social Advocacy. Public Opinion, Political Parties, Interest groups and Pressure groups, NGOs and Politics.

Mass Communication: Concept, Importance, Strategies and Techniques (Traditional and Modern), Use of information Technology in social advocacy.

Media Relations: Type of mass media, Strategic choice of media, Media Relation, Sensitizing media and Media documentation (writing news, features, stories etc.)

Section C

NGO Networking : Network and Networking, Generic and Issue based Present Status of networking at National and International Scenario, Models of Networking. Challenges Faced in the sustainability of Network, Importance of Network in Social Advocacy

References:

1. Meyer C. (1999), The Economics and Politics of NGO in Latin America. Praeger Publishers.
2. Dale, R. (2000) : Organisation and development Strategies Structures and Processes. Sage, New Delhi.
3. Dantawala, M.L.et.al. (ed) (1998) : Social Change Through Voluntary action, Sage, New Delhi.
4. Abdelrahman, M. (2004), Civil Society Exposed: The Politics of NGO in Egypt. The American University in Cairo Press. Al- Ahram Weekly ([http:// weekly.ahram.org.eg](http://weekly.ahram.org.eg)) has done a review of the book (<http://weekly.ahram.org.eg/2005/756/bo10.htm>).
5. PRIA. (1989) : NGO – Government Relations, Participatory Research in Asia, New Delhi.
6. Sankaran & Rodrigues (1983) : Handbook for Management of Voluntary Organisation, Alpha Publications, Madras.
7. Kamat, S. (2002) : Development Hegemony: NGOs and the State in India. Oxford University Press, Delhi, New York.
8. Werker & Ahmed (2008): What do Non- Governmental Organisation do?
9. Charnovitz S. (1997), Two Centuries of Participation: NGOs and International Governance, Michigan Journal of international Law, Vol.18, Winter, at 183-286.

Qualitative Research Methods in Social Work

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale:

This paper aims to develop and understand the role of qualitative methods of research in social work theory building and practice enhancement. Understand the nature and application of alternative research paradigms in a practice profession like social work. Develop skills in conceptualizing, designing and executing qualitative research studies

Section A

Qualitative Research Method

Meaning and Rationale of Qualitative Research

Approaches of Qualitative Research- Ethnography, Phenomenology, Grounded Theory, Case Study, Triangulation Steps & Uses of Qualitative research in Social Work

Ethics in Qualitative Research

Section B

Qualitative Data Collection and Analysis

Constructing Qualitative Research Design & Research Question

Population and Sampling in Qualitative Research

Strategies of Data Collection- FGD Transcript, Field Notes, Oral History, Ethnography

Integration of Data Collection and Data Analysis (Content, Thematic & Narrative Analysis)

Section C

Qualitative Report Writing

Emerging trends in Qualitative Writings, The Literature Review

Standard Formats for Referencing & Bibliography: Footnotes & Endnotes

Preparing Research Abstract, Using the Internet for Social Research

Use of Software for Qualitative Data Analysis (Atlas-ti) for Practical demonstrations

References:

1. Denzin, N. & Lincoln, Y, (Eds.) 1994: Handbook of Qualitative Research Thousand Oaks, Sage Publications.
2. Jane, R, & Jane, L. 2003: Qualitative Research Practice: A Guide for social science students and researchers. New Delhi, Sage Publication.
3. Taylor, G. R. 2000: Integrating Quantitative and Qualitative Methods in Research Maryland, University Press of America.
4. Marshall, C. & Rossman, G. B. 1995: Designing Qualitative Research, 2nd Edition Thousand Oaks, Sage Publications.
5. Bruce, B. L. 1995: Qualitative Research Methods in Social Sciences. Boston Allyn and Bacon.
6. Podgett, D. 1998: Qualitative Methods in Social Work Research. Challenges and Rewards. New Delhi, Sage Publications.
7. Krueger, R. A. 1988: Focus Groups: A Practical Guide for Applied Research Newbury Park, Sage Publications.
8. Yin, R. k. 1984: Case Study Research: Design and Methods. Beverly Hills, sage Publications.
9. Dobbett, M. L. 1982: Ethnographic Research: Theory and Application for Modern Schools and Societies. New York, Praeger.
10. Miles, M. & Huberman, A. 1994: Qualitative Data Analysis: A Sourcebook of New Methods, 2nd Edition. Thousand Oaks, Sage Publications.

Social Policies and Social Legislations

L T P C

5 0 0 5

Max. Marks : 100

(CA: 40 + ESA: 60)

Rationale:

This paper acquaints the students regarding social policies and legislations, their objectives especially in Indian context. It helps the students to develop critical insight to evaluate the government policies in the planned social change and there by to enable the students to suggest the ways for its effective implementation.

Section A

Social Policy and Social Welfare Policy: Concept, Evolution of social policy in India, Sources of social policy, Social policy and Planned Social Change. Model of Social Policy, Process of Social Policy Formulation in India.

Section B

Social Legislations in India:

Social Legislations: Definition and Role in a Welfare State.

Personal laws: Hindu, Muslims, Christian

Social legislation as an instrument of social change.

Section C

Legislation Regarding Social Problems: Protection of Civil Right Act (1955), Dowry Prohibition Act (1961), Immoral Traffic Prevention Act (1956), Bonded Labour Abolition Act (1976), Transplant of Human Organs Act (1994), Protection of Domestic Violence Act 2005.

Factors impeding the effective implementation of Social Legislation,

References:

1. Ahmad. E. Dreze. J. (1991): Social Security in Developing Countries, New Delhi: Oxford University Press.
2. Bank. R. K. (1997): Welfare Administration in India: A Critical Evaluation, Indian journal of public Administration, XLIII: 749-757.
3. Basu D.D. (2004): Introduction to the Constitution of India, Agra: Wadhwa And Company Law publishers.
4. Behn. R.D. (1985): Policy Analyst, Dlients and Social Scientist, Journal of Policy Analysis and management, 4 (3): 428-432.
5. Charles, L. Cochram, Eloise F. malone (2007): Public Policy: Perspectives and choice, New Delhi: Viva Books Pvt. Ltd.
6. Gal, I. W. and Gal, J. (2007): Social Workers Attitudes Towards Social Welfare Policy, international Journal of Social Welfare, 16: XXX.
7. Gangapathy, R.S. et al (eds), (1985): public policy and policy Analysis in India, New Delhi: Sage publications.
8. May, P.J. & Cho, Y.H. (1989): Policy Analysis: Past, Present and Future, Public Administratio Review, 49(2): 210-212.
9. Meth, C. (2004): Ideology And Social Policy: Handouts And The Spectre of Dependency Transformation, 56: 1-30.
10. Midgley, J.O. (2000): The Handbook of Social Policy, New Delhi
11. Rastogi, P.N. (1992): Policy Analysis and problem Solving for Social Systems, New Delhi: Sage Publications.
12. Padhy, P. (ed.), (2006): Social Legislation and Crime, New Delhi: Isha Books.
13. Parrot, I. (2002): Social Work and Social Care, London:Routledge

Rural Community Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to
Sensitively understand the challenges in rural settings.
Understand the functioning of various rural community development programme in India.
Proficiently apply their knowledge and social work competencies in field work intervention while working in a rural setting.

Section- A

Rural Development :

Meaning, Concept and Challenges of rural Development Rural Poverty-Socio-economic and Cultural Characteristics, Problems, Survival and Coping Patterns of Rural Poor.

Section- B

Role of Co-operatives and Rural Banks :

National Bank Agriculture and Rural Development (NABARD), District Rural Development Agency in Rural Development (DRDA)

Rural Community Development Programme :

Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) Food Security Act 2013, Deen Dayal Upadhyay-Gram Kaushal Yojana (DDUKSGY) Desert Development Programme (DDP)

Poverty Alleviation Programme :

Swarnjayanti Gram Swarajgar Yojana (SGSY) Rashtriya Gram Swaraj Yojana (RGSY) Desert Prone Areas Programme (DPAP) Indira Aawas Yojana (IAY)

Role of Government and NGOs and responsibilities in Rural Development,

Section- C

Administrative and Organizational Arrangement for Rural Development : Panchayati Raj-Origin, Philosophy and Characteristics, 73rd Amendment and its implications.

Recommended Books:

Narang, A. (2006). *Indian rural problems*. New Delhi : Murari Lal & Sons.

Shah, D. (2005). *Rural sociology*. India, ABD Publisher.

Sharma, R. K. (2004). *Rural sociology*. New Delhi : Atlantic Publishers and Distributors

Doshi S. L. (2002). *Rural sociology*. Jaipur, Rawat Publications.

Mishra, A. K. (1998). *Rural tension in India*. New Delhi : Discovery Publishing House.

Singh, R. (1986). *Rural development and social legislation. India : A dilemma*. New Delhi : Ajanta Publication

Jain, N. P. (1970). *Rural reconstruction in India and China* (A comparative study). Bhopal : Writers and Publishers Corporation.

Desai, A. R. (2009). *Rural sociology*. Bombay : Popular Prakashan.

Singh, K. (2009). *Rural development principles, policies and management*. New Delhi : Sage Publication.

Karalay, G. N. (2005). *Integrated approach to rural development: Policies, programmes and strategies*. New Delhi : Concept Publishing Company.

Bohare, R. (1995). *Rural poverty and unemployment in India*. New Delhi : Northen Book Centre.

Report, 2005-06, *National programme NRHM*. National Health Accounts Cell Ministry of Health and Family Welfare Government of India (In collaboration with WHO India Country Office).

Evaluation report on sarva shiksha abhiyan (2010). *Report of sarva shiksha abhiyan* New Delhi : Planning Commission Government of India..

Mihir Shah Committee February, (2012). *Report of Mahatma Gandhi National Rural Employment Guarantee Act-2005*: Delhi : Ministry of Rural Development, Government of India

Madan, G.R. (2007). *Co-Operative movement in India*. New Delhi : Krishna Mittal and Mittal Publication.

Suggested E-resources:

Rural Development

Platform: Planning Commission.

Link: http://planningcommission.nic.in/plans/stateplan/sdr_punjab/sdrpun_ch5.pdf

Role of Cooperative banks in Financial Inclusion

Platform: ResearchGate.

Link: https://www.researchgate.net/publication/304483927_Role_Of_CoOperative_Banks_In_Financial_Inclusion

The Role of NGOs in Rural Development with special reference to women

Platform: Shodhganga.

Link: http://shodhganga.inflibnet.ac.in/bitstream/10603/18591/9/09_chapter%203.pdf

Panchayati Raj in action: A study of Rajasthan.

Platform: The Economic and Political Weekly.

Link: https://www.epw.in/system/files/pdf/1964_16/5-6-7/panchayati_raj_in_actiona_study_of_rajasthan.pdf?0=ip_login_no_cache%3Dcad5026513d674a3e03b085d56bf41a

Social Welfare Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Develop their competency on management of Social Welfare agencies.

Understand the applicability of planning, formulating, operating and monitoring projects for an effective impact among target beneficiaries.

Apply varied techniques in developing project proposals for effective monitoring and evaluation.

Understand the importance in fund raising and resource utilization in a project.

Section A

Social Welfare & Development Management:

Nature and Scope.

Social Welfare Programme:

Methods and Models, Ideology and Social Welfare Management, State, International Organization and Social Welfare Organisation.

Section B

Project Management-I :

Programme Model Approach: Input, Activities, Output and Impact.

Project Cycle Approach: Logical Framework Approach (LFA) and Programme, Evaluation and Review Technique (PERT).

Project Formulation: Situational Analysis, Social and Organizational Assessment.

Resource Planning: Budgeting and Financial Accounting.

Section C

Project Management-II :

Project Appraisal: Social, Technical and Financial Analysis.

Monitoring and Evaluation: Nature, Types & Techniques.

Fund Raising: Methods, Sources, Donor Reporting, Public Relation and Media Management.

Recommended Books:

Gangrade, K.D. (1989). *Development of people*. New Delhi : Delhi School of Social Works, University of Delhi.

Goel, S.L. & Jain, R.K. (1988). *Social welfare administration*. (Vol. I, II). New Delhi : Deep and Deep Publications.

Goel, S.L. (1990). *Modern management techniques*. New Delhi : Deep and Deep Publications.

Pranjpe, N. (1990). *Social welfare in India*. New Delhi : Associate Publishing House.

Sachdeva, D.R. (1993). *Social welfare administration*. Allahabad : Kitab Mahal.

Specker, P. (1988). *Principles of social welfare*. New York : Routledge.

Weinbach, R., W. (1998). *The social worker as manager*. London: Allyn & Bacon.

Suggested E-resources:

Social welfare administration: concept, nature and scope.

Platform: IGNOU.

Link: <http://www.ignou.ac.in/upload/Bswe-003%20Block-2-UNIT-6-small%20size.pdf>

Logical framework analysis

Platform: The Global Development Research Centre.

Link: <http://www.gdrc.org/ngo/logical-fa.pdf>

Project formulation

Platform: Central Institute of Fisheries Education.

Link: http://eprints.cmfri.org.in/9671/1/Project_Formulation.pdf

Project Appraisal

Platform: Distant Production House University

Link: http://www.dphu.org/uploads/attachements/books/books_2358_0.pdf

Feminist Theory and Feminist Thought

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Be acquainted with issues related to feminism.

Understand the concept of WID, WAD and GAD.

Imbibe knowledge on Foundations of Feminist Theories.

Section- A

Concept:

Feminism, Development, Women/Gender, Sexual Division of Labour, Patriarchy.

Emergence of Women as a Constituency in Development: WID, WAD, and GAD

Section- B

Feminist Classics Key Thinkers:

Mary Wallstone Craft, Simone de Beauvoir

Indian Feminist Thought: Gandhi, Annie Besant, Sarojini Naidu, Veena Mazumdar, Ela Bhatt, Lotika Sarkar

Section- C

Feminist Theory:

Liberal, Radical, Marxist- Socialist, Foundations of Feminist Theories.

Recommended Books:

Bhagwat V. (2004). *Feminist social thought*. New Delhi : Rawat Publication.

Clough, P. (1994). *Feminist thought*. Oxford : Blackwell.

Collins, P.H. (2004). *Black feminist thought*. London : Routledge.

Eagrlton M. (Ed.). (2003). *A concise companion to feminist theory* Hoboken, New Jersey : Wiley Blackwell

Kaplan, C. (2000). *Genders*. London : Routledge.

Nicholson L. (Ed.). (1997) *The second wave: A reader in feminist theory*. New York : Routledge.

Schneir, S.C. (1993). *Fire eminent women*. New Delhi : ANMOL Publication.

Dowovan, J. (2000). *Feminist theory*. London : Continuum.

Suggested E-resources:

Feminism

Platform: McGraw Hill Education.

Link: <https://www.mheducation.co.uk/openup/chapters/0335204155.pdf>

Women's movements, feminism and feminism movments

Platform: Researchgate.

Link: https://www.researchgate.net/publication/288623012_Women's_movements_feminism_and_feminist_movements

WID, WAD, GAD: Trends in Research and Practice

Platform: IDRC Digital library.

Link: <https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/5225/34345.pdf?sequence=1>

A classification of Feminist theories

Platform: Researchgate.

Link: https://www.researchgate.net/publication/38105958_A_Classification_of_Feminist_Theories

Women and Health

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Be competent to acquaint with concept of Health status of women.

Develop understanding on the functioning of modern health care system, policies and programmes in promoting better health status of women in India.

Apply their analytical skills in to identify means to combat critical health status of women globally, as well as of sex workers and marginalized groups.

Section- A

Demographic Profile of Women :

Understanding of Women Health. Gender Bias- The Historical and Ideological Context.

Modern Health Care System :

Primary, Secondary and Tertiary level Health Care Structure and their Functions. Public Health Programmes in India: Legislation and Policies regarding Health in India-National Rural Health Mission (NRHM), National Health Policy.

Feminist Discourse.

Section- B

Women Across the life Cycle:

Adolescence to Old Age.

The Communicable diseases: Tuberculosis, Leprosy, STD, AIDS, and Poliomyelitis and Government Programmes.

Global Challenges and Women Health, Women and the Caste Question, Dalit and Indigenous Women, The Sex Workers' Debate.

Ageing Problem of Women.

Section- C

Mental Healthcare scenario in India:

Women and Mental Health:

Clinical and Social Aspect, Women and Depression, Treatment Approaches and Intervention.

The Development of Personality and Emotional Disturbance during Adolescence and Young age, Emotional Problem in Work and Marriage during Adulthood, Emotional Maturity.

Recommended Books:

Gracious, T. (1997). *AIDS social work and law*. New Delhi : Rawat Publications.

Dandekar, K. (1996). *The elderly in India*. New Delhi : Sage Publications.

Brook, E & Davis, A. (1985). *Women, the family and social work*. London : Tavistock Publication.

Harven & Kathleen (1977). *Aging life and course*. London : Gavistock Publication.

Birren J. R. & Sloane R. B. (1966). *Handbook of mental health and ageing*. New Jersey: Prentice Hall Englewood Clibbs.

Qadeer, I. (2000) . *Health care systems in transition journal of public health medicine*, Vol- II. Great Britain.

Sharma, N. (1999). *Adolescent girl child in India*. New Delhi : News Bulletin of the Indian Council of Child Welfare.

Caplan, G. (1961). *An approach to community mental health..* New York : Routledge.

Roy, S. (1962). *A handbook of preventive and social medicine*. Calcutta : Academic Publishers.

Suggested E-resources:

Women and Health

Platform: United Nations.

Link: <http://www.un.org/womenwatch/daw/beijing/beijingat10/C.%20Women%20and%20health.pdf>

From adolescence to later adulthood: femininity, masculinity, and androgyny in six age groups

Platform: Researchgate.

Link: https://www.researchgate.net/publication/225573103_From_Adolescence_to_Later_Adulthood_Femininity_Masculinity_and_Androgyny_in_Six_Age_Groups

Global health

Platform: WHO.

Link: <https://www.who.int/whr/2003/en/Chapter1.pdf?ua=1>

Women's Mental Health: Promoting a Gendered Approach to Policy and Service Provision

Platform: The Women's Health Council.

Link: <https://health.gov.ie/wp-content/uploads/2014/03/Womens-Mental-Health-Promoting-a-Gendered-Approach-to-Policy-and-Service-Provision.pdf>

Women and Law

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Develop capacity to understand constitutional provisions related to women.

Comprehend Criminal Procedure Code Arrest and Examination, IPC, Eve Teasing, Molestation, Adultery, Abduction, Kidnapping, Rape.

Analyze important judgments, international convention, and emancipation of women – a socio- legal perspective.

Section- A

Constitution and Indian Women :

Constitutional Provisions relating to Women, Family Law : Marriage (Hindu, Muslim, Christian, Parsi), Marital relief and Divorce, Maintenance and Custody of Children, Inheritance and Succession, Adoption Procedure, Minority and Guardianship, Female Foeticide, Women Property, Family Court PCPNDT Act, 1994, Domestic Violence, Sexual, Harassment at Work Place

Section- B

Women and Industrial Law:

Equal Remuneration for Women, Maternity Benefits, Protection from Retrenchment, Prohibition of Employment of Women during Certain Period.

Special Provision for Women in Labour Legislation: Crèche, Special Provision for Rest rooms

Section- C

Criminal Procedure Code:

Bailable and Non Bailable Offences, Arrest and Examination Indian Penal Code: Eve Teasing, Molestation, Adultery, Abduction, Kidnapping, Rape.

Policies Related to women: National Commission for Women, Important Judgments, International Convention, Emancipation of Women-A Socio-Legal Perspective

Recommended Books:

Dube, L. & Palriwala R. (Ed.) (1989). *Structure and strategies: Women*. (Work and family in Asia, Vol.3). New Delhi : Sage Publications.

Uberoi, P. (Ed.). (1996). *State, sexuality and social reforms*. New Delhi : Sage Publications.

Kanpur R. (Ed.) (1996). *Feminist terrains in legal domains*. New Delhi : Kali for Women.

Butalia, U & Sarkar, T. (Ed.) (1996). *Women and hindu right*. New Delhi : Kali for Women.

Sangari K. (1999). *Political of possible*. New Delhi : Tulika.

Kant, A. (1997). *Women and law*. New Delhi : APH Publishing Corp.

Akhieanarda, S. (1952). *Mental health & hindu psychology*. London : George Allen & Unwin Ltd.

Favazza, A.R. (1976). *The psycho-dynamics of family life*. New York : Basic books Inc.

Suggested E- resources:

Women's Rights in India

Platform: Researchgate.

Link: https://www.researchgate.net/publication/323825501_Women's_Rights_in_India

Family Courts in India: An analysis

Platform: shodhganga.

Link: http://shodhganga.inflibnet.ac.in/bitstream/10603/166330/1/10_chapter3.pdf

Critical Assessment of Labour Laws, Policies and Practices through a gender lens

Platform: Ministry of Women and Child Development, GOI.

Link: <http://www.shram.org/uploadFiles/20141204062826.pdf>

Legal provisions for the women welfare and safety

Platform: Shodhganga.

Link: http://shodhganga.inflibnet.ac.in/bitstream/10603/153565/11/11_chapter%203.pdf

Industrial Relations and Legal Environment

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Comprehend concepts of Industrial relations, grievance Handling, collective bargaining, role of Trade Union and welfare officer.

Understand Industrial legislations, process of Industrial relations, collective.

Proficiently perform their role as Industrial Relation Officer.

Section-A

Industrial Relation:

Concept, Nature and Objective

Grievance: Concept Characteristics, Process of Collective Bargaining.

Industrial Relation in changing scenario, The Role of State, Employees and Trade Union, Role of Labour Welfare Officer in Industrial Relations.

Section-B

Labour Legislation:

History of Labour Legislation in India,

Industrial Law as distinguished from Common Law, Industrial Labour Code (ILC) Industrial Relations Legislation : Indian Trade Unions Act 1926, Industrial Disputes Act, 1947, Factories Act, 1948,

Legislation Related to Children: Child Labour (Abolition and Regulation) Act, 1986

Section-C

Employment Legislation:

Industrial Employment Act, 1946, Employment Exchanges Act, 1959, Apprentices Act, 1961. Contract Labour Legislation: Contract Labour (Regulation and Abolition) Act, 1970. Wage Legislation: Payments of Wages Act, 1936, Minimum Wages Act, 1948, Payment of Bonus Act, 1965.

Recommended Books:

Agarwal, S.L. (1978). *Labour relations law in India*. Delhi: Macmillan.

Banerjee, N. (1975). *Women workers in the unorganized sector*. Hyderabad : Sangam Books.

Ghosh, S. (1960). *Trade unionism in the under- developed countries*, Calcutta : Bookland Pvt. Ltd.

I.L.O. (1978). *Special services of rural worker' organization: A workers' education manual*. Geneva : The Author.

Joshi, Preeta (1985). *I.L.O. and its impact of India*. Delhi : B.R. Publishing Corporation.

Mathur, J. S. (1964). *Indian working class movement*. Allahabad : The Author.

Mukherje, I. (1985). *Industrial workers in a developing society*. Delhi : Mittal Publications.

Sarma, A.M. (1996). *Labour welfare, social security and trade unionism*. Delhi : Himalaya Publishing House.

Sood, S. (1987). *Trade union leadership in India*. Delhi : Deep & Deep Publication.

Zaheeruddin (1985). *Labour welfare laws and employment conditions in India* (With special Reference to Beedi and Cigar Workers) New Delhi : Deep & Deep Publication.

Suggested E - resources:

A study of Industrial Relation in India

Platform: International Journal of Development Research.

Link: <https://www.journalijdr.com/sites/default/files/issue-pdf/9540.pdf>

Labour Law in India: Structure and Working

Platform: Researchgate.

Link: https://www.researchgate.net/publication/260276132_Labour_Law_in_India_Structure_and_Working

The Indian Legal System

Platform: Researchgate.

Link: https://www.researchgate.net/publication/47704506_The_Indian_Legal_System

Employee Legislation

Platform: Pondicherry University.

Link: http://www.pondiuni.edu.in/storage/dde/downloads/hrmiii_el.pdf

Organizational Behavior at Work

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Competent in organizational Behaviour and Human Relation in an Organization.

Understand and manage behavioural pattern in an organization.

Proficient in solving and managing malfunctions in Organization.

Section- A

Conceptual Understanding of Organizational Behaviour.

Human Behavior and Relation within Organization, Historical Background of Organization Behavior.

Model of Organization Development:

OCTAPACE Model Understanding and Managing Individual Differences, Personality, Values, Attitudes, Abilities and Skills.

Section- B

Concept of Perception and Emotional Intelligence:

Motivation: Concept and Theories- Maslow, McGregor, McClelland, Vroom's and Locus of Control Theory, Concept of Stress, Conflict and Change Management in Organization.

Managing Misbehavior at Work: Sexual Abuse, Cyber Stalking, Aggression and Violence.

Section- C

Communication: Concept, Theories and Barriers

Leadership: Understanding Leadership, Concept, Theories and Types, Group and Group Dynamics, Team Work, Corporate Values, Ethics and Social Responsibility.

Recommended Books:

Bratton, J., Callinan M., Forshaw C. & Sawchuk, P. (2007). *Work and organisational behavior*. New York : Palgrave Macmillan.

Buelens, M., Broeck, H.V.D., Vanderheyden, K., Kreitner, R. & Kinicki, A. (2006) *Organisational behavior*. (3rd ed.). Berkshire : McGraw-Hill Education.

Champoux, J. E. (2001). *Organizational behavior: essential tenets for a new millennium south western thomson learning* Ahmedabad, Team Spirit (India) Pvt. Ltd.

Chandan, J. S. (1996). *Organizational behavior*. New Delhi : Vikas Publishing House Pvt. Ltd.

Daft, R. L. & Raymond, N. A. (2001). *Organizational behavior*. USA : Harcourt College Publishers.

Gannon, M., J. (1989). *Organizational behavior-A managerial and organizational perspective*. Little Boston/Toronto : Brown and Company.

Hersay, P. and Blanchard, H. K. (1988). *Management of organisational behaviour: Utilizing Human Resources*. New Delhi : Prentice Hall of India Private Limited.

Hersey, P. and H. Kenneth Blanchard, Johnson, E. D. (2006). *Management of organizational behavior: Leading human resources*. (8th ed.). India : Pearson Education Asia.

Hitt, M. A., Miller, C. C. & Colella, A. (2006). *Organizational behavior: A strategic approach*. USA : John Wiley & Sons. Inc.

- Luthans, F. (2008). *Organisational behaviour*. New York : McGraw-Hill Higher Education.
- Mullins, L. J. (2013). *Management and organizational behaviour*. Harlow, United Kingdom : Essex. Pearson Education Limited.
- Newstrom, J. W. & Davis, K. (2007) *Organizational behavior- human behavior at work*. New Delhi : Tata McGraw-Hill Publishing Company Limited.
- Pestonjee, D. M., & Pareek, U. (Eds.). (1997) *Organizational role stress & coping*. Jaipur : Rawat Publications.
- Robbins, S. P. (1996). *Organizational behaviour*. Delhi : Pearson Education Pvt. Ltd.
- Robbins, S. P. & Judge T. A. (2007). *Organizational behavior*. (12th ed.). New Delhi : Prentice Hall of India.

Suggested E - resources:

Organisational Behaviour An Introduction

Platform: Macmillan Education.

Link: https://www.macmillanihe.com/resources/sample-chapters/9781137429445_sample.pdf

A study of Organizational Culture: Octopace Profile

Platform: IOSR Journal of Business and Management (IOSR - JBM).

Link: <http://www.iosrjournals.org/iosr-jbm/papers/Vol19-issue2/Version-3/N1902038792.pdf>

Maslow's Need Hierarchy Theory: Applications and Criticisms

Platform: Global Journal of Management and Business Studies. Research India Publications.

Link: https://www.ripublication.com/gjmbs_spl/gjmbsv3n10_03.pdf

Understanding and managing misbehavior in organizations

Platform: ResearchGate.

Link: https://www.ResearchGate.net/publication/291158812_Understanding_and_managing_misbehavior_in_organizations

Introduction to Human Resource Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this Course students will be able to

Acquaint with concepts of Human Resource Management (HRM), Human Resource Development (HRD) and Personnel Management (PM).

Understand the Function of Human Resource Manager

Manage Disciplinary Action related to HRM as well as Employee Counseling.

Section- A

Conceptual Understanding :

Concept of Human Resource Management (HRM), Human Resource Development (HRD) and Personnel Management (PM)

Function of HRM: Human Resource Planning, Recruitment, Placement, Selection, Induction, Orientation, Performance Management, Wage and Salary Administration, Handling Employee Grievance, Discipline and Disciplinary Action, Employee Counseling.

Section- B

Training and Development:

Meaning, Importance, Need Assessment, Methods of Training, Training Evaluation

Internal Mobility: Transfer, Promotion, Demotion, Absenteeism and Turnover

Personnel Research: Personnel Records and Research, Human Resource Audit and Human Resource Information System.

Section- C

Human Relations Skills and HRM:

Use of skills in Human Relation for Managing People in Industry, Management by Objective, Accountability, Socio-Political Climate and HRM.

Employee's Self Development: Psychology of the Working Class, Employee's Motivation for Self Development through HRD Programmes in Industry.

Recommended Books:

Arnold & Feldman (1987). *Organizational behaviour*. New Delhi : McGraw Hill Publishing Company Limited.

Asgwatgaoa, K. (1997). *Human resources and personnel management*. New Delhi : Tata McGraw Hill Publishing Company Limited.

Beardwell, I. and Holden, L. (1998). *Human resource management*. (2nd ed.). London : Pitman Publishing.

Beumont, P.B. (1993). *Human resource management: Key Concepts and Skills* : London, Sage Publishing.

Dessler, G. (1997). *Human resource management*. New Delhi : Prentice Hall.

Dwivedi, R.S. (1982). *Management of human resources*. New Delhi : Oxford and IBH Publishing Co.

Flippo, E.B. (1984). *Principles of personnel management*. New York : McGraw Hill Publishing Company Limited.

Goss, D. (1997). *Human resource management*. London : Thompson Business Press.

Legge, K. (1995). *Human resource management: Rhetoric and reality*. London : Macmillan.

Mabey, C. Salaman G. and Storey, J. (1998). *Human resource management: A strategic introduction*. Oxford : Blackwell.

Memoria, C.B. (1990). *Personnel management*. New Delhi : Himalaya Publishing House.

Newstrom & Davis (1987). *Organization behavior: Human behavior at work*. New Delhi : McGraw Hill Publishing Company Limited.

Robins, S. P. (1966). *Organization behavior*. New Delhi : Prentice Hall.

Saini, Debi S. & Sami, A Khan (Ed.) (2000). *Human resource management-perspectives in the new era*. New Delhi : Response Books.

Singh, P.N. (1992). *Developing and managing human resources*. Bombay : Suchandra Publications.

Suggested E - resources:

Human Resource management

Link:https://www.researchgate.net/publication/305954894_Human_Resource_Management_Theory_and_Practice

Human Resources Information System (HRIS): A Theoretical Perspective

Platform: ResearchgateLink:https://www.researchgate.net/publication/272668111_Human_Resources_Information_System_HRIS_A_Theoretical_Perspective.

The Roles, Competencies and Skills of HRM Professionals in Indian Organisations

Platform: Researchgate.

Link:https://www.researchgate.net/publication/295920930_the_roles_competencies_and_skills_of_hrm_professionals_in_indian_organisations

Training and Development: Issues in the Indian Context

Platform: Global Journal of Finance and Management. Research India Publications.

Link:https://www.ripublication.com/gjfm-spl/gjfmv6n7_01.pdf

Rural Community Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to
Sensitively understand the challenges in rural settings.
Understand the functioning of various rural community development programme in India.
Proficiently apply their knowledge and social work competencies in field work intervention while working in a rural setting.

Section- A

Rural Development :

Meaning, Concept and Challenges of rural Development Rural Poverty-Socio-economic and Cultural Characteristics, Problems, Survival and Coping Patterns of Rural Poor.

Section- B

Role of Co-operatives and Rural Banks :

National Bank Agriculture and Rural Development (NABARD), District Rural Development Agency in Rural Development (DRDA)

Rural Community Development Programme :

Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) Food Security Act 2013, Deen Dayal Upadhyay-Gram Kaushal Yojana (DDUKSGY) Desert Development Programme (DDP)

Poverty Alleviation Programme :

Swarnjayanti Gram Swarajgar Yojana (SGSY) Rashtriya Gram Swaraj Yojana (RGSY) Desert Prone Areas Programme (DPAP) Indira Aawas Yojana (IAY)

Role of Government and NGOs and responsibilities in Rural Development,

Section- C

Administrative and Organizational Arrangement for Rural Development : Panchayati Raj-Origin, Philosophy and Characteristics, 73rd Amendment and its implications.

Recommended Books:

Narang, A. (2006). *Indian rural problems*. New Delhi : Murari Lal & Sons.

Shah, D. (2005). *Rural sociology*. India, ABD Publisher.

Sharma, R. K. (2004). *Rural sociology*. New Delhi : Atlantic Publishers and Distributors

Doshi S. L. (2002). *Rural sociology*. Jaipur, Rawat Publications.

Mishra, A. K. (1998). *Rural tension in India*. New Delhi : Discovery Publishing House.

Singh, R. (1986). *Rural development and social legislation. India : A dilemma*. New Delhi : Ajanta Publication

Jain, N. P. (1970). *Rural reconstruction in India and China (A comparative study)*. Bhopal : Writers and Publishers Corporation.

Desai, A. R. (2009). *Rural sociology*. Bombay : Popular Prakashan.

Singh, K. (2009). *Rural development principles, policies and management*. New Delhi : Sage Publication.

Karalay, G. N. (2005). *Integrated approach to rural development: Policies, programmes and strategies*. New Delhi : Concept Publishing Company.

Bohare, R. (1995). *Rural poverty and unemployment in India*. New Delhi : Northen Book Centre.

Report, 2005-06, *National programme NRHM*. National Health Accounts Cell Ministry of Health and Family Welfare Government of India (In collaboration with WHO India Country Office).

Evaluation report on sarva shiksha abhiyan (2010). *Report of sarva shiksha abhiyan* New Delhi : Planning Commission Government of India..

Mihir Shah Committee February, (2012). *Report of Mahatma Gandhi National Rural Employment Guarantee Act-2005*: Delhi : Ministry of Rural Development, Government of India

Madan, G.R. (2007). *Co-Operative movement in India*. New Delhi : Krishna Mittal and Mittal Publication.

Suggested E-resources:

Rural Development

Platform: Planning Commission.

Link: http://planningcommission.nic.in/plans/stateplan/sdr_punjab/sdrpun_ch5.pdf

Role of Cooperative banks in Financial Inclusion

Platform: ResearchGate.

Link: https://www.researchgate.net/publication/304483927_Role_Of_CoOperative_Banks_In_Financial_Inclusion

The Role of NGOs in Rural Development with special reference to women

Platform: Shodhganga.

Link: http://shodhganga.inflibnet.ac.in/bitstream/10603/18591/9/09_chapter%203.pdf

Panchayati Raj in action: A study of Rajasthan.

Platform: The Economic and Political Weekly.

Link: https://www.epw.in/system/files/pdf/1964_16/5-6-7/panchayati_raj_in_actiona_study_of_rajasthan.pdf?0=ip_login_no_cache%3Dcad5026513d674a3e03b085d56bf41a

Tribal Community Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to

Competent in comprehending the nature and characteristics of tribal community.

Develop understanding on various constitutional provisions and government initiated programmes for promoting the conditions of tribal communities.

Apply their proficiency as a professional social worker while rendering quality services for the well being of tribal society.

Section-A

Introduction to Tribal Community:

Tribal Community-Meaning, Definitions, Nature and Characteristics.

Power Structure-Analysis of Economic, Social and Political Factors influencing Tribal Power Structure.

Tribal Poverty-Socio-economic and Cultural Characteristics, Problems, Survival and Coping Patterns.

Section-B

Tribal Welfare and Development:

Constitutional Safeguards, Five Year Plans, Sub-Plans for Tribal Area, National Commission for Schedule Tribes, Tribal Cooperative Marketing Development Federation of India Ltd. (TRIFED)

Section-C

Panchayat Extension in Scheduled Areas (PESA) :

Role of panchayat in Tribal Development

Role of Government and NGOs and Responsibilities in Tribal Communities.

Recommended Books:

Loornis & Beegle (1957) *Rural sociology (The strategies of change)*. Englewood Cliffs, New Jersey : Prentice Hall, Inc.

Alexander, K.C., Prasad, R. R. & Jahagirdar, M.P. (1991). *Tribals - rehabilitation and development*. Jaipur : Rawat Publications.

Ansari, M.A. (1987). *Tribes in criminal web*. Jaipur : Publication Scheme

Bhanti, R. (2001). *Social development* (Analysis of some social work & field), New Delhi : Himanshu Publications.

Chaurasia, B. P. (1990). *Scheduled castes and scheduled tribes in India*. Allahabad : Chugh Publications.

Dasgupta, B. (1964). *Village society and labour use*, New Delhi : Oxford University Press.

Harrey, D. (1973) *Social justice and the city*. London : Edward Arnold Publications.

Doshi, S.L. & Jain, P.C. (2001). *Social anthropology*. New Delhi : Rawat Publications.

Dubey, S.C. (2010). *Indian society*. (12th ed.). New Delhi : National Book Trust in India.

Gavit, M.H. & Chand, A. (1989). *Nehru-tribal and women welfare*. New Delhi : Deep & Deep Publication.

Hiremah, S. R. (ed.). (1997). *Forest lands forest produce as if People mattered*. Karnataka : National Committee for Protection of Natural Resources et al.

Hiremath, S. R., Kanwalli S., Kulkarni, S. (1994). *All about draft forest bill and forest lands: towards policies and practices as if people mattered karnataka*. (2nd ed.). Pune : SPS, DFD (K), JVA (K) & Centre for Tribal Conscientisation.

Ansari, M.A. (1987). *Tribes in criminal web*. Jaipur : Publication Scheme

Rath, G. C. (2006). *Tribal development in India, the Contemporary Debate*. New Delhi : Sage Publications.

Suggested E-resources:

Tribal population in India : Regional dimensions & imperatives.

Platform : ResearchGate.

Link : http://www.researchgate.net/publication/302904252_TRIBAL_POPULATION_IN_INDIA_REGIONAL_DIMENSIONS_IMPERATIVES

Historical perspectives of different tribal groups in India.

Platform : International Journal of Interdisciplinary and Multidisciplinary Studies (IJIMS).

Link : <http://www.ijims.com/uploads/6bd9df8d35bc3899587coc0.pdf>

Policies and Programmes for Tribal Development in India

Platform : Odisha State Open University

Link: <http://osou.ac.in/eresources/PPTDI.pdf>

Panchayati Raj and Tribal Development in India

Platform: International Journal of Advanced Research n Social Sciences & Humanities

Link:

<http://www.iaster.com/uploadfolder/IpanchayatRajandTribalDevelopmentinIndiaCopy/1Panchayati%20Raj%20and%20Tribal%20Development%20%India%20Copy.pdf>

Urban Community Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes: After the completion of this course students will be able to
Be competent in understanding the effect of urbanization on the changing status of society.
Understand the functions and roles of Urban Local Bodies in Urban Community Development.
Apply their learning and skills for field work intervention while working with Urban community.

Section-A

Urban Community:

Meaning, Concept, Characteristics

Urban Community Development: Its Need, Origin and Approaches.

Urban Community Development Projects in India (UCD)

Urban Based Schemes Programs, Urban Development Schemes and Programmes in Five-Year Plans

Section-B

The Role of District Urban Development Agency (DUDA), Role of Development Authorities and Other Bodies
Town and Country Planning, Housing Boards, Slum Clearance Boards, Housing Development Housing Urban
Development Cooperation Ltd. (HUDCO) and City and Industrial Development Cooperation in Urban
Development.

Section-C

Historical Development of Urban Local Self Governance in India:

74th Amendment.

Types, Structure and Functions Urban Local Self Government

Problems and Recent Administrative Reform of Urban Local Self Governance Administration.

Recommended Books:

Pickvance, C. G. (ed.). (1976). *Urban sociology: Critical essays*. UK : Methuen.

Chris Hasluck (1987). *Urban unemployment: Local labour markets and employment initiatives*. New York : Longman.

James, M. B. (1962). *Urban social structure*. New York : The Free Press of Glencoe.

Jayapalan, N. (2002). *Urban sociology*. New Delhi : Atlantic Publishers & Distributors

Morris, R.N. (1968). *Urban sociology*. London : George Allen and Unwin Ltd.

Nair, J. (2005). *The promise of the metropolis*, Delhi : Bangalore's Twentieth Century.

Ramchandran, R. (1989). *Urbanisation and urban system in India*. Delhi : Oxford University press.

Patel, S. & Deb K. (ed.). (2006) *Urban studies*. Delhi : Oxford University Press.

Low, S. (2000). *Theorizing the city*. Chicago : Rutgers University Press.

Sharma, R. K. (2004). *Urban sociology*. New Delhi : Atlantic Publishers & Distributors.

Sharon, Z. (1995). *The cultures of cities*. Hoboken, New Jersey : Blackwell.

Miton, S. & Bernald, C. S. (ed.). (2001) *Structure and change in Indian society*. New Delhi : Rawat Publications.

Singh, A. M. (1976). *Neighborhood and social network in urban India*. New Delhi : Marwah.

Sivaraman, K.C, Kundu A. & Singh B.N (2005). *Handbook of urbanization in India*. Delhi : OUP.

Smith, M. P. (2001). *Transnational urbanism, locating globalisation*, Hoboken, New Jersey : Blackwell.

Suggested E -resources:

Urban Community Development

Platform: Its Nature and Scope

Link: https://www.epw.in/system/files/pdf/1959_11/45/urban_community_developmentits_nature_and_scope.pdf

Housing and Urban Development Corporation Limited

Platform: Hudco.org.

Link: <https://www.hudco.org/writereaddata/NOTICE-AR-2017.pdf>

Evolution of urban local governments in india

Platform: Shodhganga.

Link: http://shodhganga.inflibnet.ac.in/bitstream/10603/66623/8/08_chapter%202.pdf

Urban Development in India in the Twenty First Century: Policies for Accelerating Urban Growth

Platform: Centre for International Development, Stanford.

Link: <https://globalpoverty.stanford.edu/sites/default/files/publications/231wp.pdf>

Field Work Practicum -1

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	10	5

Learning Outcomes: After completion of this course, students will be able to
Become aware of the functioning of various settings non Governmental Organizations, Government Departments and Institutions, Health Functionaries etc.
Competent in acquainting with knowledge of theory into practical situation for problem solving.
Comprehend role of Social work profession in facilitating social change, human rights and social justice .

*Social work is a practice oriented programme wherein students are able to develop their understanding by applying their theoretical knowledge through practical interventions while working in various settings. Initially students are oriented to develop their understanding on the importance of field work practicum. In the first semester, MSW students are provided with exposures of various Government and Non-Government organizations and departments. They are provided with opportunities in understanding structure, functions and services provided by NGOs, Government Departments, Health functionaries, Aanganwadi centres, Panchayat offices, Government education institutions etc. for the betterment of the society.

Suggested E resources:

<https://www.mswguide.org/schools/the-ultimate-field-education-guide/>

<http://fielddeducator.simmons.edu/article/field-learning-in-online-social-work-programs/>

Field Work Practicum – II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	10	5

Learning Outcomes: After the completion of this course, students will be able to

Competent in acquainting with knowledge of theory into practical application.

Capable to understand social work intervention through methods of social work in various field work settings.

Develop skills and professional qualities for social work.

Become aware of problems and Recent Administrative Reform of government and non Governmental Organization.

*In the second semester, students are provided with a platform to practice their field work in rural settings. They are provided with an opportunity to conduct various methods and skills such as Transect walk, Participatory Rural Appraisal, visiting various political, educational, health Institutions functioning in the adopted village. Students interact the rural community to understand socio-economic, political, cultural values, traditions and conditions among rural masses.

Suggested E resources:

<http://fielddeducator.simmons.edu/article/field-learning-in-online-social-work-programs/-placement/navigating-your-field-placement-search-as-an-online-student/>

<http://hhd.fullerton.edu/msw/Fieldwork/index.htm>

Field Work Practicum –III

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	10	5

Learning Outcomes: After the completion of this course, the students will be able to

- Competent in acquainting with knowledge of theory into practical situation for problem solving.
- Capable to understand social work intervention through methods of social work in various field work settings.
- Comprehend role of Social work profession in facilitating social change, human rights and social justice.
- Develop skills and professional qualities for social work.

*During the third semester, after completion of one year of field work practicum and one month summer internship, students are now competent to apply various social work methods, techniques and skills namely Social case work, Social group work, Community Organization, Social action, Social Work Research and Social Work Management and are capable to critically analyse their practical application. They are regularly supervised by their concerned supervisors through Individual and Group Conferences.

Suggested E resources:

<http://fieldeducator.simmons.edu/article/field-learning-in-online-social-work-programs/-placement/navigating-your-field-placement-search-as-an-online-student/>
<http://hhd.fullerton.edu/msw/Fieldwork/index.htm>

Field Work Practicum -IV

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	10	5

Learning Outcomes: After the completion of this course, students will be able to
Competent in acquainting with knowledge of theory into practical situation for problem solving.
Capable to understand social work intervention through methods of social work in various field work settings.
Develop skills and professional qualities for social work.

*The final semester's field work practicum comprises of the continuous practical application of field work of Semester III. Students comprehend role of Social work profession empowering individuals, groups and communities and facilitating social change, Human rights and Social justice. They are now proficiently skilled and ready to apply their skills and qualities of professional social work practitioners.

Suggested E resources:

Field Work

Platform: Field Educator Simmons School of Social Work

<http://fieldeducator.simmons.edu/article/field-learning-in-online-social-work-programs/-placement/navigating-your-field-placement-search-as-an-online-student/>

<http://hhd.fullerton.edu/msw/Fieldwork/index.htm>

[placement/navigating-your-field-placement-search-as-an-online-student/](#)

Field Work Practicum – Summer Placement

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	10	5

Learning Outcomes: After the completion of this course, students will be able to

Competent in acquainting with knowledge of theory into practical situation for problem solving and social work intervention through methods of social work in various field work settings and Apply social work Research techniques in practice.

Comprehend role of Social work profession in facilitating social change , human rights and social justice .

Develop skills and professional qualities for social work.

Become aware of problems and Recent Administrative Reform of government and non Governmental Organization

* After the completion of their first year of MSW, students undergo One month (4 weeks) Summer Internship in an Organization namely development sectors, CSR, Research Institutions, Government departments etc. Summer Internship is a crucial component of Field Work in Social Work Education. It is an important practice learning educational components that acquaint students with the field of practice. It is a supervised practice learning venture in which the students practice theoretically learn social work skills, techniques, tools and methods in the field under the guidance and supervision of field personnel.

Suggested E resources:

<http://fielddeducator.simmons.edu/article/field-learning-in-online-social-work-programs/-placement/navigating-your-field-placement-search-as-an-online-student/>
<http://hhd.fullerton.edu/msw/Fieldwork/index.htm>

Classical Literature in English

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of the course, students will be able to:
understand of basic concepts of Indian, Greek and Latin classical literatures.
develop critical thinking;
improve social interaction through the understanding of classical literary tradition;
inculcate effective citizenship with a deep grounded sense of ethics and moral dimensions;
inculcate effective citizenship with a deep grounded sense of ethics and moral dimensions.

Course Content

Section I

Kalidas : *Abhigyan Shakuntalam*

Section II

Homer : *Iliad* Bk I, II & III (Detailed study)

Sophocles : *Antigone*

Section III

Virgil : *Aeneid* Bk II (Detailed study)

Suggested Readings:

Aristotle. (1960). *The Art of Poetry*, Ingrams Bywater. (Trans) London : O.U.P.
Enright, D. J. (1980). *English Critical Texts*. London: O.U.P.
T.S. Dorch (Ed.). (1965). *Classical Literary Criticism*, London Penguin Books.
Watson George. (1978). *The Literary Critic*, London O.U.P.
Atkins J.W. (1987). *Literary Criticism in Antiquity*, London : Rutledge.
A.H. Gilbert. (1895). *Literary Criticism: Plato to Croce*, New York: Rutledge.
A.P. Dani. (1998). *Literary Theory and Criticism*. Delhi : Pencraft.
Rajan, Chandra. (2000). *Kalidas: The Loom of Time*. Delhi: Penguin.
Bloom, Harold . (1987). *Homer's Iliad*. New York, Chelsea.
Rayor, D (Ed.). (2011). *Sophocles Antigone :A New Translation*. Cambridge University Press.
Bloom, Harold. (1996). *Aeneid* . Chelsea Publication House.
Watson George. (1978). *The Literary Critic*, London O.U.P.

Suggested E-learning Materials:

Plays of Kalidas

<https://www.jstor.org/stable/40871930>

<https://www.jstor.org/stable/40873952>

Homer

<https://www.ancient.eu/homer/>

Virgil

https://www.ancient-literature.com/rome_vergil.html

Translation Studies

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

After the completion of the course, students will be able to:

comprehend the basic concepts, types, theories, models of translation;

Know relationship between language and translation, culture and translation, politics and translation, knowledge and translation, translation and multiculturalism;

enhance effective communication both in Source Language and Target Language to develop better social interaction;

engage in the praxis of applying those theoretical and linguistic ideas for translating a text from a source language to target language.

Course Content

Translation Studies

Section I

1. Introduction to Translation and Translation Studies.
2. Problems and methods of translation: Linguistic, cultural and semantic aspects.

Section II Major translated works in India

- a) **Valmiki** *Joothan*
- b) **Dharmaveer Bharti** *Andha Yug*
- c) **Mira** : 'I'm colored with the color of dusk', 'Life without Hari is no life', 'Today your friend is coming',
- d) **Kabir** : 'Go naked if you want', 'Hey Qazi, what's the book you're preaching from?'
- e) **halib** : Poems : 'Charagh-i-Dair' (Temple Lamps), from 'Poems from Persian', in Ghalib and his Poetry, by Sardar Jafri and Qurratulain Haider.
- f) **Amrita Pritam** – "Main tenu phir milangi"

Section III

Students will attempt to translate a short story or two poems (minimum 20 lines) and a piece of prose (fictional/ nonfictional prose of minimum 1000 words) of their choice from Hindi to English and English to Hindi.

Suggested Readings:

1. UR Ananta Murthy (1970) *Samskara: A Rite for a Dead Man*, tr. A.K. Ramanujan New Delhi: Oxford University Press.
2. Dharam Vir Bharati, (1954). *Andha Yug* New Delhi : Oxford University Press,
3. Mira Bai's Selected Poems in English 'I'm colored with the color of dusk', 'Life without Hari is no life', 'Today your friend is coming', (New Delhi: Oxford University Press, 2004), pp. 134-140.
4. Kabir's Selected Poems in English 'Go naked if you want', 'Hey Qazi, what's the book you're preaching from?' Songs of the Saints of India
5. Ghalib Selected Poems in English 'Charagh-i-Dair' (Temple Lamps), from 'Poems from Persian', in Ghalib and his Poetry, by Sardar Jafri and Qurratulain Haider (Bombay: Popular Prakashan, 1970), pp. 70-71
6. Amrita Pritam – "Main tenu phir milangi" (I will meet you yet again) Translated by Nirupama Dutt and published in *The Little Magazine* 2005)
7. Jeremy Munday (2012). *Introducing Translation Studies : Theories and Applications*. Routledge.
8. Anthony Pym, (2018). *Exploring Translation Studies*. London Routledge.
9. Susan Bassnett, (2003). *Translation Studies*. London Routledge.
10. Mona Baker, (2011). *In Other Words : A Course Book on Translation*. London Routledge.

Suggested E-learning Materials:

Theories of Translation: Introduction and Development

http://shodhganga.inflibnet.ac.in/bitstream/10603/7825/5/05_chapter%202.pdf

Problems of Translation

<http://www.egyankosh.ac.in/bitstream/123456789/14120/1/Unit-7.pdf>

Language, Linguistics and Translation

<http://www.egyankosh.ac.in/bitstream/123456789/14111/1/Unit-2.pdf>

Cultural approach to Translation

<http://egyankosh.ac.in/bitstream/123456789/14140/1/Unit-36.pdf>

Dalit Poetry and Aesthetics

<https://journals.sagepub.com/doi/pdf/10.1177/0971521514556942org/vol2/97-SA1019.pdf>

Dharmaveer Bharti: *Andha Yug*

http://shodhganga.inflibnet.ac.in/bitstream/10603/98252/10/10_chapter4.pdf

उपन्यास साहित्य

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

अपेक्षित परिणाम

1. छात्राएँ हिन्दी उपन्यास एवं कहानी विधा से परिचित हो पाएँगी।
2. प्रेमचंद के लेखन एवं साहित्य के माध्यम से तद्युगीन परिस्थितियों को समझ सकेंगी।
3. छात्राएँ राष्ट्र की भावी नागरिक हैं, महाभोज उपन्यास पढ़ कर वे अपने सामाजिक एवं राजनीतिक उत्तरदायित्व के प्रति सचेत हो पाएँगी।
4. रचना के सामाजिक सन्दर्भों को देखने की दृष्टि विकसित कर पाएँगी।

इकाई-1 लेखक परिचय –

प्रेमचन्द : व्यक्तित्व एवं कृतित्व

इकाई-2 लेखक परिचय –

मन्नू भण्डारी : व्यक्तित्व एवं कृतित्व

इकाई-3 निर्मला – प्रेमचन्द, राजपाल एण्ड सन्स, दिल्ली, वर्ष 1927

इकाई-4 महाभोज – मन्नू भण्डारी, राधाकृष्ण प्रकाशन, दिल्ली, वर्ष 2010

इकाई-5 हिन्दी उपन्यास का प्रवृत्तिमूलक इतिहास

(क) स्वतंत्रता पूर्व हिन्दी उपन्यास

(ख) स्वातंत्र्योत्तर हिन्दी उपन्यास

सहायक पुस्तकें :

1. मदान, डॉ. इन्द्रनाथ, (2000), *आज का हिन्दी उपन्यास*, नई दिल्ली, राजकमल प्रकाशन
2. वाष्णीय, डॉ. लक्ष्मीसागर, (1970), *हिन्दी उपन्यास : उपलब्धियाँ*, दिल्ली, राधाकृष्ण प्रकाशन
3. मिश्र, रामदरश, (1968), *हिन्दी उपन्यास : एक अन्तर्यात्रा*, दिल्ली, राजकमल प्रकाशन
4. सिन्हा, सुरेश, (1962), *हिन्दी उपन्यास : उद्भव और विकास*, इलाहाबाद, लोकभारती प्रकाशन
5. शर्मा, रामविलास, (1989), *प्रेमचन्द और उनका युग*, नई दिल्ली, कमल प्रकाशन
6. सिंह, शम्भुनाथ, (2018), *प्रेमचन्द का मूल्यांकन*, नई दिल्ली, वाणी प्रकाशन
7. राय, गोपाल, (2016), *हिन्दी उपन्यास का इतिहास*, नई दिल्ली, राजकमल प्रकाशन
8. सिंह, त्रिभुवन, (1961), *हिन्दी उपन्यास और यथार्थवाद*, वाराणसी, हिन्दी प्रचारक पुस्तकालय

ई-सामग्री स्रोत –

<http://egyankosh.ac.in/>

पत्रकारिता

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

अपेक्षित परिणाम

पत्रकारिता के क्षेत्र में रोजगार की संभावनाओं को खोज सकेंगी।
हिन्दी दैनिक समाचार पत्रों में संवाददाता, विशेष संवाददाता और संपादक के पदों हेतु योग्यता अर्जित कर सकेंगी।
इलेक्ट्रॉनिक मीडिया में फीचर लेखन, समाचार लेखन, समाचार वाचन आदि के क्षेत्र में क्षमता विकसित कर सकेंगी।
स्वतंत्र पत्रकारिता के गुणों एवं तार्किक क्षमता का विकास कर पायेंगी।
सामयिक परिस्थितियों में मीडिया की भूमिका से अवगत हो सकेंगी।

खण्ड – 1

पत्रकारिता के विविध आयाम

1. समाचार के मूल तत्त्व, समाचार संकलन तथा लेखन के मुख्य आयाम
2. समाचार के विभिन्न स्रोत
3. सम्पादन कला के सम्पादन सिद्धान्त : शीर्षकीकरण, पृष्ठविन्यास और समाचार पत्र की प्रस्तुति प्रक्रिया
4. कॉपी राइट, प्रेस काउंसिल, आर.टी.आई. तथा आचार संहिता

खण्ड –2

भारत में पत्रकारिता का उद्भव एवं विकास

1. भारतीय नवजागरण और हिन्दी पत्रकारिता
2. राष्ट्रीय आन्दोलन और हिन्दी पत्रकारिता
3. स्वातन्त्र्योत्तर हिन्दी पत्रकारिता (प्रिंट मीडिया)

खण्ड—3

पत्रकारिता : समकालीन संदर्भ

1. स्वातन्त्र्योत्तर पत्रकारिता : मुख्य प्रवृत्तियाँ
2. इलेक्ट्रॉनिक मीडिया और हिन्दी पत्रकारिता
3. फोटो पत्रकारिता

सहायक पुस्तकें –

1. पन्त, नवीनचन्द्र (2007), *पत्रकारिता के मूल सिद्धान्त*, नई दिल्ली, कनिष्क पब्लिशर्स
2. पन्त, नवीनचन्द्र (2004), *समाचार लेखन एवं संपादन*, नई दिल्ली, कनिष्क पब्लिशर्स
3. गुप्ता, ओम (2010), *पत्रकारिता और कानून*, नई दिल्ली, कनिष्क पब्लिशर्स
4. गुप्ता, ओम (2002), *प्रसारण और फोटो पत्रकारिता*, नई दिल्ली कनिष्क पब्लिशर्स
5. शर्मा, आलोक, डॉ. ठाकुरदत्त (2000), *हिन्दी पत्रकारिता और दूरसंचार*, नई दिल्ली, वाणी प्रकाशन
6. गोदरे ,विनोद, (2000), *हिन्दी पत्रकारिता—स्वरूप और सन्दर्भ*, नई दिल्ली, वाणी प्रकाशन
7. अगनानी, कन्हैयालाल, (1998), *पत्रकारिता के मूल सिद्धान्त*, राजस्थान, हिन्दी ग्रन्थ अकादमी
8. भानावत, डॉ. संजीव, (1993), *प्रेस कानून और पत्रकारिता*, जयपुर, सिद्धश्री प्रकाशन।
9. सिंह ,ओमप्रकाश, (2004), *संचार और पत्रकारिता के विविध आयाम*, नई दिल्ली, क्लासिकल पब्लिशिंग हाउस।
10. वापती ,जमनालाल (1999), *पत्रकारिता के सिद्धान्त*, जयपुर, राजस्थान प्रकाशन।
11. कोठारी, गुलाब, (2008), *समाचार पत्र प्रबंधन*, दिल्ली, राधाकृष्ण प्रकाशन।

ई-सामग्री स्रोत :

<http://egyankosh.ac.in/>

Computer Fundamentals and Programming

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

Develop conceptual understanding of input and output devices of computers and how it works and recognize the basic terminology used in computer programming

Develop the ability to write, compile and debug programs in C language and use different data types for writing the programs.

Formulate the programs based on structures, loops and functions.

Conceptualize the understating of differentiating between call by value and call by reference.

Develop the conceptual understanding of the dynamic behavior of memory by the use of pointers.

Syllabus

Unit-I Introduction to Computer System and functions of its components. Evolution of Computers and its classification. Hardware and Software.

Introduction to Number System: Decimal, Binary, Octal and Hexadecimal and their inter conversions.

Integer and real number representation, Character and codes (BCD, ASCII, and EBCDIC), Logic Gates (AND, OR, NOT, NAND, NOR, XOR and XNOR), Binary and Floating Point Arithmetic (addition and subtraction).

Introduction to Operating system (Windows, DOS), DOS commands (Internal and External).

Unit-II Basic concepts of Boolean algebra and their electronic implementation through various logic gates. Simplification of Boolean Expressions (Boolean Algebra and Karnaugh map method).

Characteristics of Memory Devices, Memory types - Primary and Secondary, Random Access and Sequential Access, Memory Hierarchy, Storage location and addresses, RAM, ROM, PROM, EPROM, EEPROM, Core memory, Magnetic Bubble memory, Cache Memory, Virtual memory (definition and block diagram), Secondary Memory devices and their characteristics, Interleaving memory.

Unit-III Introduction to computer programming, Problem analysis, stepwise refining, Problem definition, algorithm, flowcharts, Programming languages (high level, low level), Compiler, Interpreter.

Computer Programming (in C): Overview of C language- History, Character set, Identifiers, Various Data types (Simple and Structured) and their representation, Constants and Variables, Operators (arithmetic, logical, relational), Program structure, Data assignment, Input-Output statements, Arithmetic and Logic expressions, Control statements (sequencing, conditional & un conditional branching and looping),

Unit-IV Single & Multi-dimensional Arrays, Matrix manipulations, functions, parameter passing (call by value, call by reference), recursion, storage classes.

Unit-V Concept of pointers, pointer expression, pointer v/s arrays, structure, union and enumerated data types, file handling, command line arguments, concept of structured programming.

(Unit III, IV & Unit V to be done using C Programming).

Suggested Books:

Sinha, P. K., & Sinha, P. BPB Publication. *Computer Fundamental*, Third Edition-2005, 12..

Mano, M. M. (2003). *Computer system architecture*. Prentice-Hall of India.

Norton, P. (1989). *Peter Norton's DOS guide*. Brady.

Balagurusamy, E. (2012). *programming in ANSI C*. Tata McGraw-Hill Education.

Venugopal K.R., *Programming with C*, Tata McGraw-Hill Publishing Company Limited.

Hayes John P., *Computer Architecture and Organization*, Tata McGraw Hill, New Delhi, 1998.

RAM B., *Computer Fundamentals, Architecture & Organization*, New Age International, New Delhi.

Kernighan Brian W., Ritchie Dennis M., *The C Programming Language*, Pearson Education, 2nd Edition, New Delhi Prentice Hall.

Kanetkar, Y. P. (2016). *Let us C*. BPB publications..

Gottfried, B. (1996). *Programming with C*, Schaum's Outlines

Suggested E-Resources:

Introduction to Programming in C

<https://nptel.ac.in/courses/106104128/>

Introduction to Programming in C Specialization

<https://www.coursera.org/specializations/c-programming>

Sinha, P. K. (2003). *Computer fundamentals: concepts, systems & applications*. BPB publications.

<https://www.edutechlearners.com/computer-fundamentals-p-k-sinha-free-pdf/>

Computer Fundamentals and Programming Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab no. Problems

L 1 -L2 Simple hands on DOS Commands e.g. CD, MD, RD. COPY, TYPE/TREE etc.

L4-L7 Simple problems using scanf and printf functions. Formula based problems using constants, variables and use of operators.

L8-L10 Condition checking using if statement, nested if statement, switch and goto constructs. Programs like:

- i. Check odd-even, positive-negative
- ii. Calculation of Division, Rank of student
- iii. Solution of Quadratic Equations
- iv. Menu Driven Programs

LI 1-L19 Loop Statement using for, while, do-while. Problems like:

- i. Sum of digits of number, reverse of number, palindrome checking
- ii. Table Generation.
- iii. Prime number checking, generation.
- iv. Calculation of GCD, LCM.
- v. Sum of various series, Fibonacci series, sin, cos, exp etc.
- vi. Printing patterns with digits/alphabets/symbols.

L20-L27 Problems on arrays (one and two dimensional arrays) like:

- i. Maximum, minimum & average calculation
- ii. Linear Search
- iii. Binary Search
- iv. Bubble Sort
- v. Selection Sort
- vi. Insertion Sort
- vii. Merging
- viii. Matrix Manipulation
- ix. Sum of row, column & diagonal elements
- x. Display and sum of upper triangular, lower triangular matrix elements
- xi. Matrix Arithmetic (Addition, Subtraction, Multiplication)
- xii. String Manipulation.

L28-L36 Using Pointers and Functions

- i. Implementation of previous programs using user defined functions.
- ii. Use of pointers and function in array and string processing.

Recursion

- i. Calculation of factorial and power of a given number, GCD, etc.
- ii. Programs on Fibonacci series.

L37-L39 Declaration, reading, writing and manipulation on struct and union.

- i. Operations on Complex numbers
- ii. Reading, writing, searching records of student/teacher/employee etc.
- iii. Use of Union

L40-L43 File handling

- i. Reading and writing from and to a file.
- ii. Copy/ move the contents of one file to another.
- iii. Searching a string/number in a file etc.

L44-L45 Command Line Arguments.

Basic Digital Electronics Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab No. Problems

L1-L3 Demo of various Hardware components of a Desktop PC, and assembling of a PC.

L4-L5 Study of Logic gates with 2-input.

L6-L8 Design of various 2-input gates with help of NAND & NOR gates

L9-L12 Implementation of Boolean expression in AND-OR-INVERT logic after simplification (up to 4- variables only)

L13-L15 Implementation of Boolean expression in universal gates (NAND/NOR) logic after simplification (up to 4- variables only).

Computer Architecture and Object Oriented Programming

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

Equip the students to meet the requirement of corporate world and Industry standard.

Engage in professional development and to pursue graduate education in the fields of Information Technology and Computer Applications

Apply computing principles and business practices in software solutions, outsourcing services, public and private sectors

Apply C++ features to program design and implementation.

Explain object-oriented concepts and describe how C++ including identifying the features and Peculiarities of the C++ programming language support them.

Use C++ to demonstrate practical experience in developing object-oriented solutions

Syllabus

Unit-I Introduction to Computer Architecture. Instruction Formats- instruction execution cycles, Machine Instruction types. Concept of Microprogramming, Addressing Modes- (Direct, Indirect, Register direct, Register indirect, Auto increment, Auto decrement, Base, Index, Absolute and Relative addressing). Instruction formats-(zero address, one address, two address and three address machines).

I/O Organization-Simple I/O devices and their properties, device interfacing, DMA interface, program & interrupt control transfer.

Unit-II Combinational Circuits: Binary Adder (Half and Full), Binary Subtractor, Decoder, Encoder, Multiplexer, Demultiplexer, Parallel adder and subtractor.

Introduction to Sequential circuits. Flip Flops (RS, JK). Introduction to Shift Registers and Counters (synchronous and asynchronous).

Unit-III Basic Concept of Object Oriented Programming: Need of OOP, advantage over other programming paradigms, Tokens, Keywords, Identifiers and Constants, Basic Data Types, Control Structures.

Functions: Call by Value, Call by Reference.

Classes & Objects: Concepts of Objects & Classes, declaring multiple objects, array of objects.

Unit-IV Constructors and Destructors: Introduction, Default, Parameterized and Copy Constructor, Concept and use of destructors.

Operator Overloading: Overloading Unary Operators and Binary Operators.

Static and friend functions. Inheritance, Function Overriding.

Unit-V Pointers to Objects, this Pointer, Virtual Functions, polymorphism.

Console I/O: Concept of Streams, Hierarchy of Console stream Classes, Unformatted and formatted I/O Operations, Manipulators.

Templates: Class and function templates.

Introduction to file handling.

Suggested Books:

Mano, M. M. (2002). *Digital design*. EBSCO Publishing, Inc...

Mano, M. M. (2003). *Computer system architecture*. Prentice-Hall of India.

Balagurusamy, E. (2001). *Object Oriented Programming with C++*, 6e. Tata McGraw-Hill Education.

Schildt, H. (2003). *C++: The complete reference*. McGraw-Hill..

Hafez, A. A. (1988). Computer architecture and organization

Venugopal, K. R. (2013). *Mastering C++*. Tata McGraw-Hill Education.

Lafore, R. (2001). *Object-oriented programming in Turbo C++*. Galgotia publications.

Stroustrup, B. (2000). *The C++ programming language*. Pearson Education India..

Kumar K., Programming with C++ Made Simple.

Suggested E-Resources:

Programming in C++

<https://nptel.ac.in/courses/106105151/>

Computer Organizations and Architecture

<https://nptel.ac.in/courses/106103068/>

Stallings, W. (2003). *Computer organization and architecture: designing for performance*. Pearson Education India.

<http://williamstallings.com/ComputerOrganization/>

Computer Architecture and Object Oriented Programming Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Lab Number Problems

- L1-L4 Implementation of simple problems with the objects and classes. (Involving if- else, switch, for, while do-while loops and arrays)
- i. Sum of digits of number, palindrome checking etc.
 - ii. Calculation of GCD, prime numbers etc.
 - iii. Menu driven programs.
 - iv. Searching/sorting arrays.
- L5-L8 Programs based on use of constructors & destructors and access specifiers (public, private, protected)
- L9-L10 Implementation of static variable & static member functions. Problems using friend function.
- LI 1-LI 4 Programs related to function overloading.
- L15-L19 Implementation of inheritance and its type.
- L20-L26 Programs involving operator overloading(using member functions and friend functions)
- i. Unary operators (+, -, *, % etc)
 - ii. Binary operators: +, *, [], >> and << operators.
- L27-L33 Problem related with dynamic binding and function overriding. Problems using this pointer.
- L34-L37 Problems related with the templates function and template classes-
- L38-L45 File handling and 10 manipulators
- i. Reading and writing from and to a file.
 - ii. Copy/ move the contents of one file to another.
 - iii. Searching a string/number in a file etc.

Computer Oriented Numerical and Statistical Methods

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

Apply numerical methods to obtain approximate solutions to mathematical problems.

Using appropriate numerical methods, determine the solutions to given non-linear equations, systems of linear equations, interpolation, numerical differentiation and integration and numerical solution of ordinary differential equations.

Analyze the errors obtained in the numerical solution of problems.

Apply appropriate algorithms to solve selected problems, both manually and by writing computer programs.

Compare different algorithms with respect to accuracy and efficiency of solution.

Implement numerical methods algorithm using programming language.

Unit-I Computer arithmetic and errors, Floating point arithmetic and error estimates, Implication of precision, Illustrations of errors due to round-off.

Solution of non-linear equations: Zeros of polynomials, real & complex. Bisection, Fixed point iteration, Newton - Raphson method, Aitkins process, rate of convergence.

Unit-II Solution of Linear system of equations: Direct method - Gaussian elimination including pivoting and Jordan, Iterative method: Jacobi's and Gauss-Siedel.

Interpolation: Lagrange's Polynomials, divided differences, Evenly spaced data, Newton-Gregory forward and backward interpolations, and Inverse interpolations, Error term and error of interpolation.

Unit-III Numerical differentiation: Differentiation formula based on interpolating polynomials, formulae for higher derivatives.

Numerical integration: Newton-Cotes integration formulae, The Trapezoidal, rule, Romberg integration Simpson's 1/3 & 3/8 rule, Gaussian quadrature formulae for integration.

Unit-IV Solution of ordinary differential equations - Taylor's series method, Euler's and modified Euler's method. Local and global error analysis, Runge-Kutta 2nd orders and 4th orders methods, Predictor-Corrector method, multistep method- Milne's method.

Approximation: Approximation of functions by Taylor's series, Least squares approximations, Fitting linear and nonlinear curves by least squares, Chebyshev polynomials.

Unit-V Statistical Methods: Concept of population, sample and Variance, Correlation and regression-simple & multiple, Test of significance for large and chi-square test for goodness of fit and Independence of Attributes, analysis of variance for one way classified data, Statistical decision making.

Suggested Books:

Rajaraman, V. (2004) *Computer Oriented Numerical Methods*.

Sastry, S. S. (2012). *Introductory methods of numerical analysis*. PHI Learning Pvt. Ltd..

Gupta, S. P. (1994). *Statistical Methods*, Sultan Chand & Sons, New Delhi

Gupta, S. C., & Kapoor, V. K. (1997). *Fundamentals of Mathematical Statistics*, Ninth Extensively Revised Edition, Sultan Chand & Sons.

Grewal, B. S. (2018). *Numerical Methods in Engineering and Science: (C, and C++, and MATLAB)*. Stylus Publishing, LLC.

Krishnamurthy, E. V., & Sen, S. K. *Numerical Algorithms: Computations in Science and Engineering*. 2001. Affiliated East-West Press, New Delhi.

GovilR., *Kamputer se sankhyatmak Reetiyen*, et.al. Pitamber Publications, New Delhi

Krishnamurthy, E. V., & Sen, S. K. (1976). *Computer-based numerical algorithms*. East-West Press.

Rao, K. S. (2017). *Numerical methods for scientists and engineers*. PHI Learning Pvt. Ltd..

Yule, G. U., & Kendall, M. G. (1987). *An Introduction to the Theory of Statistics* Universal Book Stall. New Delhi.

Agarwal, B. L. (2006). *Basic statistics*. New Age International.

Govil R. *Kamputer se sankhyatmak Reetiyen*, et.al. Pitamber Publications, New Delhi

Suggested E-Resources:

Numerical methods and programming

<https://nptel.ac.in/courses/122106033/>

Computer Oriented Numerical and Statistical Methods Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab Number

Problems

- L1 – L2 Perform floating point operations using normalization (addition, subtraction, multiplication, division)
- L3 – L8 Find the roots of equation (bisection method, regula-falsi method, Newton raphson method, secant method, successive approximation method)
- L9 – L11 Find solution of n linear equation (Gauss elimination method (with & without pivoting), Gauss Seidel method, Gauss Jordan method)
- L12 – L14 Generate following difference tables (forward, backward, divided difference)
- L15 – L17 Interpolate value of $f(x)$ at given x (Lagrange's interpolation method, Newton forward interpolation method, Newton's backward interpolation method)
- L18 Interpolate value of x at given $f(x)$ using Inverse interpolation method.

Data Structures

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to
choose appropriate data structure as applied to specified problem definition.
handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
apply concepts learned in various domains like DBMS, compiler construction etc.
use linear and non-linear data structures like stacks, queues, linked list etc.

Syllabus

Unit-I Concept of Data types, Abstract data type and data structure, Running time of program, Complexity of algorithm, Asymptotic notations: Big- Ω , Big-O, Big- θ notation) Searching and Sorting: Linear search and Binary Search, Bubble sort, Selection sort, Insertion sort, Quick sort, Radix sort.

Unit-II Linear Data structures : Stacks, Queues and their types, their array and linked list implementations, applications of stacks & queues, recursion stacks and recursive procedures

Unit-III Linear Linked structures: Single Linked Lists, Doubly & Circular Linked Lists, simple applications. Representation of polynomial using linked list, addition and subtraction of polynomials.

Unit-IV Nonlinear structures: Tree concepts, General Tree, binary tree and types and their applications. Binary Search Tree: implementation of various operations on Binary Search Tree (tree traversal, searching, insertion and deletion, counting leaf and non-leaf nodes, height).

Unit-V Heap and heap sort, Balanced tree: Introduction and concepts.

Graph: Introduction, Graph Theory terminology, Sequential representation of graphs: Adjacency Matrix, Path Matrix, Linked Representation of graph, Graph traversal: DFS, BFS.

Note : Data structures to be implemented using C/C++.

Suggested Books:

Ullman, J. D., Aho, A. V., & Hopcroft, J. E. (1974). *The design and analysis of computer algorithms*. Addison-Wesley, Reading, 4, 1-2.

Tremblay, J. P., & Sorenson, P. G. (1976). *An introduction to data structures with applications*. McGraw-Hill Computer Science Series, New York: McGraw-Hill, 1976..

Knuth D.E., *Fundamental Algorithms (The Art of Comp. Prog. Vol. 1)*, Narosa Publishing House, New Delhi

Horowitz, E. (2006). *Fundamentals of data structures in C++*. Galgotia Publications.

Tenenbaum, A. M. (1990). *Data structures using C*. Pearson Education India.

Kruse, R., & Tondo, C. L. (2007). *Data structures and program design in C*. Pearson Education India.

Lipschutz, S. (1987). *Schaum's Outline of Data Structure*. McGraw-Hill, Inc...

Suggested E-Resources:

Programming and Data Structures

<https://swayam.gov.in/course/1407-programming-and-data-structures>

Data Structures and Program Methodology

<https://nptel.ac.in/courses/106103069/>

Data Structures Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Lab no. Problems

- L1-L4 Programs on Searching and Sorting: Linear search and Binary Search, Bubble sort, Selection sort, Insertion sort, Quick sort, Radix sort.
- L5-L6 Programs based on static implementation of stacks.
- L7-L8 Programs based on static implementation of queues.
- L9-L13 Programs based on dynamic implementation of stack and its applications.
- L14-L17 Programs based on dynamic implementation of queue and its applications.
- L18-L27 Programs based on Singly, Doubly & Circular Linked lists. Operations on linked lists like: creation, insertion, deletion, traversal, searching etc.
- L28-L40 Operations on Binary tree, binary search tree.
- L41-L45 Simple programs on representation of graphs and their traversal.

Application Software and Visual Computing

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

Familiarity with windows environment while practicing on Windows

Achieve operator skills in MS-Word, MS-Excel and MS-PowerPoint.

Understand basic concepts of database system and its use as backend (MS-Access) in a project at any level.

Gain knowledge of visual programming through VB.NET as a programming language in .NET framework.

Develop a small (minor) project.

Syllabus

Unit-I Concept of System software and application software, Windows, Desktop Publishing and Office Automation (Ms-Word : Introduction, Editing files, Basic formatting features, Page setup, Inserting and formatting objects, Tables, Mail-merge, Excel: Fundamentals, Functions, Formulas, References, Filters, Validation, Chart, Data Tables, Goal Seek, Scenario, Solver, Pivot tables. PowerPoint: Creating and Formatting a presentation, Animation, Inserting Pictures, Sound, Table, Chart etc, Running and Printing a slide)

Unit-II Introduction to Data Base, Concept and Architecture of database, Ms-Access Table: Designing and Creation, data types and relationships between tables, Query: Select, Update, Delete, Create table, Crosstab, Parameterized queries and Report generation

Unit-III Introduction to .NET framework : Managed Code and the CLR- Intermediate Language, Metadata and JIT Compilation - Automatic Memory Management.

Language Concepts and the CLR: Visual Studio .NET - Using the .NET Framework.

The Framework Class Library: .NET objects - ASP .NET - .NET web services – Windows Forms

Unit-IV Elements : Variables and constants – data types – declaration. Operators – types – precedence. Expressions. Program flow – Decision statements – if ..then, if..then..else, select..case– Loop statements – while..end while, do..loop, for..next, for..each..next.

Types: Value data types – Structures, Enumerations. Reference data types- Single-dimensional – Multi-dimensional arrays – jagged arrays – dynamic arrays

Windows programming: Creating windows Forms – windows controls – Button, Check box, Combo box, Label, List box, Radio Button, Text box. Events – Click, close, Deactivate, Load, Mousemove, Mousedown, MouseUp.

Menus and Dialog Boxes: Creating menus – menu items – context menu - Using dialog boxes – showDialog() method, APPLICATION DEVELOPMENT USING ADO .NET

Unit-V Features of ADO.NET: Architecture of ADO.NET – ADO.NET providers – Connection – Command – Data Adapter – Dataset.

Accessing Data with ADO.NET: Connecting to Data Source, Accessing Data with Data set and Data Reader - Create an ADO.NET application - Using Stored Procedures.

Suggested Books:

Govil R. et al, *PC Software*, New Delhi:BPB

Robinson, C. (1999). *Access 2000: No Experience Required*. SYBEX Inc..

Deitel, H. M., Deitel, P. J., & Nieto, T. R. (2001). *Visual Basic.Net with Cdrom*. Prentice Hall PTR.

Platt, D. S. (2002). *Introducing Microsoft. Net*. Microsoft press.

Esposito, D. (2011). *Programming Microsoft ASP.net 4*. Pearson Education.

Developing XML Web Services Using Microsoft® ASP.NET -Microsoft- Microsoft Press

Reilly, D. J. (2002). *Designing microsoft asp. net applications*. Microsoft Press.

Ryan, D., & Ryan, T. (2001). *ASP. NET: Your Visual Blueprint for Creating Web Applications on the. Net Framework*. John Wiley & Sons, Inc..

Suggested E-Resources:

W3Schools website

<https://www.w3schools.com/asp/>

Grundgeiger, D. (2018). *Programming Visual Basic. NET*. O'Reilly.

[N/vbNet_programming.pdf](#)

Application Software and Visual Computing Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Lab Number Problems

L1-L3	Microsoft Word (Document creation & formatting. Grammatical & Spelling checking. Table handling, Find & Replace, Mail Merge, Macro, Document with multiple columns. Templates, OLE)
L4-L6	Microsoft Excel (Creation of Workbook, Entering data in multiple sheets. Cell referencing. Drawing different type of charts. Functions-Date& time. Mathematical. Statistical, Look up & text,)
L7-L10	Microsoft Excel Contd. (Creation of Pivot table. Filtering, validation and Sorting, Extra features of Excel such as Freezing, protection etc of sheets)
L11-L20	Microsoft Access (Familiarity with environment. Creation of tables using design. Wizard & Entering, Properties - General and Local, Query Design view- Insert, Update, delete, SQL view, Relationship between tables. Designing of Forms, Designing of Reports)
L21-L26	Introduction of VB.NET framework IDE (Exploration of IDE (Tool box, menu bar, Project Explorer etc.). Simple programs to print messages on form, text box. label etc. Form Load Event, Change property of form, text box, label etc. Formula based problems i.e. Addition of two numbers etc. (At least 10 different types of problems)
L27-L40	VB.NET Programming (Problems based on Conditional constructs (if-then-else, select case etc.) (At least 10 different types of problems), Problems based on looping constructs (while-wend, for-next) (At least 10 different types of problems) eg. Star patterns, series etc. Picture box, image box, shape control. (Animation type problems), Problems based on List Box & Combo Box (adding items, deleting items, display index etc.). Problems based on Arrays, Creating different types of arrays. Usage of array functions. Procedures (Function, Sub Routines), Parameter passing, Swapping.
L41-L45	Project Work: Designing Menus (MDI. SDI), Form handling using GET, POST, Use of Request and Response Objects, Creation of sessions. Creation of Cookies, Creating web page using QueryString and Hidden Field. Database Connectivity with (Data Control ADO.NET Control, Connection String, Command Object, Connection Object etc.)

Business Data Processing

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

Develop Business applications in Cobol.

Identify all peripheral devices.

Prepare of all documents developed during system development.

Syllabus

Unit 1 Introduction to Business organization: Business system and its environments, major business functions including production, marketing, personnel & finance, information systems need and role of management services.

I/O devices: Properties of simple I/O devices, types of I/O devices - on-line, off-line, serial and parallel, commonly used I/O devices – keyboard, mouse, joystick, scanners, printers (impact & nonimpact), display devices (raster & random scan), color monitors, readable media inputs – CDROM, MICR, OCR. Memory and Storage Devices: Memory device characteristics, RAM, ROM, EPROM, Random & Sequential access storage devices, magnetic disks and disk drives, CDROM drives.

Unit II System Analysis & Design: introduction, SDLC, Role of system analyst, investigation: project selection, feasibility analysis, fact gathering, System design & implementation, cost/benefit analysis, system evaluation, input form design, interfacing, input data validation, documents & its importance, system maintenance and its review.

Unit III COBOL Language: COBOL program structure: Divisions, Sections, Paragraphs, Input-Output verbs, Data transfer verbs, conditional verbs including condition-name-condition, Table handling in COBOL.

Unit IV Introduction to file processing: record, files, file organization: sequential, indexed & direct access (random) files, various file operations, master files and transaction files.

Unit V File handling in COBOL: SORTING, MERGING, UPDATION, SORT & MERGE statements, Character handling, subroutine, Report writing facility in COBOL, Segmentation, Library facility.

Suggested Books:

Clifton, H. D. (1974). *Systems analysis for business data processing*.

Orilla, An Introduction to Business Data Processing, Mc Graw Hill

Roy, M. K., & Dastidar, D. G. (1989). *COBOL Programming*. Tata McGraw-Hill Education.

Awad, E. M. (1985). *Systems Analysis and Design*.

Irwin, R. D., .Stern, N. B., & Stern, R. A. (1985). *Structured COBOL Programming*. John Wiley & Sons.

Suggested E-Resources:

COBOL Programming

<http://www.csis.ul.ie/cobol/course/Default.htm>

Norton, P. (2002). *Introduction to computers*. McGraw Hill.

<https://onlinestudy4u.files.wordpress.com/2012/10/introduction-to-computers-by-peter-norton-6th-ed.pdf>

Business Data Processing Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Lab Number	Problems

L1-L2	Familiarity with COBOL environment
L3-L6	Program based on the use of various data types, Input output verbs: ACCEPT DISPLAY, arithmetic verb ADD, SUBTRACT, MULTIPLY, DIVISION
L7-L10	Program for data movement verbs, COMPUTE verb with various options.
L11-L13	Program for various conditions: relational, sign, class, condition-name-condition, negated, compound.
L14-L15	Program for GO TO with depending phrase, ALTER, EXIT, PERFORM
L16-L19	Program for various PERFORM verbs: TIMES , UNTIL, VARYING, VARYING-AFTER
L20-L23	Program for Table handling : - Implementation of single and multi dimensional tables, INDEX table. - Implementation of SEARCH, SEARCH-ALL, SET, OCCURS DEPENDING - Implementation of various sorting algorithm (bubble, insertion, selection, shuttle
L24-L26	Program for performing following operations on sequential file - Creation - Insertion - Deletion - Modification
L27-L30	Program for SORT, MERGE and INPUT-OUTPUT procedure
L31-L34	Program for performing following operations on Relative file - Creation - Insertion - Deletion - Modification
L35-L39	Program for performing following operations on INDEX file - Creation - Insertion - Deletion - Modification
L40-L41	Program for character handling verb: EXAMINE, INSPECT, STRING, UNSTRING
L42-L43	Program for use of subroutines
L44-L45	Program for segmentation and library facility: COPY statement.

System Programming

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

To define the basics of system programs like editors, compiler, assembler, linker, loader, interpreter and debugger.

Define how computer and operating system handles the memory.

Describe the various concepts of assemblers and microprocessors.

To analysis the various phases of compiler and compare its working with assembler.

To examine how linker and loader create an executable program from an object module created by assembler and compiler.

To identify various editors and debugging techniques

Syllabus

Unit I Components of system software. Evolution of system software, General machine structure (memory, register, data, instructions). Structured Programming, Applications of structured programming techniques to construction of system software.

Unit II Assembler - Design of one pass and two pass assembler. Introduction to preprocessor and Macro processor. Interpreter and brief description of different phases of a compiler.

Unit III Loaders: loading concepts, various loading schemes: Compile & go, absolute, relocating, direct linking & subroutine linkage loader schemes, binders, linking loaders. Design of two pass direct linking loader.

Introduction to System Software tools for program entry and testing, editors, debug monitors.

Unit IV Operating System: Types and basic functions of an operating system. Single User and multiuser operating system.

UNIX: Introduction, history, kernel and shell, file system, user management in Unix, Unix commands, security, background processing, editors on Unix.

Unit V Access to system services: ROM, BIOS, DOS, Mouse and EMS function, keyboard and screen management, introduction to Interrupts and its processing. Device drivers: types, structure and processing.

Suggested Books:

Donovan, J. J., & International Student edition. (1972). *Systems programming* (Vol. 3, No. 5). New York: McGraw-Hill.

Das, S. (2005). *Your UNIX: The ultimate guide*. McGraw-Hill, Inc..

Duncan, R. (1988). *Advanced MS-DOS Programming* (p. 309). Redmond, WA: Microsoft Press.

Ellzee, *System Software*, Science Research Association.

Bose, S. K. (1996). *Hardware and Software of Personal Computers*. New Age International..

Biggerstaff T. J., *System Software Tools*, Pentrice - Hall..

Aho, A. V., & Ullman, J. D. (1977). *Principles of Compiler Design* (Addison-Wesley series in computer science and information processing). Addison-Wesley Longman Publishing Co., Inc.,.

Kanetkar, Y. P. (1996). *Unix shell programming*. BPB Publ..

Dhamdhere, D. M. (1999). *Systems Programming and Operating Systems*. Tata McGraw-Hill.

Beck, L. L. (1997). *System software: an introduction to systems programming*. Addison-Wesley.

Suggested E-Resources:

System Programming

<http://solomon.ipv6.club.tw/Course/SP.941/>

Database Management Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

Describe data models and schemas in DBMS

Learn the features of database management systems and Relational database.

Use SQL-the standard language of relational databases.

Learn the functional dependencies and design of the database.

Learn the concept of Transaction and Query processing.

Syllabus

Unit-1 Data Information and related concepts, Database system architecture, History, design, function, structure
Data models schema and instances, Data independence and database languages, DBMS Vs file
Organization. Classical data management: classical data models (relational, hierarchical and network)

Unit-2 ER modeling: concepts, notation for ER diagrams, mapping constraints, Keys, Concept of super key,
candidate key, primary key, Generalization, Aggregation, reducing ER diagrams to tables, extended ER
model, Relationship of higher degree.

Unit-3 Relational Data Model and Language: Relational data model concepts, relational algebra, SQL, DDL, DML
& DCL commands, integrity constraints, Example DBMS System (Oracle 9i) : Basic architecture, data
definition and data manipulation, PLSQL, cursors, triggers, stored procedures.

Unit-4 Database design : Functional dependencies, Normalization: first to fifth normal forms, Advanced DBMS
concepts: Data integrity and reliability, consistency, security, privacy and authentication aspects in data
bases

Unit-5 Transaction processing concepts. Concurrency control techniques, locking techniques, and time stamping ,
Management of deadlock and crashes.

Distributed data base: Introduction, advantages, DBMS Vs DDBMS, distributed system structure, data
fragmentation, homogeneous VS heterogeneous systems, Distributed query processing. Distributed data
storage. Distributed transactions.

Suggested Books:

Silberschatz, A., Korth, H. F., & Sudarshan, S. (1997). *Database system concepts* (Vol. 4). New York: McGraw-Hill.

Date C.J., *An Introduction to Database systems*, Addison Wesley

Elmasri, R., & Navathe, S. (2003). *Fundamentals of Database Systems* Addison Wesley. Reading, MA.

Majumdar & Bhattacharya, *Database Management System*, Tata McGraw-Hill

Ramakrishna, Gehkre, *Database Management System*, Tata McGraw-Hill

Leon, A., & Leon, M. (2010). *Database management systems*. Vikas Publishing House Pvt. Limited

Ullman, J. D. (1984). *Principles of database systems*. Galgotia publications

Shah, N. (2016). *Database Systems Using Oracle*. Pearson Education India

Gupta, P. K. D., & KRISHNA, P. R. (2013). *Database management system Oracle SQL and PL/SQL*. PHI Learning Pvt. Ltd

Martin, J. (1977). *Computer database organization*. Prentice Hall PTR.

Suggested E-Resources:

Data Base Management System

<https://nptel.ac.in/courses/106105175/>

Database Management Essentials

<https://www.coursera.org/learn/database-management>

Silberschatz, A., Korth, H. F., & Sudarshan, S. (1997). *Database system concepts*. New York: McGraw-Hill.

<https://kakeboksen.td.org.uit.no/Database%20System%20Concepts%206th%20edition.pdf>

Database Management Systems Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab Number	Problems

L1 – L3	Look and feel of DBMS (ORACLE/SQL Server)
L4 – L5	DDL commands (create, Alter, drop)
L6– L9	DML commands (Insert, Update, delete)
L10 – L15	SQL (basic constructs)
L16 – L18	SQL (aggregate functions, set membership functions, set operators)
L19 – L21	Nested Sub-queries
L22 – L30	A small project comprising of table, query, form and report.

Java Programming Applications

L T P C

6 0 0 6

Max. Marks : 90

(CA: 30 + ESA: 60)

Objectives :

- Understand object oriented programming concepts and basics of Java programming language (style, syntax, data types, operators, branching and looping constructs)
- Learn object oriented programming concepts through Java (classes, objects, methods, access specifiers, nested classes, command-line arguments, arrays)
- Learn Java programming language in detail (inheritance, run-time polymorphism, abstract classes, interfaces, packages)
- Learn the essentials of Java class library, exception handling and multithreading

Introduce applets and event driven Graphical User Interface (GUI) programming

Unit 1 Object Oriented Paradigm, Concepts of Object Oriented Programming (Objects and Classes, Data Abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Communication), Benefits of Object Oriented Programming, Applications of Object Oriented Programming, Procedural v/s Object Oriented Programming, Java History, Java Features, Comparison between Java and C++, Java Virtual Machine (JVM), Java Runtime Environment (JRE), Java Development Kit (JDK), Structure of Java Program, Java Tokens (Java Character Set, Keywords, Identifiers, Literals, Operators, Separators), Constants, Variables, Data Types, Scope of Variables, Type Conversion & Casting, Automatic Type Promotion, Operators (Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Special), Operator Precedence, Expressions, Branching (if, if...else, Nested if...else, else if ladder, switch, ? : operator), Looping (while, do...while, for), Jumps in Loops (break, continue), Labeled Loops

Unit 2 Classes, Objects and Methods, Constructors, this Keyword, Garbage Collection, finalize() Method, Overloading Methods, Objects as Parameters, Returning Objects, Recursion, Access Specifiers (default, private, protected, public), static Keyword, final Keyword, Nesting of Methods, Nested and Inner Classes, Command-Line Arguments, Arrays, One-Dimensional Arrays, Two-Dimensional Arrays

Unit 3 Inheritance, Super Class, Sub Class, Visibility Controls, super Keyword, Types of Inheritance (Single, Multilevel, Hierarchical), Method Overriding, Dynamic Method Dispatch, final with Inheritance, Abstract Methods and Abstract Classes, Object Class, Interfaces (Defining, Extending, Implementing), Packages, Standard Java Packages, Programmer-Defined Java Packages (Creating, Accessing), CLASSPATH, Access Protection

Unit 4 String and StringBuffer Classes and their Methods, Wrapper Classes, Vector Class, Types of Errors (Compile Time Errors, Run Time Errors), Exceptions, Checked and Unchecked Exceptions, Handling Exceptions (try, catch, finally, throw, throws), Programmer-Defined Exceptions, Multithreading, Creating Threads (Extending Thread Class, Implementing Runnable Interface), Life Cycle of a Thread, Thread Exceptions, Thread Priority, Synchronization

Unit 5 World Wide Web, Web Browser, HTML, Basic Features of HTML, HTML Tags, Applets v/s Stand Alone Applications, Creating and Executing Small Applets, GUI Components, Graphics Class, Lines and Rectangles, Circles and Ellipses, Arcs, Polygons, Delegation Event Model, AWT and its Basic Controls, Layout Managers (FlowLayout, BorderLayout, GridLayout, CardLayout)

Text Books:

1. *Bhave M.P., Patekar S.A., Programming with Java, Pearson Education*
2. *Kahate, Java Programming, Oxford*

References Books:

1. Balagurusamy E., *Programming with JAVA – A Primer*, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi
2. Mughal Khalid A., Rasmussen Rolf W., *A Programmer's Guide to JAVA Certification*, Second Edition, Pearson Education Pte. Ltd., Delhi
3. Arnold Ken, Gosling James, Holmes David, *The Java Programming Language*, Third Edition, Pearson Education Pte. Ltd., Delhi
4. Zukowski John, *Mastering Java 2*, BPB Publications, New Delhi
5. Deitel H.M., Deitel P.J., *Java How To Program*, Third Edition, Prentice-Hall of India Private Limited, New Delhi
6. Horstmann Cay S., Cornell Gary, *Core Java 2*, Volume I & II, Seventh Edition, Pearson Education Pte. Ltd., Delhi
7. Schildt Herbert, *Java: The Complete Reference*, Seventh Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi

Java Programming Applications Lab

L T P C

0 0 8 4

Max. Marks : 60

(CA: 20 + ESA: 40)

Lab Number	Problems
L1	Display the given information in a given format using Sequential statements
L2-L3	Problems based on arithmetic, logical, relational and bitwise operators such as the following programs
L4-L6	Problems based on Conditional Statements (if, if.. else, switch, goto, labeled continue, labeled break)
L7-L10	Problems based on conditional and unconditional loop (For, While, Do...While)
L11-L13	Problems based on single and multidimensional Arrays
L14-L19	Problems based on object oriented concepts (class)
L20-L23	Problems based on Inheritance
L24-L29	Problems based on Package and Interface
L30-L32	Problems based on Wrapper Class
L33-L35	Problems based on Exception handling
L36-L41	Problems based on I/O Stream
L42-L47	Problems based on String class and its methods
L48-L50	Problems based on Applet
L51-L54	Problems based on Graphics(GUI component)
L55-L60	Problems based on Event Handling

Communication and Networking

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will

Be able to demonstrate knowledge of the network and its application areas.

Have the ability to use various networks protocols.

Have an understanding of the proper contents of a data communication and networking

Syllabus

- Unit 1** Data Communication today, Components of a data communication system, Equipment at user's end, Equipment at the computer end, Data Transmission Concepts (Time domain and Frequency domain concepts), Digital and analog, transmission, Serial/parallel data transmission, Signal encoding techniques, Modulation and modems.
- Unit 2** Transmission channels (twisted pair, coaxial cable, microwave, optical fiber, satellite), Transmission Impairments, Channel Capacity and its numerical, Baud rate, Bandwidth, Multiplexing (frequency division, time division, wave division), Synchronous and asynchronous transmission, Simplex, half duplex and duplex transmission.
- Unit 3** Computer Network, Advantage of Networking, Local Area Networks. Types of LAN (Star, Ethernet, Bus, EPABX), LAN Technology (IEEE 802.3, 802.4, 802.5), Network Switching: Circuit, Packet (Datagram & Virtual Circuit), Wide Area Networks (WAN): Requirements, Advantages. Network Operating Systems, Introduction to Novell Netware.
- Unit 4** ISO-OSI model of Networking, Different layers and their functions, Definition of protocol, Networking & Internetworking Services gateway and bridges, E-mail, Teleconferencing, Electronic banking, Videotext, Network Security & Privacy.
- Unit 5** TCP/IP protocol suite, Introduction to Internet, Intranet, Extranet, Internet applications like DNS, TFTP, FTP, SMTP, SNMP, www, HTTP, URL), Introduction to ISDN, B-ISDN. Distributed databases, Social implications of telemetric society, Awareness of Indian Networks-NICNET, ERNET etc.), An introduction to mobile computing.

Suggested Books:

Stallings, W. (2007). *Data and computer communications*. Pearson Education India.

Forouzan, A. B. (2007). *Data communications & networking*. Tata McGraw-Hill Education.

Tanenbaum, A. S., & Wetherall, D. (2014). *Computer networks*. Harlow, Essex: Pearson,.

Martin, J. (1978). *Computer networks and distributed processing*.

Suggested E-Resources:

Kurose, J. F., & Ross, K. W. (2009). *Computer networking: a top-down approach*. Boston: Addison Wesley.

https://www.bau.edu.jo/UserPortal/UserProfile/PostsAttach/10617_1870_1.pdf

Data Communication

<https://nptel.ac.in/courses/106105082/>

Multimedia and Web Designing

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On successful completion of the course students will be able to

Design and develop a static and dynamic website

Use java script to add dynamic content to website.

Analyze the various latest interactive multimedia devices and the basic concepts about images and image format.

Discuss various multimedia tools like Photoshop, Flash.

Design interactive multimedia software using multimedia tools(Photoshop, Flash) and web programming languages (HTML, CSS, Java Script, PHP)

Syllabus

Unit 1 Multimedia: Introduction, Main elements, Need, Benefits, Multimedia devices, Applications, Concept of virtual reality. Photoshop: Image editing tools, Layers, Channel & Masks. Introduction to Flash.

Unit 2 Web Development: Internet and History of Internet, Internet Connection methods, Basic services, WWW, Concept of Web browser, Web document, Web server, DNS Basics of Web site design, Characteristics of good website, Publishing & Registering websites, Introduction to Internet Service Providers & Search Engines.

Unit 3 HTML : Introduction to HTML, structure of HTML code, various tags, Frames, creating link in Web pages, Forms, CSS, HTML DOM, XML : Introduction, structure, XML Markup, Viewing XML document (using CSS, DOM), Embedding multimedia contents to the web.

Unit 4 DHTML, **Java Script** : Introduction, Basic: syntax, data types, variables, Expression, operator, Control structure, Loops: while, do while, for, Functions.

Unit 5 **PHP**: Introduction, Basic: syntax, data types, variables constant, PHP Expression, operator, Control structure, Loops, Functions: Syntax, Arguments, Variables, References, Pass by Value & Pass by references, Return Values, Variable Scope, Array, Form handling, State management: Query String, Cookies, Session Handling. Database Connectivity.

Suggested Books:

Ray, D. S. *Mastering HTML 4.0*, 1997. Sybex, San Francisco, CA, USA

Bayross, I. *Web Enabled Commercial Application Development by using HTML, Java Script, DHTML and PHP*

Reinhardt, R. (2004). *Flash Mx 2004 Action Script Bible*. John Wiley & Sons.

Bangia, R. (2004). *Multimedia and Web Technology*. Firewall Media.

Alexis, L., & Mathews, L. (1997). *Internet for everyone*

Wirasinha, A. (2002). *Flash in a Flash: Web Development*. Prentice-Hall of India.

Jeffcoate, J. (1995). *Multimedia in practice: technology and applications*. Prentice-Hall, Inc..

Holzner, S. (2007). *PHP: the complete reference*. Tata McGraw-Hill Education.

Suggested E-Learning Materials:

W3Schools website

<https://www.w3schools.com/>

Internet Technology

<https://nptel.ac.in/courses/106105084/13>

Multimedia and Web Designing Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Lab Number	Problems
L1-L2	Create a page with HTML basic tag like, Paragraph, formatting, inserting image
L3	Create different types of list using HTML
L4	Create pages with internal and external linking using HTML
L5-L6	Create different types of tables using HTML
L7	Create different types of image maps using HTML
L8-L9	Create pages with different frame formats using HTML
L10-L11	Create pages using HTML Form, CSS Introduction
L12	Types of CSS, Designing a web page using Font Tables and Link, border in CSS
L13-L14	Java Script Introduction, Use of data types, variables, constant, Expression, operator in Java Script
L15-L16	Use of conditional statements in Java Script
L17-L18	Use of looping statements in Java Script
L19	Java Script functions
L20-L21	Introduction to XML, XML Structure, Viewing XML using CSS
L22-L23	PHP Introduction, Use of data types, variables, constant. Expression, operator
L24	Use of conditional statements in PHP
L25	Use of looping statements in PHP
L26-L27	Creating different types of arrays
L28	Usage of array functions
L29-L30	Creating user defined functions. Functions Call by value and call by reference
L31-	Form handling using GET, POST
L32	Creation of sessions
L33-L34	Creation of Cookies and Creating web page using QueryString
L35-L37	Database Connectivity, ADD, DELETE, UPDATE and VIEW data from database
L38-L39	Photoshop basic Environment and Layer , Selection images in Photoshop
L40-L41	Retouching and repairing images in Photoshop, Masking effect
L42-L43	Flash basic Environment, Toolbar, Layer, Frame, Symbol etc.
L44-L45	Creating a different type of animation using Flash

Introduction to Discrete Mathematics

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, the student will be able to,

- Write an argument using logical notation and determine if the argument is or is not valid.
- Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
- Understand the basic principles of sets and operations in sets.
- Prove basic set equalities.
- Apply counting principles to determine probabilities.
- Demonstrate an understanding of relations and functions and be able to determine their properties.
- Determine when a function is 1-1 and "onto".
- Demonstrate different traversal methods for trees and graphs.
- Model problems in Computer Science using graphs and trees.

Unit 1 Permutations, Combinations, selection with & without replacement; Sets and multisets, permutation and combinations of multisets, enumeration of permutations and combination of sets & multisets, Discrete probability, Conditional Probability, Bayes Theorem, Functions, Relations, Properties of binary relations, equivalence relations, partial order relations, Pigeonhole Principle : Inclusion-Exclusion principle,

Unit 2 Graph theory :- Basic concepts of graph theory, multigraph and weighted graphs, matrix representation of graphs, paths & circuits, shortest path in weighted graph, Adjacency matrix, Eulerian path and circuits, Hamiltonian path and circuits, planar graphs.

Unit 3 Chromatic number, vertex and edge colouring of graphs, K-connected and K-edge -connected graphs, Trees, rooted trees, Spanning tree, minimum spanning tree (Prim's and Kruskal's algorithm), Tree traversal, Travelling salesman problem (TSP), Depth first search and breadth first search, Cut sets and cut vertices

Unit 4 Discrete numeric functions - manipulation of numeric functions Asymptotic behaviour of numeric function, Recurrence relations, Linear recurrence relation with constant coefficients and their solutions, Homogeneous solution, particular solution & total solutions,

Unit 5 Mathematical logic: Basic Connectives, rules of inference, normal forms (CNF and DNF), proof of validity, Predicate logic. Boolean Algebra, lattices, chain and antichain, principle of duality, basic properties of algebraic systems defined by lattices and Boolean Algebras, Boolean functions and Boolean expressions

Text Books:

1. Liu C.L., *Elements of Discrete Mathematics*, McGraw Hill Int. Ed.
2. Kolman B. & Busby C.R., *Discrete Mathematical Structures for Computer Science*, Prentice Hall of India Ltd.
3. Deo N., *Graph Theory*, Prentice Hall of India.

Reference Books:

1. Trembley J.P. & Manohar R., *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill.
2. Rosen, K. H.: *Discrete Mathematics and Its Applications*, McGraw Hill, 2012.

Suggested E-learning materials:

Notes on Graph Theory: <https://www.geeksforgeeks.org/engineering-mathematics-tutorials/>

Discrete Mathematics: <http://mathworld.wolfram.com/DiscreteMathematics.html>

Computer Oriented Numerical and Statistical Methods

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Apply numerical methods to obtain approximate solutions to mathematical problems.

Using appropriate numerical methods, determine the solutions to given non-linear equations, systems of linear equations, interpolation, numerical differentiation and integration and numerical solution of ordinary differential equations.

Analyze the errors obtained in the numerical solution of problems.

Apply appropriate algorithms to solve selected problems, both manually and by writing computer programs.

Compare different algorithms with respect to accuracy and efficiency of solution.

Implement numerical methods algorithm using programming language.

Section-A

Errors and Approximations in Digital Computers, Number representation, Floating point Arithmetic. Solution of systems of linear equations - direct method, Gauss Jordan & Gauss Elimination methods, Pivoting, Iterative methods - Jacobi & Gauss Seidel method.

Solution of Nonlinear equations in n variable : Localization of the roots, Bisection and Regula-Falsi methods, Newton-Raphson method, Secant method successive Approximation method, Rate of convergence and Aitkin's process.

Section-B

Interpolation: Newton's Interpolation formulae - Forward and Backward difference formulae, Lagrange's and Divided difference Interpolation formula, Error term and error of Interpolation, Inverse Interpolation. Numerical Differentiation and Integration: Differentiation formula based on Interpolating polynomials- Newton-Gregory Forward, Backward and Divided difference Polynomial, Newton-Cotes formulae - Trapezoidal & Simpson's rule, change of interval of integration.

Numerical solution of ordinary Differential equations : ODE's as a system of first order ODE's, Euler's, Picard's and Taylor series methods of real functions, Runge-Kutta 2nd order method, Runge-kutta 4th order method. Modified Euler's Method, Predictor-corrector method. Polynomial Approximations, Least squares approximation.

Section-C

Statistical methods: treatment of data, frequency distribution, measures of central tendency, dispersion and partition values .Probability distribution-Binomial, Poisson and Normal. Correlation and regression.

Inference- test of significance for large sample only (mean, variance, proportion),chi-square test for goodness of fit and Independence of attributes. Analysis of variance, analysis of covariance.

Suggested Books:

1. Rajaraman, V. (1993). *Computer Oriented Numerical Methods* (3rd ed.). PHI Learning, New Delhi.
2. Cheney E.W. & Kincaid D.R. (2008). *Numerical Methods and Applications*. Cengage Learning, New Delhi.
3. Gupta, S.P. (2008). *Statistical Methods* (11th ed.). Sultan Chand & Sons, New Delhi.
4. Gupta, S.C. & Kapoor, V. K. (2002). *Fundamentals of Mathematical Statistics* (11th ed.). Sultan Chand & Sons, New Delhi.
5. Krishnamurthy, E.V. & Kumar S. S. (1976). *Computer Based Numerical Algorithms*. East West Press, New Delhi.
6. Rao, K.S. (2007). *Numerical Method for Scientists and Engineers*. PHI Learning Pvt. Ltd., New Delhi.
7. Sastry, S.S. (2008). *Introductory Methods of Numeric Analysis* (4th ed.). PHI Learning Pvt. Ltd., New Delhi.
8. Yule, G.U. & Kendall, M.G. *An Introduction to the Theory of Statistics*, Universal Book Stall.

9. Agarwal, B.L. *Basic Statistics*. New Age International Publication.

Suggested E-Resources:

1. Computer Oriented Numerical and Statistical Methods
<https://nptel.ac.in/courses/122106033/#>
2. Computer Oriented Numerical and Statistical Methods MOOC website
<https://www.mooc-list.com/tags/numerical-methods>

Computer Oriented Numerical and Statistical Methods Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab No.

Problems

- L01 Perform floating point operations using normalization (addition, subtraction, multiplication, division)
- L02-L03 Find the roots of equation (bisection method, regula-falsi method, Newton raphson method, secant method, successive approximation method)
- L04-L05 Find solution of n linear equation (Gauss elimination method (with & without pivoting). Gauss Seidel method. Gauss Jordan method)
- L06 Generate following difference tables (forward, backward, divided difference)
- L07-L09 Interpolate value of $f(x)$ at given x (Lagrange's interpolation method, Newton forward interpolation method, Newton's backward interpolation method), Inverse interpolation
- L10-L11 Fitting of different curves (straight line fit (x on y), straight line fit (y on x), parabola, geometric curve, exponential curve)
- L12- L13 Find derivative of a given tabulated function at given value (Newton's forward method, Newton's backward method)
- L14 – L16 Find Integrated value, (when tabulated function given-Trapezoidal rule (simple & modified), Simpson's 1/3 (simple & modified), Simpson's 3/8 (simple & modified))
- L17 – L19 Find Integrated value, when algebraic expression given (when algebraic expression given-Trapezoidal rule (simple & modified), Simpson's 1/3 (simple & modified), Simpson's 3/8 (simple & modified)).
- L20-L21 Solve differential equation (Euler's method, Runge-Kutta 2nd order method, Runge-kutta 4th order method. Modified Euler's method, Predictor-corrector method.
- L22-L23 Determination of Mean, Median, Mode, G.M., H.M., Quartiles, Deciles and Percentiles.
- L24-L25 Computation of Range, Standard deviation, Mean deviation, Quartile deviation and Coefficient of variation.
- L26 Computation of coefficients of correlation and rank correlation.
- L27-L28 Fitting of (i) Binomial, (ii) Poisson
- L29 Test of Significance problems for Large sample testing
- L30-L31 Chi Square test for goodness of fit and independence of attributes
- L32 ANOVA for one way classification.

Computer Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Understanding the concepts of computer basics and programming.

Understanding of the organization and operations of a computer system.

Understanding of Binary logic in design of electronic circuits.

Students would have logical thinking for Analyzing problems, designing and implementing algorithmic solutions.

Students would get the skills for the use of the C programming language to implement the real world applications.

Section-A

Fundamentals of Computer System: Block Diagram, CPU, Memory, Input/Output Devices. Hardware and Software, Booting Process and DOS Commands.

Steps in Program Development: Problem analysis, algorithms & flow charts, High level and low level programming languages.

Computer Programming Using C: History, Data types (simple and structured) and their representation, Constants and variables, Operators, Arithmetic's and logical expressions, Type casting, Input and output statements.

Section-B

Control Statements: Sequencing, Conditional and unconditional branching and looping.

Arrays: Single and multidimensional arrays, Arrays and strings, String built-in functions, Applications of arrays: Searching (linear and binary), Sorting (bubble, selection and insertion).

Structured Programming: Function declaration and definition, Function call, Passing parameters to the functions: call by value, call by reference. Returning values, Recursive functions, Passing arrays to functions.

Section-C

Storage classes in C: Automatic, Register, External, and Static.

Pointers: Pointer arithmetic, Pointers and arrays, Pointers and strings, Pointer to pointer, Dynamic Memory Allocation.

Derived Data Types: Structures, unions, Array of structure, Pointer to structure, enumerated data types.

File Handling in C: Types of files, Opening and closing a data file, reading and writing a data file, Random access in a file, Error handling during file I/O operations, Command line arguments.

Suggested Books:

1. Kanetkar, Y. P. (2009). *Let us C*. BPB Publications.

2. Sinha, P. K. (2004). *Computer Fundamentals: Concept, Systems and Applications*. BPB Publications.
3. Kernighan, B. W., & Ritchie, D. M. (2006). *The C Programming Language*. PHI Learning Pvt. Ltd., New Delhi.
4. Kanetkar, Y. P. (2009). *Understanding Pointers in C*. BPB Publications.
5. Dromey, R. G. (2007). *How to Solve it by Computer*. PHI Learning Pvt. Ltd . New Delhi.
6. Govil, Mahesh Chand, *Computer Fundamentals and Programming in C*, Jaipur Publishing House.
7. NIIT, *Introduction to Computer Programming* (2005). PHI Learning Pvt. Ltd . New Delhi.
8. Venugopal, K. R. (2005). *Programming with C*. Tata McGraw-Hill.
9. Balagurusamy, E., (2010). *Programming in ANSI C*. Tata McGraw-Hill.

Suggested E-Resources:

1. Introduction to Programming in C
<https://nptel.ac.in/courses/106104128/>
2. Introduction to Programming in C Specialization by Duke University
<https://www.coursera.org/specializations/c-programming>
3. Computer Fundamentals by P. K. Sinha
<https://www.edutechlearners.com/computer-fundamentals-p-k-sinha-free-pdf/>

Computer Programming Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab Number

Problems

- L1-L3 Simple hands on computers and DOS Internal & External Commands
- L4-L6 Simple Problems Using scanf and printf functions. Formula Based Problems using Constants, Variables and use of operators.
- L7-L8 Use of Library Functions e.g. sqrt, sin, cos, log etc.
- L9-L20 Loop Statement using for, while, do –while statement
- L21-L25 Conditional Checking Using if statement, Nested if statement, switch statement and Unconditional goto
- L26-L40 Problems based on array data types. Problems on One Dimensional Array-Searching (Linear, Binary), Sorting (Bubble, Selection, Insertion), Merging.
- L41-L45 Problems on two Dimensional Array -Matrix Operation: Addition, Subtraction, Multiplication etc.
- L46-L50 Problems based on pointers, Parameter passing in functions, Recursion
- L51-L55 Declaration, Reading, Writing and manipulation on struct and union data type
- L56-L62 File handling
- L63-L64 Command line Arguments

System Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Understand the basics of system programs like editors, compiler, assembler, linker, loader, interpreter and debugger.

Describe the various concepts of assemblers and macro-processors.

Understand the various phases of compiler and compare its working with assembler.

Understand how linker and loader create an executable program from an object module created by assembler and compiler.

Know various editors and debugging techniques.

Section-A

System Software: Components and Evolution. General Machine Structure: Memory, Instructions, Registers.

Operating Systems: Types & basic functions. Assemblers: Elements of Assembly Language Programming, A Simple Assembly Scheme, Pass Structure of Assemblers, Design of 2 pass assembler.

Section-B

Macros and macro processors: Macro Definition and Call, Macro Expansion, Nested Macro Calls, Design of a Macro Preprocessor. Loaders and linkers: Loader schemes (Compile and go loader, general loader scheme, absolute loader, subroutine linkage, relocating loader, direct linking loader, binders and overlays).

Section-C

Software Tools: Editors, Debug Monitors, Program generators
description of different phases.
Translators: Interpreters, Compiler: Brief
ROM BIOS, EMS, input and output services. Device
Drives: Types, structure and processing. Interrupt: Types, Organization, processing, IVT, interrupt handler.

Suggested Books:

1. Donovan J.J (1991). *Systems Programming*. Tata Mc-Graw Hill.
2. Dunkan R (1994). *Advance MS-DOS Programming*, BPB Publications.
3. Elzeey Roy S. (1987). *Computer System Software*, Science Research Associates.
4. Dhamdhere D.M. (1987). *Introduction to System Software*. Tata Mc-Graw Hill.
5. Bigger Staff T. J. (1986). *System Software Tools*, PHI Learning Pvt. Ltd . New Delhi.
6. Dhamdhere D.M (2001). *System Programming and Operating Systems* (2nd ed.). Tata Mc-Graw Hill.
7. Bose S. K. (1991). *Hardware and Software of Personal Computers*. New Age International Publishers.

Suggested E-Resources:

1. System Programming by Leland L. Beck
<http://solomon.ipv6.club.tw/Course/SP.941/>

Web Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand working of Internet & World Wide Web.
- Develop a dynamic webpage by the use of java script, HTML & CSS.
- Develop an application using Javascript.
- Develop web application using PHP with database connectivity.
- Get the knowledge of publishing and hosting web application.

Section-A

Internet: Concept of Networking, Applications, Evolution of Internet, Basic Internet services, WWW, Concept of Web browser, Web server, Domain Name Server (DNS), URL, HTTP, Internet Service Providers, Search engines, Cookies, Basics of Web site design, Characteristics of a good website, Web hosting and Web publishing, Web crawlers, Introduction to Web Design Tools (Front page, Dreamweaver).

HTML: Introduction, Elements, Structure of HTML code, Attributes, Headings, Paragraphs, Styles, Formatting, Lists, Quotations, Links, Images, Tables, Forms, Frame, DHTML.

Section-B

Cascading Style Sheets (CSS): Syntax, Internal, External and Embedded CSS. CSS: Text, Fonts, Links, Tables, Border, Outline, Margin, Class Selector, ID Selector.

JavaScript: Introduction, Syntax, Data types, Variables, Expressions, Operators, Conditional statements, Looping structures: while, do while, for. Arrays, Functions, Forms and validations, Event Handling, DOM of JavaScript, JavaScript objects.

Section-C

PHP Introduction: Origin, PHP with the Web Server, syntax, data types, variables, constant, expression, operator, Control structure, Loops, Functions, argument passing in functions, References, Pass by Value & Pass by references, Return Values, Variable Scope, Array, Form handling, String handling, Cookies and Sessions, Basics of MySQL, Connectivity with MySQL.

Suggested Books:

1. Deborah S. Roy & Eric J. Roy. *Mastering HTML 4.0*. BPB Publications.
2. Bayross I. (2009). *Web Enabled Commercial Applications Development Using HTML, DHTML and PHP* (4th ed.). BPB Publications.
3. Holzner, S. (2008). *PHP: The Complete Reference*. Tata McGraw-Hill.
4. P.J. Deitel, & H.M. Deitel. *Internet and World Wide Web How to Program*, Pearson Education.
5. Greenlaw, R., & Hepp, E. (2001). *Fundamentals of the Internet and the World Wide Web* (2nd ed.). Tata McGraw-Hill.

Suggested E-Resources:

1. W3Schools website
<https://www.w3schools.com/xml/>
2. HTML, CSS, and Javascript for Web Developers by Johns Hopkins University
<https://www.coursera.org/learn/html-css-javascript-for-web-developers>
3. Internet Technology by IIT Kharagpur
<https://nptel.ac.in/courses/106105084/>

Web Technology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab Number

Problems

- L1-L2 Create a page with HTML basic tag like, Paragraph, formatting, inserting image
- L3 Create different types of list using HTML
- L4 Create pages with internal and external linking using HTML
- L5-L6 Create different types of tables using HTML
- L7 Create different types of image maps using HTML
- L8-L9 Create pages with different frame formats using HTML
- L10-L11 Create pages using HTML form, CSS Introduction
- L12- L14 Types of CSS Designing a web page using Font Tables and Link in CSS and HTML
- L15 Create a pages using DIV
- L16 Create a pages using Class and ID Selector
- L17-18 Java Script Introduction, Use of data types, variables, constant, Expression, operator in Java Script
- L19-L21 Use of conditional statements in Java Script
- L22-L24 Use of looping statements in Java Script
- L25-26 Java Script functions
- L 27- L28 Java Script DOM and Event in Java Script
- L29-L30 PHP Introduction, Use of data types, variables, constant, Expression, operator
- L31 Use of conditional statements in PHP
- L32-L33 Use of looping statements in PHP
- L34-L35 Creating different types of arrays
- L36-37 Usage of array functions
- L38-39 Creating user defined functions, Functions Call by value and call by reference
- L40 Form handling using GET, POST
- L41 Creation of sessions, Cookies
- L 42 Creating web page using Query String and Hidden Field
- L43- L45 Database Connectivity, ADD, DELETE, UPDATE and VIEW data from database

Database Management Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Describe data models and schemas in DBMS

Understand the features of database management system and Relational databases.

Use SQL -the standard language of relational databases.

Understand the functional dependencies and design of the database.

Understand the concept of Transaction and Query processing.

Section-A

Introduction : Database system concepts and architecture, Data models schema and instances, Data independence and database language and interface, Data definition languages, DML, Overall database structure.

Data modeling using Entity Relationship Model : E. R. model concepts, notation for ER diagrams, mapping constraints, Keys, Concept of super key, candidate key, primary key, Generalization, Aggregation, reducing ER diagrams to tables, extended ER model, Relationship of higher degree.

Relational Data Model and Language : Relational data model concepts, relational algebra, relational calculus, tuple and domain calculus, SQL, data definition queries and updates in SQL, integrity constraints, Keys-constraints, domain constraints, referential integrity, assertions, security of databases.

Section-B

Example DBMS System (Oracle 8) : Basic architecture, data definition and data manipulation, ISQL, PLSQL, cursors, triggers, stored procedures.

Database design : Functional dependencies, normal forms, first, second and third functional normal forms. BCNF, multivalued dependencies, fourth normal forms, join dependencies and fifth normal forms. Steps in database design.

Query processing: Steps of Query Processing, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Evaluation of Expressions.

Section-C

Query Optimization: Catalog Information for Cost Estimation, Estimation of Statistics, Transformation of Relational Expressions, Dynamic Programming for Choosing Evaluation Plans.

Transaction processing concepts. Concurrency control techniques, locking techniques, and time stamping and concurrency control.

Recovery-Log-Based, Shadow Paging, Recovery with concurrent Transactions Distributed database systems: Fragments of Relations, Optimization transmission cost by semi joins, Distributed concurrency control, Management of deadlocks.

Suggested Books:

1. Korth Henry F., Silberschatz Abraham, & Sudarshan S. (2006). *Database System Concepts* (5th ed.). Tata McGraw-Hill.
2. Murdick, R. G., Ross, J. E., & Claggett, J. R. *Information Systems for Modern Management*. Prentice Hall Professional Technical Reference.
3. Date C.J. *An Introduction to Database Systems*. Addison Wesley.
4. Majumdar & Bhattacharya. *Database Management System*. Tata McGraw-Hill.
5. Ramakrishnan, R., & Gehrke, J. (2000). *Database Management Systems*. Tata McGraw-Hill.

6. Leon, A., & Leon, M. (2010). *Database Management Systems*. Vikas Publishing House Pvt. Limited.

Suggested E-Resources:

1. Data Base Management System
<https://nptel.ac.in/courses/106105175/>
2. Database Management Essentials by University of Colorado
<https://www.coursera.org/learn/database-management>
3. Database System Concepts by Abraham Silberschatz, Henry F. Korth and S. Sudarshan
<https://kakeboksen.td.org.uit.no/Database%20System%20Concepts%206th%20edition.pdf>

Database Management Systems Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab	Problem

1-5	Basic DDL commands(Create,Drop,Alter) with integrity constraints
6-10	DML & DCL commands (Insert, Update, Delete, Select, Commit, Rollback)
11-13	Operators (Arithmetic,Logical,Relational etc.)
14-18	Assignment based on DDL and DML with conditions also Joins (Self join, inner join, outer join, equi join)
19-20	Complex queries (Retrieval of data from more than one table)
21-25	PL/SQL Block,Loops
26-27	Cursors, Triggers, Procedure, Function
28	Assignment of PL/SQL
29-32	Forms and report using front and tool. Connecting of database

Object Oriented Methodology and Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand the features of C++ supporting object oriented programming
- Understand the relative merits of C++ as an object oriented programming language
- Understand how to produce object-oriented software using C++
- Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism
- Understand advanced features of C++ specifically stream I/O, templates and operator overloading
- Understand other features of the C++ language including templates, forms of casting, conversions, and file handling.

Section-A

Object-Oriented Methodology: Differences from Functional Methodology, Abstraction, Encapsulation, Object Modeling Technique, Objects, Classes, Object Diagrams, Attributes, Operations and Methods, Links, Associations, Multiplicity, Generalization and Inheritance, Aggregation, Abstract Classes, Multiple Inheritance

C++: Tokens, Data Types, Operators and Expressions, Promotion and Type Conversion, Operator Precedence and Associativity, Conditional and Looping Constructs, Operations on Arrays, Strings Manipulations, Function Components, Parameter Passing, Return by Reference, Default Arguments, Inline Functions, Function Overloading, Arrays and Functions, Scope and Extent of Variables, Storage Classes, Functions with Variable Number of Arguments, Recursive Functions, Class Specification, Class Objects, Data Hiding, Empty Classes, Passing Objects as Arguments, Returning Objects from Functions.

Section-B

Friend Functions and Friend Classes, Constant Parameters and Member Functions, Static Data and Member Functions, Constructors, Destructor, Constructor Overloading, Constructors with Default Arguments, Nameless Objects, Dynamic Initialization through Constructors, Copy Constructor, Constant Objects and Constructor, Static Data Members with Constructors and Destructors, Pointers and their Binding, void Pointers, Runtime Memory Management, Pointer Constants, Pointers to Constant Objects, Constant Pointer, Pointers to Objects, Live Objects, Array of Objects, this Pointer, Unary Operator Overloading, Increment/ Decrement Operators, Binary Operator Overloading, Arithmetic Operators, Concatenation of Strings, Comparison Operators, Arithmetic Assignment Operators, Overloading of new and delete Operators, Data Conversion, Overloading with Friend Functions, Assignment Operator Overloading, Inheritance and Member Accessibility, Constructors and Destructors in Derived Classes, Constructors Invocation and Data Member Initialization, Overloaded Member Functions, Abstract Classes, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Multipath Inheritance and Virtual Base Classes, Hybrid Inheritance.

Section-C

Virtual Functions, Pointer to Derived Class Objects, Pure Virtual Functions, Abstract Classes, Dynamic Binding Implementation, Function Templates, Overloaded Function Templates, Nesting of Function Calls, Multiple Arguments Function Template, User Defined Template Arguments, Class Templates, Inheritance of Class Template, Class Template Containership, Class Template with Overloaded Operators, Console I/O, Concept of Streams, Hierarchy of Console Stream Classes, Unformatted and Formatted I/O Operation, Managing Output with Manipulators, File Handling, Classes for File Stream Operation, Open and Close a File, File Models, File Pointers

and their Manipulations, Sequential I/O Operations, Updating a File, Error Handling during File Operation, Exception Handling, Use of Standard Template Library (STL).

Suggested Books:

1. Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F., & Lorensen, W. E. (1991). *Object-oriented Modeling and Design*. PHI Learning, New Delhi.
2. Venugopal, K.R., Buyya, Rajkumar, & Ravishankar (1997). *Mastering C++*. Tata Mc-Graw Hill.
3. Schildt, H. (2001). *C++: The Complete Reference*. Tata McGraw-Hill.
4. Balagurusamy, E. (2008). *Object Oriented Programming with C++* (6th ed.). Tata McGraw-Hill.
5. Kanetkar, Y. P. (2010). *Let us C++*. BPB Publications.

Suggested E-Resources:

1. The C++ Programming Language by Bjarne Stroustrup
<http://www.stroustrup.com/C++.html>
2. Programming in C++
<https://nptel.ac.in/courses/106105151/>

Object Oriented Methodology and Programming Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab Number Problems based on

- L1-L2 Operators and Expressions, Conditional and Looping Constructs, Operations on Arrays, Strings Manipulations
- L3-L4 Function Components, Default Arguments, Inline Functions, Function Overloading, Functions with Variable Number of Arguments, Recursive Functions
- L5-L7 Class Specification, Class Objects, Empty Classes, Passing Objects as Arguments, Returning Objects from Functions
- L8-L9 Friend Functions and Friend Classes
- L10 Static Data and Member Functions
- L11-L12 Constructors, Destructor, Nameless Objects, Copy Constructor, Static Data Members with Constructors and Destructors
- L13-L14 Pointers and their Binding, void Pointers, Pointers to Constant Objects, Constant Pointer, Pointers to Objects, Array of Objects, this Pointer
- L15-L17 Operator Overloading, Concatenation of Strings, Overloading of new and delete Operators, Data Conversion, Overloading with Friend Functions, Assignment Operator Overloading
- L18 Inheritance and Member Accessibility, Constructors and Destructors in Derived Classes
- L19-L20 Overloaded Member Functions, Abstract Classes, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Multipath Inheritance and Virtual Base Classes, Hybrid Inheritance
- L21 Virtual Functions, Abstract Classes, Dynamic Binding Implementation
- L22-L23 Function Templates, Overloaded Function Templates, Multiple Arguments Function Template, User Defined Template Arguments
- L24-L25 Class Templates, Inheritance of Class Template
- L26 Console I/O, Stream Classes, Unformatted and Formatted I/O Operation, Managing Output with Manipulators
- L27-L28 File Handling, File Pointers and their Manipulations, Sequential I/O Operations, Updating a File, Error Handling during File Operation
- L29-L30 Exception Handling, Use of Standard Template Library (STL)

Java Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On completion of the course students will able to

Understand concept of Object Oriented Programming & Java Programming Constructs.

Understand the basic concepts of Java such as Operators, Classes, Objects, Interface, Inheritance, Packages, Enumeration and various keywords.

Understand the concept of Exception Handling, Collections, Input/output operations, Socket Programming, Database Connectivity.

Design the applications of Java, Swing, Applet and JSP.

Analyze & Design the concept of Event Handling and Abstract Window Toolkit (AWT).

Section-A

Java Introduction: Evolution, features, concepts of Java Virtual Machine (JVM) and its task, Java and Internet, Environment (JRE, JDK, JSDK, APIs), Application & Applet, Java Programming: Structure of program, Data Types, Variables, Operators, Expressions, Control statements (sequencing, alteration, looping), Object oriented Concepts, Objects, Classes, Constructors, Method Overloading, Arrays, String handling, Wrapper classes, packages, Access Specifier, Inheritance, Method Overriding, Interfaces, Inner & Anonymous classes

Section-B

Exception handling, Streams and I/O programming, Serialization, Multithreading, Collection framework (Set, Map, List, Vector), Generic, Iterators, Utility Classes (Date, Calender, Random, Timer), Networking, Socket and Datagram Programming.

Section-C

JDBC, ODBC-JDBC Drivers, Types of Drivers, Prepared Statement and Callable Statement, Resultset, Metadata.

Introduction to Web Browser and HTML, GUI in Java, Features of AWT and Swing, Layout Managers, Event handling, Adapter classes, Applets, Java Server Pages: tags and directives.

Suggested Books:

1. Schildt, H. (2007). *Java : The Complete Reference* (7th ed.). Tata McGraw-Hill .
2. Rajagopalan, S., Rajamani, R., Ramesh, K., & Sridhar, V. (2002). *Java Servlet Programming Bible*. Wiley Dreamtech India Pvt. Ltd.
3. Balagurusamy, E. (2007). *Programming with JAVA – A Primer* (3rd ed.). Tata McGraw-Hill.
4. Mughal, K. A., & Rasmussen, R. W. (2009). *A Programmer's Guide to Java SCJP Certification: A Comprehensive Primer* (3rd ed.). Pearson Education.
5. Arnold, K., Gosling, J., & Holmes, D. (2000). *The Java Programming Language* (3rd ed.). Pearson Education.

6. Zukowski, J. (1998). *Mastering Java 2*. BPB Publications
7. Deitel, P.J., & Deitel, H.M. (2009). *Java: How to Program* (7th ed.). Pearson Education.
8. Horstmann, C. S., & Cornell, G. (2005). *Core Java 2 Volume I & II* (7th ed.). Pearson Education.
9. Haecke, B. V. (2000). *JDBC3 Java Database Connectivity*. Wiley Dreamtech India Pvt. Ltd.
10. Bayross, I. (2005). *Web Enabled Commercial Applications Development Using... Java 2* (Revised ed.). BPB Publications.
11. Ganguli, M. (2002). *JSP: A Beginner's Guide*. Wiley Dreamtech India Pvt. Ltd.
12. Liang, Y. D. (2012). *Introduction to Java programming* (9th ed.). Pearson Education.

Suggested E-Resources:

1. Java Lectures
https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. Object Oriented Programming in Java Specialization by Duke University
<https://www.coursera.org/specializations/object-oriented-programming>

Java Programming Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab Number Problems

L1 – L2	Simple Programs
L3 – L4	Programs based on Control Statements
L5 – L8	Programs based on Classes & Inheritance
L9 – L10	Programs based on Arrays
L11 – L12	Programs based on Packages & Interfaces
L13 – L14	Programs based on Wrapper Classes
L15 – L16	Programs based on Exception Handling
L17 – L18	Programs based on I/ O Classes
L19 – L20	Programs based on Strings
L21 – L23	Programs based on Threads
L24 – L26	Programs based on Applets
L27 – L28	Programs based on Graphics
L29 – L32	Programs based on Event Handling
L33 – L35	Programs based on Swings & GUI Components
L36 – L37	Programs based on Serialization
L38 – L39	Programs based on Networking
L40 – L41	Programs based on JDBC
L42 – L45	Programs based on Servlets

Compiler Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Specify and analyze the lexical, syntactic and semantic structures of advanced language features.

Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation.

Write a scanner, parser, and semantic analyzer without the aid of automatic generators.

Turn fully processed source code for a novel language into machine code for a novel computer.

Describe techniques for intermediate code and machine code optimization.

Design the structures and support required for compiling advanced language features.

Section-A

Analysis of source program, Different phases of a compiler, Symbol Table.

Lexical Analysis : Different approaches to design a lexical analyzer, regular expression, finite automata (Deterministic & Non-deterministic). RE to NFA and NFA to DFA. Optimization of DFA states. Implementation of lexical analyzer (introduction), Context free Grammar.. Errors in different phases of compiler. Introduction to Compiler Construction Tools.

Section-B

Parsing techniques: Top down parsers, Predictive parser

Bottom-up parsers, Shift Reduce parsers, Operator-precedence parsing

LR parsers : SLR, LR(1), LALR

Section-C

Intermediate code generation : Intermediate language, syntax directed translation, assignment statement, Boolean statements and backpatching, array references, procedure calls and record structure.

Code optimization : Principal sources of optimization, Local & Loop optimization, loop invariant computations, induction variable elimination.

Code generation : Design of code generation, a machine model, a simple code generator, register allocation & assignment, code generation from DAG's.

Suggested Books:

1. Aho, U. (1989). *Principles of Compiler Design*. Narosa Publishing House.
2. Aho, Sethi, & Ullman (2007). *Compilers : Principles, Techniques and Tools*. Pearson Education.
3. Loudon, K. C. (1997). *Compiler Construction: Theory & Practice*. Cengage Learning.
4. Sorenson, P. G., Tremblay, J. P. (1985). *The Theory and Applications of Compiler Writing*. B. S. Publications Hyderabad.
5. Muchnick, S. S. (1997). *Advanced Compiler Design Implementation*. Morgan Kaufmann.

Suggested E-Resources:

Principles of Compiler Design

<https://nptel.ac.in/courses/106108113/>

Compilers by Stanford University

<https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/>

Web Development and .NET Framework

Max. Marks : 60

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Develop working knowledge of C# programming constructs and the .NET Framework architecture.

Develop, implement and create Applications with C#.

Build and debug well-formed Web Forms with ASP. NET Controls

Perform form validation with validation controls.

Create custom controls with user controls.

Use of XML in ADO.NET and SQL server.

Use ADO.NET in a web application to read, insert, and update data in a database.

Section-A

Introduction to .NET Framework, CLR, MSIL, Metadata, Namespaces, Console Applications using .NET Framework, C# Programming: Introduction, Tokens, Data Types, Variables, Operators, Control Statements, Methods, Arrays, String, Structures, Enumerations, Object Oriented Programming in C#, Classes and Objects, Encapsulation, Polymorphism, Inheritance, Interfaces and Collections, Properties, Exceptions Handling, Garbage Collector, Operator Overload Conversions Operators.

Section-B

Advance C#: Delegates, Events. Advance C# type Construction, Indexers, Generics, Threading, File Handling.

Web Development: Basic Concept of Client-Server Architecture, Elements of Web, Website Design Phases, Characteristics of good Website, HTML, CSS, Client Side and Server Side Coding, Introduction to Scripting Languages (JavaScript, VBScript), Client-Side Validations.

Section-C

Web Application Development using ASP.NET with C#: Web Application in ASP.NET, IIS and Development Server, Migrating ASP Web Application to ASP.NET, Working with HTML Controls, Server Controls, Validation Controls, Working with Classes and Dynamic Link Library (DLL), Master Page, State Management in ASP.NET, Data Binding, Data Management with ADO.NET, Creating & Consuming XML Web Services, Navigation, Localization, Security, Packaging and Deploying ASP.NET Web Application. Introduction to AJAX.

Suggested Books:

1. Schildt, H. (2008). *C# 4.0: The Complete Reference*. Tata McGraw-Hill.
2. Sklar, J. (2010). *Textbook of Web Design*. Publisher Course Technology.
3. Evjen, B., Hanselman, S., & Rader, D. (2008). *Professional ASP. NET 3.5 in C# and VB*. Wrox Publication.
4. *C# 2008 Programming: Covers .NET 3.5 (Black Book)*, Dreamtech Press.
5. Troelsen, A. (2007). *Pro C# With. Net 3.0*. Aprèss Publication, 2007

Suggested E-Resources:

W3Schools website

<https://www.w3schools.com/xml/>

HTML, CSS, and Javascript for Web Developers by Johns Hopkins University

<https://www.coursera.org/learn/html-css-javascript-for-web-developers>

Internet Technology

<https://nptel.ac.in/courses/106105084/>

Web Development and .NET Framework Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Lab Number Problems

L1-L2	Introduction to Visual Studio .NET
L3-L4	Create, Debug & Run Console Application in C#
L5	Programs based on Control Statements
L6-L8	Programs based on Classes & Inheritance
L9-L10	Programs based on Arrays
L11-L12	Programs based on Enumerations & structures
L13-L14	Programs based on Interfaces & Collection
L15	Programs based on Exception Handling
L16-L17	Programs based on Strings
L18-L19	Programs based on Event Handling
L20-L21	Programs based on Indexers, Operator Overloading, Conversions, Generics
L22-L23	Programs based on ADO.NET
L24	Problems based on HTML forms (GET & POST)
L25-L26	Problem based on ASP
L27	Migrating ASP Web application to ASP.NET
L28-L29	Problem based on HTML Controls
L30-L32	Problem based on Server Controls
L33-L35	Problem based on Validation Server Control
L36-L37	Problem based on Master Page
L38-L39	Problem based on state management in ASP.NET
L40-L41	Problem based on Data Management Using ADO.NET
L42-L44	Problem based on LINQ
L45-L46	Problem based on AJAX
L47-L48	Problem based on packaging & deployment
L49-L50	Introduction to Windows Application & VB.NET
L51	Simple Problems based on Windows Form
L52-L53	Problem based on Different Controls i.e. Boxes, Buttons, Labels, Check Boxes, Radio Buttons, List Boxes, Combo Boxes,, Picture Boxes inVB.NET
L54-L55	Problem based on Scrollbars, Splitters, Timer, Menus, Tree Views, Toolbars, status bars
L56	Problem based on Files I/O
L57-L58	Problem based on Multiple Document Interface (MDI)
L58-L60	Problem based on Dynamic Linked Libraries (DLL)

Parallel Computing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

CS 427 Parallel Computing

Learning Outcomes:

On successful completion of the course students will be able to

Develop computer program for different type of parallel computers.

Measure the performance of algorithm used and parallel computers.

Solve problem using parallel computers.

Optimize sequential code to parallel code and determine if they are worthwhile to parallelize. Develop, analyze and implement algorithm for parallel computers with shared memory and with distributed memory.

Analyze and perform development work related to use of parallel computers and are able to get placement in the govt. organization.

Section-A

Introduction to parallel computing, advantages of parallel computing. Solving problems in parallel : Temporal parallelism, Data parallelism and their comparison. Intertask dependency and task graphs. Structures of parallel computers : Pipelined parallel computers, Array processors, Shared memory multi-processor, message passing multiprocessors, MMC systems. Integer Arithmetic : Carry look-ahead addition and carry-save addition on binary tree, integer multiplication and convolution on a linear array. Elementary sorting algorithm.

Section-B

Matrix Algorithms : Matrix-Vector multiplication and solving lower triangular system of equations on a linear array, matrix multiplication, LU decomposition, matrix inversion, Gaussian elimination on a mesh.

Graph Algorithms : Mesh algorithm for transitive closure, connected component, shortest path, breadth first search and minimum spanning tree. Mesh of trees and its applications such as Matrix-Vector multiplication, Convolution and integer multiplication.

Section-C

More fancier networks : r-dimensional mesh of trees, shuffle trees, shuffle-exchange network, hypercube, De-bruijn network and butterfly. Some examples on these networks, sorting and FFT on butterfly.

Introduction to dataflow computers. Parallelism in logic programming.

Programming parallel computers.

Suggested Books:

1. Rajaraman, V. (1990). *Elements of Parallel Processing*. PHI Learning.
2. Quinn, M. J. (1978). *Designing Efficient Algorithms for Parallel Computers*. Tata McGraw-Hill.
3. Lakshmivaraha, S., & Dhall, S. K. (1990). *Analysis and Design of Parallel Algorithms: Arithmetic and Matrix Problems*. Tata McGraw-Hill, Inc.

Suggested E-Resources:

Parallel Computing

<https://nptel.ac.in/courses/106102114/>

Big Data Analytics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Understand big data systems and identify the main sources of Big Data in the real world.

Learn various frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.

Implement several Data Intensive tasks using the Map Reduce Paradigm in Hadoop.

Program applications using tools like Hive, pig, NO SQL for Big data Applications.

Construct scalable algorithms for large Datasets using Map Reduce techniques.

Apply the knowledge of Big Data gained to fully develop BDA applications for real life applications.

Section-A

Introduction to Big Data, Evolution, Structuring Big Data, Types of Big Data, 4 Vs, Big Data Analytics: Advantages, Applications. Comparing Report and Analysis. The Analytic Process, Types of Analytics. Characteristic of Big Data Analytics. Framing the Problem for Analytics. Statistical Significance or Business Importance of Analytics. Making Inferences. Analytic Approaches: History and Ensemble Methods, Graphical User Interface, Point Solutions, Data Visualization for Big Data.

Section-B

Gathering Data on a Distributed Environment. Architecture and Features of Hadoop Framework: HDFS, Map Reduce, YARN, Hbase, Hive, Sqoop, Zookeeper, Oozie. Exporting Data to HDFS and Importing Data from HDFS, HDFS Commands. HBase Architecture, Storing Big Data with Hbase, Interacting with Hadoop Ecosystem, Combining HBase and HDFS.

MapReduce Framework, Working of Map Reduce, Techniques to Optimize MapReduce Jobs. Building and Executing Applications. Controlling Map Reduce Execution with Input Format, Taking Input from files and applying operations for customization.

Section-C

Understanding Hive, Hive Variables, Properties, Queries and Data Types. Built in Functions in Hive. Working with Databases in Hive: Creating, Viewing, Dropping and Altering. Creating and Modifying Tables. Using Hive DDL Statements and DML Statements. Executing HiveQL. Applying Joins, Group By and Order By clauses.

Pig Architecture. Properties of Pig, Running Pig Programs, Working with Operators in Pig, Working with Functions in Pig.

Suggested Books:

1. White, T. (2012). *Hadoop: The Definitive Guide*. O'Reilly Media, Inc.
2. Miner, D., & Shook, A. (2012). *Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems*. O' Reilly Media, Inc.
3. Loshin, D. (2013). *Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph*. Elsevier.

Suggested E-Resources:

1. Big Data & Analytics by Kent State University
<http://www.cs.kent.edu/~jin/BigData/index.html>
2. Big Data Specialization by University of California San Diego
<https://www.coursera.org/specializations/big-data>

Big Data Analytics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Lab. No. Program

- L1-L2 Basic Linux command for listing, making and changing the directories and files.
- L3-L4 Linux file system security command: access rights and changing access rights.
- L5-L6 Linux file system command for processes and jobs.
- L7 Demonstrate the look and feel of cloudera and hadoop ecosysytem.
- L8 Demonstrate the various demons of hadoop file system.
- L9-L10 HDFS commands.
- L11 Import and export the input and output files from local file system to HDFS and vice versa.
- L12 Sharing the files and directories from Windows to Cloudera.
- L13-L16 Compilation and Execution of MapReduce programming example in HDFS environment.
- L17-L18 Working with database in apache Hive: creating, Viewing, Dropping and Altering.
- L19-L22 Working with Apache Hive Operators, Functions and Join operation.
- L23-L24 Apache Hive DDL and DML commands.
- L25 HiveQL: Group BY and Order By clauses.
- L26-30 Working with Apache PIG Latin Operators and Functions.

*In Hadoop

Cloud Computing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Apply cloud computing model in real application.

Use programming paradigms like MapReduce to create applications.

Operate cloud by installing virtual machines and apply migration.

Understand the challenges of cloud

Aware about the Access Control mechanisms of cloud.

Section-A

Cloud Computing Fundamentals: Definition, Characteristics, Evolution, Architecture, deployment models and service models, Cloud Computing Stack, Applications, Benefits, and Limitation.

Web Technologies for Cloud: Service Oriented Architecture, Web 2.0, Web services, Data Format (XML, JSON).

Virtualization Technology: Overview, Architecture, Virtual machine technology, Virtual Machine Provisioning & Migration, Fault Tolerance Mechanisms. virtualization of data centers.

Section-B

Resource Management and Load Balancing: Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization, Resource dynamic reconfiguration, Scheduling Techniques for Advance Reservation, Capacity Management to meet SLA Requirements, and Load Balancing, various load balancing techniques.

Interoperability: Issues with interoperability, Federated clouds, Cloud federation stack, Interoperability approaches.

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine, and Microsoft Azure, Build Private/Hybrid Cloud using open source tools (OpenStack, **Docker**).

Section-C

Data In Cloud: Characterizing data-intensive computations, Technologies for data-intensive computing, Cloud file systems:GFS And HDFS, NoSQL systems: Big Table, HBase, Programming platforms: Map-Reduce.

Cloud Security: Vulnerability Issues and Security Threats, Application-level, Security, Data level Security, and Virtual Machine level Security, Infrastructure Security, and Multi-tenancy Issues.

Advances: Energy efficiency in clouds, Green Computing, Fog Computing, Mobile Cloud Computing, Cloud Standards.

Suggested Books:

1. Krutz, R. L., & Vines, R. D. (2010). *Cloud Security: A Comprehensive Guide to Secure Cloud Computing*. Wiley Publication.
2. Shroff, G. (2010). *Enterprise Cloud Computing: Technology, Architecture, Applications*. Cambridge University Press.
3. Mather, T., Kumaraswamy, S., & Latif, S. (2009). *Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance*. O'Reilly Media, Inc.
4. Velte, A. T., Velte, T. J., Elsenpeter, R. C., & Elsenpeter, R. C. (2010). *Cloud Computing: A Practical Approach*. Tata McGraw-Hill.
5. Saurabh K. (2011). *Cloud Computing* (1st ed.). WILEY India Pvt. Ltd.
6. Sosinsky, B. (2011). *Cloud Computing*. WILEY India Pvt. Ltd.
7. Ferretti, S., Ghini, V., Panzieri, F., Pellegrini, M., & Turrini, E. (2010). *QoS-Aware Clouds*. IEEE 3rd International Conference on Cloud Computing.

Suggested E-Resources:

Cloud Computing

<https://nptel.ac.in/courses/106105167/1>

Cloud Computing Specialization

<https://www.coursera.org/specializations/cloud-computing>

Computer Graphics Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Lab. No. Program

- LI & L2 Implementation of in-built functions of C-language in Graphics.
- L 3 Implementation of Vector Generation Technique and DDA Line Drawing Algorithm.
- L 4 Implementation Bresenham's Line Drawing Algorithms.
- L 5 Implementation of Simple Circle drawing Algorithm and using Trigonometric method.
- L 6 Implementation of the Bresenham's Circle Drawing Algorithm, and Ellipse drawing by modifying Bresenham's Circle drawing algorithm.
- L 7 Implementation of the Mid-point Circle Drawing Algorithm.
- L 8 Implementation of Line and Point method of polygon drawing.
- L 9 Implementation of Inside/Outside test of pixels in respect to a polygon.
- L 10 Implementation of the Boundary Fill Algorithm and Flood-Fill Algorithm to fill convex regions.
- L I 1 Implementation of Scan Line Conversion Algorithm for Polygon Filling (concave region).
- L 12 Problems based on object translations using equations.
- L I 3 Problems based on object scaling using equations.
- L 14 Problems based on object rotations using equations.
- L 15 Problems based on object translations using homogeneous matrices.
- L 16 Problems based on object scaling using homogeneous matrices.
- L 17 Problems based on object rotations using homogeneous matrices.
- L18-L19 Problems based on object reflections using homogeneous matrices.
- L 20 Problems based on object shear using homogeneous matrices.
- L21-L22 Problems based on composite 2D transformations on any object using homogeneous matrices.
- L 23 Implementation of Gupta-Sproull Anti-Aliasing method.
- L 24 Problems based on Point Clipping.
- L 25 Problems based on Cohen Sutherland Line Clipping Algorithm.
- L 26 Problems based on Liang Barsky Line Clipping Algorithm.
- L 27 Problems based on Sutherland Hodgeman Polygon Clipping Algorithm.
- L 28 Implementation of Hilbert Curve and Koch curve.
- L 29 Problems based on Segments.
- L 30 Problems based on Character Generation using raster approach.
- L 31 Problems based on Simple Parallel Projection.
- L 32 Problems based on Simple Perspective Projection.

Data Warehouse and Data Mining

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Identify the scope and necessity of Data Mining & Warehousing for the society.

Describe the designing of Data Warehousing so that it can be able to solve the root problems.

Understand various tools of Data Mining and their techniques to solve the real time problems.

Develop ability to design various algorithms based on data mining tools.

Develop further interest in research and design of new Data Mining techniques.

Section- A

Introduction to Business Intelligence, Decision support system, Knowledge discovery & decision making, need for data warehouse, definitions of Data warehousing and data mining, common characteristics of Data warehouse, Data Marts, Metadata, Operational versus analytical databases, trends and planning of Data warehousing, Defining business requirements, Data Warehouse Architecture, Data modeling strategy, Fact tables, dimensions, Star schema and other schemas, Multi dimensional data models, Data Cube presentation of fact tables, using the Data warehouse, OLAP models and operations, Implementation of Data warehouse

Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, issues in Data Mining, Data Preprocessing: Needs Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation

Section- B

Data Mining Primitives, Languages, and System Architectures: Data Mining Primitives, Data Mining Query Languages, Architectures of Data Mining Systems, Concepts Description: Characterization and Comparison: Data Generalization and Summarization-Based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between Different Classes, Mining Association Rules in Large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases(Apriori,FP-tree), Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules

Section -C

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining,

Prediction, Classifier Accuracy, Cluster Analysis, Types of Data in Cluster Analysis, Major Clustering Methods (K means, Hierarchical clustering, DBSCAN), Mining Complex Types of Data: Multidimensional Analysis and Descriptive Mining of Complex, Spatial Mining, Multimedia Mining, Time-Series and Sequence Data, Mining, Text Mining, Web Mining, Trends in Data Mining, Introduction to Various Data mining tools (SAS Enterprise Miner 5.1, Oracle Data Mining, SPSS Clementine 8.5)

Suggested Books:

1. Kimball, R., Ross, M. (2008). *The Data Warehouse Lifecycle Toolkit* (2nd ed.). John Wiley & Sons.
2. Han, J., Kamber, M. (2011). *Data Mining: Concepts and Techniques* (2nd ed.). Elsevier.
3. Inmon, W. H. (2005). *Building the Data Warehouse* (4th ed.). John Wiley & sons.
4. Anahory, S., & Murray, D. (1997). *Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems*. Pearson Education.

Suggested E-Books:

1. Data Mining
<https://nptel.ac.in/courses/106105174/>
2. Business intelligence and data warehousing by Universidad Nacional Autónoma de México
<https://www.coursera.org/learn/business-intelligence-data-warehousing>

Mobile Computing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Have knowledge of fundamentals of mobile communication systems.

Choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.

Identify the requirements of mobile communication as compared to static communication.

Identify the limitations of 2G and 2.5G wireless mobile communication and use design of 3G and beyond mobile communication systems.

Section A

Introduction to Wireless Communication System : Evolution, Generations (1G, 2G, 2.5G, 3G), Wireless Transmission : Frequencies, ISM, Signals, Antennas; Signal propagation effects; Comparison of Wireless Communication Systems : Land-Mobile technologies (GSM, CDMA), Satellite Communication, In building Communication Systems, Personal Communication Systems.

Cellular Concept : Basics & Traffic concepts, System Capacity, Trunking theory & GoS, Improving coverage & capacity - Frequency reuse. Cell Splitting/Sectoring, Umbrella cell, Breathing cell

Section B

Wireless MAC protocols : S/F/T/CDMA, CSMA protocols, MACAW, Spread Spectrum : DSSS, FHSS; WWAN (GSM : Mobile services, System Architecture, Radio Interface, Protocols, Localization & Calling, Handover, Security, New Data Services; CDMA); WLAN (IEEE 802.11 : System architecture, Protocol architecture, MAC Management; H1PERLAN : Introduction), Mobile IP, MANET : Routing protocols, DHCP, Unicast & Multicast Communication; Wireless TCP; WPAN : Blue tooth, IEEE 802.15 (Introduction)

Section C

Mobile Computing: Challenges, Issues; Location & Data Management; Power management, Power-aware & Context-aware computing, Support for Mobility : WAP

Introduction to Pervasive Computing - Applications, Devices, Software; Mobile Computing Software development : Strategies & Tools

Suggested Books:

1. Schiller, J. H. *Mobile Communications* (2nd ed.). Pearson Education.
2. Stojmenovic, I. (2003). *Handbook of Wireless Networks and Mobile Computing*. John Wiley & Sons.
3. Rappaport, T. S. *Wireless Communications: Principles and Practice* (2nd ed.). PHI Learning.
4. Williams, V. *Wireless Computing Primer*. M & T Books.

5. Pandya, R. (1994). *Mobile and Personal Communication Systems and Services*. PHI Learning.
6. Hansmann, U., Merk, L., Nicklous, & M.S., Stober. *Pervasive Computing HandBook*. Springer.
7. Perkins, C. E., Alpert, S. R., & Woolf, B. (1998). *Mobile IP: Design Principles and Practices*. PHI Learning.
8. Garg, V. K. & Wilkis, J. E. (1996). *Wireless and Personal Communication*. PHI Learning.
9. Muller, N. J. (2001). *Bluetooth Demystified*. Tata McGraw-Hill.
10. Sturman, C. F., & Bray, J. *Bluetooth: Connect without Cables* (2nd ed.). Pearson Education.
11. Dhawan, C. (1997). *Mobile Computing: A Systems Integrator's Handbook*. Tata Mc-Graw-Hill

Suggested E-Resources:

1. Wireless Communications by Stanford University
<https://web.stanford.edu/class/ee359/>
2. Data Communications II by University of Massachusetts Lowell
<http://mobile.cs.uml.edu/~glchen/cs414-564/handouts/>

Modeling and Simulation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Define basic concepts in modeling and simulation (M&S).
- Classify various simulation models and give practical examples for each category.
- Construct a model for a given set of data and perform its validity.
- Generate and test random number and apply them to develop simulation models.
- Analyze output data produced by a model and test validity of the model.
- Explain parallel and distributed simulation methods.
- Know how to simulate any discrete system using queuing systems.

Section-A

Definition of system, system concepts, types of system. Continuous & discrete system, Models :- compartmental model, linear and nonlinear model, stochastic model, Verification & validation

Simulation: Introduction, classification of simulation models. Advantages & disadvantages of simulation. Discrete system simulation: Monte Carlo method, random no. generation, test of randomness, Probability Distributions and their random variates.

Section-B

Introduction to queuing theory: Queuing model with poison input, Exponential service & arbitrary service times, Simulation of queuing system, Simulation of single server queue; Simulation of two server queue, Application of queuing theory in computer system like operating system, computer network etc.

Introduction to inventory theory, EOQ Models, More complex inventory models.

Section-C

[Introduction of Simulation of system dynamics model]

Evaluation of simulation, length of simulation runs, Introduction to Variance reduction techniques.

Project management: Simulation of Pert /CPM technique

Models as component of information system *Modeling for decision support Virtual reality: ultimate interactive model*. [Simulation languages :- Simula. Dyanamo, Stella]

Simulation language:- Simula (Basic facts, History of Simula I and 67, Data types, Statements, Procedure, Classes and Packages)

Suggested Books:

1. Gordon, G. *System Simulation*. PHI Learning.
2. Deo, N. *System Simulation*. Tata McGraw-Hill.
3. Payne, J.A. *Introduction to Simulation*. Tata McGraw-Hill.
4. Law, A.M., Kelton W.D. *Simulation Modelling and Analysis*. Tata McGraw-Hill

Suggested E-Resources:

Modelling and Simulation of Descrete Event System

<https://nptel.ac.in/courses/112107220/>

Simulation and modeling of natural processes by University of Geneva

<https://www.coursera.org/lecture/modeling-simulation-natural-processes/modeling-and-simulation-F7vas>

CS 601 Cyber Security

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Evaluate the computer network and information security needs of an organization.

Assess cyber security risk management policies in order to adequately protect an organization's critical information and assets.

Measure the performance of security systems within an enterprise-level information system.

Troubleshoot, maintain and update an enterprise-level information security system.

Implement continuous network monitoring and provide real-time security solutions.

Formulate, update and communicate short- and long-term organizational cyber security strategies and policies.

Section-A

Information Security Concepts: Introduction to Cyber security, Cyber security: objectives, roles.

Differences between Information Security & Cyber security. Cyber security Principles: The CIA triad (Confidentiality, integrity, & availability Authentication & non-repudiation.

Section-B

Security Threats and vulnerabilities : Overview of Security threats ,Risks & Vulnerabilities, Basics of risk management. Hacking Techniques, Password Cracking , Trends in the Types of Attacks and Malware.

Hash and Authentication: Authentication Overview, Hash Functions, The Properties of Hash Functions, Feasible Attacks to a Hash. Online Authentication: The One-Time Password and Token, Two-Factor Authentication, The OTP Standards.

Section-C

Defensive measures for cyber security: The Overview of Firewalls, Types of Firewalls, challenges.

The intrusion detection system (IDS) and the intrusion prevention system (IPS), Digital Signature.

Cyberspace and the Law: Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

Suggested Books:

1. Wu, C. H. J., & Irwin, J. D. (2016). *Introduction to Computer Networks and Cybersecurity*. CRC Press.
2. Dowd, M., McDonald, J., & Schuh, J. (2006). *The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities* (1st ed.). Addison-Wesley Professional.
3. Graham, J., Olson, R., & Howard, R. (2016). *Cyber Security Essentials*. CRC Press, Taylor and Francis.

Suggested E-Resources:

1. Cyber Security by courser website:

<https://www.coursera.org/learn/cyber-security-domain>

2. Ahmad Kamal, The law of Cyber-Space an Invitation To The Table of Negotiations, UNITAR United Nations Institute of Training and Research, October 2005.
3. CYBER LAW - An exhaustive section wise Commentary on The Information Technology Act along with Rules, Regulations, Polices, Notifications etc. by Pavan Duggal

Digital Image Processing

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Explain how digital images are represented and manipulated in a computer, including reading and writing from storage, and displaying. Write a program which implements fundamental image processing algorithms.

Conversant with the mathematical description of image processing techniques

Know how to go from the equations to code.

Section-A

Image processing: introduction, linear systems, the Fourier transforms, matrix theory results. Image Perception: Light, Luminance, Brightness, Contrast, MTF of Visual System, Visibility Function, Monochrome Vision Models and Color Vision Models, Temporal properties of vision. Image Sampling: 2-D sampling theory, Nyquist theorem. Image Quantization: Optimum Mean Square (Lloyd-Max) Quantizer, Compandor design.

Section-B

Image transforms: two dimensional orthogonal and unitary transforms, properties, one dimensional discrete Fourier transform (DFT), two dimensional DFT, Cosine transform, Sine transform. Image enhancement: point operation, histogram modelling, spatial operations, transform operation, multispectral image enhancement, false color and pseudocolor, color image enhancement. Image filtering and restoration: image observation models, Inverse and Wiener filtering, finite impulse response (FIR) wiener filtering, other Fourier domain filters.

Section-C

Image Analysis: Feature extraction, Edge detection, Scene segmentation and labelling. Pattern recognition: Introduction, Recognition process, Statistical decision making (Bayes' theorem), Nonparametric decision making (Nearest neighbourhood classification techniques), Clustering.

Suggested Books:

1. Jain A. K. (1989). *Fundamentals of Digital Image Processing*. PHI Learning.
2. Gonzalez, R. C., & Woods, R. E. (2008). *Digital Image Processing* (3rd ed.). Pearson Education.
3. Jayaraman S., Esakkirajan S., & Veerakumar T. (2009). *Digital Image Processing*. Tata McGraw-Hill.
4. Rosenfield, A., Kak A. C (1982). *Picture Processing*. NY: Academic Press.
5. Pratt, W. K. (1991). *Digital Image Processing* (2nd ed.). John Willey and Sons.
6. Duda R., Hart Peter, Stork D. (1973). *Pattern Classification*. Willey Interscience Publication.
7. Friedman, M., & Kandel, A. (1999). *Introduction to Pattern Recognition: Statistical, Structural, Neural and Fuzzy Logic Approaches*. World Scientific Publishing Company.

Suggested E-Resources:

Digital Image Processing by Stanford University

<https://web.stanford.edu/class/ee368/>

Digital Image Processing

<https://nptel.ac.in/courses/117105079/>

Digital Signal Processing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

Describe the characteristics and transformations of discrete time signals mathematically.

Apply techniques in time and transform domains to the analysis and design of discrete-time systems

Estimate the spectra of deterministic and stochastic signals, and appropriately interpret the information contained therein

Demonstrate the ability to manipulate signals using analytical techniques and write algorithms to implement discrete-time systems

Describe the techniques for signal modulation and discriminate between the different modulation schemes used in communication systems

Section-A

Introduction of Signals, Systems and Signal Processing, Classification of Signals and Systems, Advantages of Digital over Analog Singnal processing, Signal Models - Continuous Time versus Discrete time signals, Periodic and Aperiodic Signals, Phasor Signals and Spectra, Energy and Power Signals, System Modeling Concepts, The superposition integral for Fixed and Linear Systems, Impulse Response of a Fixed and Linear System - Fourier Series - Trigonometric Series- Exponential Fourier Series-Symmetry Properties of the Fourier Coefficients.

Fourier Integral, Energy Spectral Density, Fourier Transforms in the Limit, Fourier Transform Theorems and Pairs, System Analysis with Fourier Transform, Laplace Transform Theorems, Network Analysis using the Laplace Transform.

Section-B

Discrete Time Signals and Systems - Review of Sampled Data Systems, Time Domain Representations of Discrete Time Signals, Frequency Domain Representation of Discrete Time Signals, Discrete Time Signals obtained by sampling, Discrete Fourier Transform. Z-Transform - Definition and Examples, Inverse Z-Transform, Properties of the Z-Transform, Introduction to Realization of Digital Systems - Block Diagrams and Signal Flow Graphs. Introduction to Realization of an IIR and FIR systems, Discrete Fourier Transforms (DFT) and Fast Fourier Transform (FFT).

Section-C

Design of Digital Filters : Introduction to Filters, A comparison of IIR and FIR Digital Filters. Design of IIR Digital Filters - Impulse Invariant Transformation, Bilinear Transformation, Design of Digital Butterworth and Chebyshev Filters. Design of FIR Digital Filters - Windowing and Rectangular Window, Filter Designs using Windows, Frequency Sampling Technique. DSP tools and DSP techniques in various applications.

Suggested Readings:

1. Proakis J.G., & Manolakis D.G. *Digital Signal Processing: Principles, Algorithms and Applications* (3rd ed.). PHI Learning.
2. Oppenheim, A. V., & Schafer, R. W. *Digital Signal Processing*. PHI Learning.
3. Nagarath, I. J., Sharan S. N., Ranjan R., & Kumar S. *Signals and Systems*. Tata McGraw-Hill.
4. Mitra, S.K. (2010). *Digital Signal Processing : A Computer Based Approach* (2nd ed.). Tata McGraw-Hill.
5. Defatta J. *Digital Signal Processing*. John Willey & Sons.

Suggested E-Resources:

Digital Image Processing by Stanford University

<https://web.stanford.edu/class/ee368/>

Digital Image Processing

<https://nptel.ac.in/courses/117105079/>

Client-Server Computing and Applications

Max. Marks : 100

L	T	P	C
0	0	0	2

Learning Outcomes:

On successful completion of the course students will be able to

Understand real life application using client-server architecture.

Learn concepts of network and its usage in client-server model.

Design distributed database for various application.

Distributed systems and database. Client-Server computing model, client-server hardware and software needs, issue in client server computing-shared access, connectivity, security, Advantages of client-server computing. Example: UNIX and Windows NT.

Client-server applications: Database server networks gateways, video-conferencing and multimedia applications. Client server architectures: Segmentation, switched FDDI, peer-to-peer architecture.

Suggested Books:

1. Dewire, D. T. *Client Server Computing* (1st ed.). Tata McGraw-Hill.
2. Berson, A. *Client Server Architecture*. Tata McGraw-Hill.
3. Orfali, R., Harkey, D., & Edwards, J. (2007). *Client Server Survival Guide* (3rd ed.). John Wiley & Sons.
4. Trivedi, M., Khanna, M. *Client Server Computing*. Book Publishing Co. Pvt. Ltd.

Introduction to Discrete Mathematics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Solve counting problems involving the multiplication rule, permutations, and combinations (with and without replacement)
- Have a better understanding of sets, apply the operations of sets and use Venn diagrams to solve applied problems
- Apply the inclusion-exclusion principle to problems with more than two sets and use the principle to solve counting problems
- Understand the basics of discrete probability and be able to apply the methods from these subjects in problem solving
- Demonstrate an understanding of relations and functions and be able to determine their properties
- Understand the basic principles of lattices and Boolean algebra
- Demonstrate an understanding of various types of graph and its properties
- Apply the Pigeonhole Principle to solve various problems
- Understand the numeric function and generating function
- Solve linear homogeneous and linear non-homogeneous recurrence relations with constant coefficients using various methods

Section-A

Permutations, Combinations, selection with & without replacement; Sets and multisets, permutation and combinations of multisets, enumeration of permutations and combination of sets & multisets, placing distinguishable (indistinguishable) objects into distinguishable (indistinguishable) boxes. Inclusion - Exclusion principle, Discrete probability; The rules of sum & product, generation of permutation and combinations. Relations and functions - properties of binary relations, equivalence relations, partial order relations, chains and antichains, Pigeon hole Principle.

Section-B

Basic concepts of graph theory: vertices, edges, degree, paths, circuits, cycles, complete graphs and trees. Multi-graphs, weighted graphs and directed graphs. Adjacency matrix of a graphs. Connected and disconnected graphs. K-connected and K-edge connected graphs. Shortest path in weighted graphs, Eulerian path and circuits, Hamiltonian path and circuits. Planar graphs, chromatic number, edge colouring of graphs, Vizing's theorem. Trees and cut sets : Trees, spanning tree and cut set, minimum & panning tree.

Section-C

Lattices and boolean algebra; Algebraic structures : binary operation, group, ring, field; Mathematical Logic: Basic connectives, rules of inference, normal forms, proofs of validity, predicate logic. Generating functions and Recurrence relations Linear recurrence relation with constant coefficients and their solution, Homogeneous solution, particular solution & total solutions. Solution by the method of generating functions.

Suggested Books:

1. Liu, C. L. (1987). *Elements of Discrete Mathematics*. Tata McGraw-Hill Education.

2. Kolman, B., Busby, R. C., & Ross, S. C. (2009). *Discrete Mathematical Structures*. PHI Learning.
3. Deo N. (1974). *Graph Theory*, PHI Learning.
4. Trembley J.P. & Manohar R. (1975). *Discrete Mathematical Structures with Applications to Computer Science*. Tata McGraw Hill.

Suggested E-Resources:

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen
<https://mathcs.clarku.edu/~djoyce/ma114/Rosen6E.pdf>
2. Discrete Mathematical Structures
<https://nptel.ac.in/courses/106106094/>

Management Information System

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Outcomes

On successful completion of the course students will be able to

Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making.

Analyze and synthesize business information and systems to facilitate evaluation of strategic alternatives.

Effectively communicate strategic alternatives to facilitate decision making.

Describe the role of information technology and information systems in business

Record the current issues of information technology and relate those issues to the firm

Reproduce a working knowledge of concepts and terminology related to information technology

Interpret how to use information technology to solve business problems

Illustrate the impact of information systems in society

Section-A

Introduction to management, Evolution of management, (Scientific Management – F.W. Taylor, Administration Management – Henry Fayol, Human Relation – Elton Mayo, System Approach) Functions of management, Overview of contemporary challenges : Global management, Workforce diversity, Corporate, Social responsibility.

Section-B

International Management Information System: Definition and Characteristics, Components of MIS, Framework of understanding MIS: Robert Anthony's, Hierarchy of Management Activity. Information requirements and Levels of Management.

The new strategic role of Information systems, methodologies for evaluating investments in IT, Framework and methodologies should be discussed and illustrated with Case Studies, Critical success factor in implementing IT applications, Study of successful / failed IT projects. Critical role of security in implementing IT application.

Section-C

Decision Support System: Overview, components and classification, steps in constructing a DSS, role in business, group decision support system, integration and implementation of DSS, Information system for strategic advantage, strategic role for information system, reengineering business process, improving business Qualities, Marketing Information system, Manufacturing IS, financial information system.

Suggested Books:

1. Sadagopan, S. (2014). *Management Information Systems* (2nd ed.). PHI Learning, New Delhi.
2. Kroenke, D. M., & Boyle, R. J. (2016). *Using MIS*. PHI Learning, New Delhi
3. Miller, L. (2008). *MIS Cases: Decision Making with Application Software* (3rd ed.). PHI Learning, New Delhi.
5. Robbins, S. P., & Mary Coulter (2010). *MANAGEMENT* (10th ed.). PHI Learning, New Delhi
6. Weihrich, H., & Koontz, H. (2010). *Essentials of Management* (8th ed.). Tata McGraw-Hill.

Communication Skills

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

2 0 0 2

Learning Outcomes:

On completion of the course students will able to

Understand and apply knowledge of human communication and language processes as they occur across various contexts, e.g., interpersonal, intrapersonal, small group, organizational, media, gender, family, intercultural communication, technologically mediated communication, etc. from multiple perspectives.

Understand and evaluate key theoretical approaches used in the interdisciplinary field of communication.

Explain major theoretical frameworks, constructs, and concepts for the study of communication and language, summarize the work of central thinkers associated with particular approaches, and begin to evaluate the strengths and weaknesses of their approaches.

Understand the research methods associated with the study of human communication, and apply at least one of those approaches to the analysis and evaluation of human communication.

Find, use, and evaluate primary academic writing associated with the communication discipline.

Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others. Such skills could include communication Competencies such as managing conflict, understanding small group processes, active listening, appropriate self-disclosure, etc.

Communicate effectively orally and in writing.

Section-A

Types of Communication- oral communication, written communication- formal, informal, Business letters – types of letter, writing letters, business correspondence, applying for job, Resume writing, filling out employment application.

Language skills: constructing correct sentences by using the right tenses, prepositions, concord. Vocabulary building .

Section-B

Report writing- Defining and determining reports purpose, Report Planning, collecting information, Developing an outline, section of report, types of report, writing short reports, writing long project reports. Writing an abstract for a research paper, dissertation, project report, guidelines for writing a good abstract. Writing a project synopsis-research project synopsis and summer training project synopsis.

Guidelines for writing a good research paper.

Section-C

Introduction to soft skills and hard skills, self development-etiquette and manners, positive attitude and self confidence, motivation skills, communication skills.

Body language: Facial Expression, Posture, Gesture, eye contact, Appearance (Dress Code). Interpersonal Skills: Negotiations, listening skills, social skills, assertive skills, cross-cultural communications.

Goal setting, priority management, time management & career planning. Resume building, Group discussions and Interview skills: Effective interview techniques, mock interviews, stress interviews.

Suggested Books:

1. Raman, M., & Sharma, S. (2004). *Technical Communication: Principles and Practice*. Oxford University Press.
2. Kaul, A., (2009). *Business Communication*(2nd ed.). PHI Learning.
3. *SOFT SKILLS, 2015, Career Development Centre*, Green Pearl Publications.
4. Tyagi, K., & Misra, P. (2011). *Basic Technical Communication*. PHI Learning.
5. Sharma, S., & Mishra, B. (2009). *Communication Skills: For Engineers and Scientists*. PHI Learning.
6. Flatley, L. (2005). *Basic Business Communication* (10th ed.). Tata McGraw-Hill.
7. Flatley, L. (2008). *Business Communication: Making Connections in a Digital World* (11th ed.). Tata McGraw-Hill.
8. Chaturvedi, P. D., & Chaturvedi, M. (2011). *Business Communication* (2nd ed.). Pearson Education.
9. Covey S. (1998). *Seven Habits of Highly Effective Teens*. New York, Fireside Publishers.
10. Carnegie, D. (1998). *How to Win Friends & Influence People*. New York: Simon & Schuster.
11. Harris, T. A. (1972). *I am OK, You are OK*. New York - Harper and Row.

Suggested E-Resources:

1. English Grammar & Composition BY WREN & MARTIN
<https://www.mockbank.com/bulletin/wp-content/uploads/2016/01/Wren-and-Martin-IRDA-English-Preparation.pdf>

Object Oriented Methodology and Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to

- Understand the features of C++ supporting object oriented programming
- Understand the relative merits of C++ as an object oriented programming language
- Understand how to produce object-oriented software using C++
- Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism
- Understand advanced features of C++ specifically stream I/O, templates and operator overloading
- Understand other features of the C++ language including templates, forms of casting, conversions, and file handling.

Section-A

Object-Oriented Methodology: Differences from Functional Methodology, Abstraction, Encapsulation, Object Modeling Technique, Objects, Classes, Object Diagrams, Attributes, Operations and Methods, Links, Associations, Multiplicity, Generalization and Inheritance, Aggregation, Abstract Classes, Multiple Inheritance

C++: Tokens, Data Types, Operators and Expressions, Promotion and Type Conversion, Operator Precedence and Associativity, Conditional and Looping Constructs, Operations on Arrays, Strings Manipulations, Function Components, Parameter Passing, Return by Reference, Default Arguments, Inline Functions, Function Overloading, Arrays and Functions, Scope and Extent of Variables, Storage Classes, Functions with Variable Number of Arguments, Recursive Functions, Class Specification, Class Objects, Data Hiding, Empty Classes, Passing Objects as Arguments, Returning Objects from Functions.

Section-B

Friend Functions and Friend Classes, Constant Parameters and Member Functions, Static Data and Member Functions, Constructors, Destructor, Constructor Overloading, Constructors with Default Arguments, Nameless Objects, Dynamic Initialization through Constructors, Copy Constructor, Constant Objects and Constructor, Static Data Members with Constructors and Destructors, Pointers and their Binding, void Pointers, Runtime Memory Management, Pointer Constants, Pointers to Constant Objects, Constant Pointer, Pointers to Objects, Live Objects, Array of Objects, this Pointer, Unary Operator Overloading, Increment/ Decrement Operators, Binary Operator Overloading, Arithmetic Operators, Concatenation of Strings, Comparison Operators, Arithmetic Assignment Operators, Overloading of new and delete Operators, Data Conversion, Overloading with Friend Functions, Assignment Operator Overloading, Inheritance and Member Accessibility, Constructors and Destructors in Derived Classes, Constructors Invocation and Data Member Initialization, Overloaded Member Functions, Abstract Classes, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Multipath Inheritance and Virtual Base Classes, Hybrid Inheritance.

Section-C

Virtual Functions, Pointer to Derived Class Objects, Pure Virtual Functions, Abstract Classes, Dynamic Binding Implementation, Function Templates, Overloaded Function Templates, Nesting of Function Calls, Multiple Arguments Function Template, User Defined Template Arguments, Class Templates, Inheritance of Class Template, Class Template Containership, Class Template with Overloaded Operators, Console I/O, Concept of Streams, Hierarchy of Console Stream Classes, Unformatted and Formatted I/O Operation, Managing Output with Manipulators, File Handling, Classes for File Stream Operation, Open and Close a File, File Models, File Pointers

and their Manipulations, Sequential I/O Operations, Updating a File, Error Handling during File Operation, Exception Handling, Use of Standard Template Library (STL).

Suggested Books:

1. Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F., & Lorensen, W. E. (1991). *Object-oriented Modeling and Design*. PHI Learning, New Delhi.
2. Venugopal, K.R., Buyya, Rajkumar, & Ravishankar (1997). *Mastering C++*. Tata Mc-Graw Hill.
3. Schildt, H. (2001). *C++: The Complete Reference*. Tata McGraw-Hill.
4. Balagurusamy, E. (2008). *Object Oriented Programming with C++* (6th ed.). Tata McGraw-Hill.
5. Kanetkar, Y. P. (2010). *Let us C++*. BPB Publications.

Suggested E-Resources:

1. The C++ Programming Language by Bjarne Stroustrup
<http://www.stroustrup.com/C++.html>
2. Programming in C++
<https://nptel.ac.in/courses/106105151/>

Object Oriented Methodology and Programming Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Lab Number Problems based on

- L1-L2 Operators and Expressions, Conditional and Looping Constructs, Operations on Arrays, Strings Manipulations
- L3-L4 Function Components, Default Arguments, Inline Functions, Function Overloading, Functions with Variable Number of Arguments, Recursive Functions
- L5-L7 Class Specification, Class Objects, Empty Classes, Passing Objects as Arguments, Returning Objects from Functions
- L8-L9 Friend Functions and Friend Classes
- L10 Static Data and Member Functions
- L11-L12 Constructors, Destructor, Nameless Objects, Copy Constructor, Static Data Members with Constructors and Destructors
- L13-L14 Pointers and their Binding, void Pointers, Pointers to Constant Objects, Constant Pointer, Pointers to Objects, Array of Objects, this Pointer
- L15-L17 Operator Overloading, Concatenation of Strings, Overloading of new and delete Operators, Data Conversion, Overloading with Friend Functions, Assignment Operator Overloading
- L18 Inheritance and Member Accessibility, Constructors and Destructors in Derived Classes
- L19-L20 Overloaded Member Functions, Abstract Classes, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Multipath Inheritance and Virtual Base Classes, Hybrid Inheritance
- L21 Virtual Functions, Abstract Classes, Dynamic Binding Implementation
- L22-L23 Function Templates, Overloaded Function Templates, Multiple Arguments Function Template, User Defined Template Arguments
- L24-L25 Class Templates, Inheritance of Class Template
- L26 Console I/O, Stream Classes, Unformatted and Formatted I/O Operation, Managing Output with Manipulators
- L27-L28 File Handling, File Pointers and their Manipulations, Sequential I/O Operations, Updating a File, Error Handling during File Operation
- L29-L30 Exception Handling, Use of Standard Template Library (STL)

Computer Programming

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of this course the student will be able to :

Learn fundamental of computers and operating systems

Learn basic languages and their coding

Develop good programming skills using algorithms and flowcharts.

Coding programs in 'C' using data types, control structures, functions arrays and pointers.

Demonstrate the ability to run, test, and debug 'C' programs.

Section-A

Simple Model of a Computer System: CPU, Memory, Input/Output Devices. Hardware and Software, Booting Process and DOS Command. Steps Involved in computer programming, problem analysis, algorithms & flow charts. Computer programming (in C) : Various data types (simple and structured) and their representation, constants and variable, arithmetic's and logical expressions, data assignment, input and output statement. High level and low level programming language.

Section-B

C Programming: Control statement- sequencing, conditional and unconditional branching and looping. Single and multi-dimensional arrays. Searching (Linear, binary), sorting (bubble, selection and insertion) and merging.

Section-C

Pointer, address arithmetic. Function, Parameter passing, recursion. Dynamic memory allocation. Structure and union, file handling, command line arguments.

Recommended Books:

1. Kanetkar, Yashavant P., Let us C, BPB Publications
2. Sinha, P. K., *Computer fundamentals: concept, systems and application*, BPB

Reference Books:

1. Kernighan, Brain W., *The C .programming language*. Prentice - Hall
2. Kanetkar, Yashavant P., *Understanding pointers in C*, BPB Publications
3. Dromey, R. G., *How to solve it by computer*, Prentice- Hall
4. Govil, Mahesh Chand, *Computer fundamentals and programming in C*, Jaipur Pub. House
5. NUT, *Introduction to computer programming*, Prentice-Hall
6. Venugopal, K. R., *Programming with C*, Tata Mcgraw Hill
7. Balagurusamy, E., *Programming in ANSI C*, Tata McGraw-Hill

Principles of Digital Electronics

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

SECTION-A

Number system (binary, octal, decimal, hexadecimal) bits & bytes, representation of integers, real, positive and negative numbers. Binary Arithmetic, Simple concept of theorems of Boolean Algebra.

Representation of characters: BCD, ASCII, EBCDIC Codes. Weighted codes, self complementary codes, Error detecting codes and error correcting codes (Parity, Gray, Hamming codes).

Logic Gates : Logic Gates and Boolean Algebra Representation and Simplification of functions by Karnaugh Maps. Combinational Circuits design. Combinational circuits - adder, subtractor, decoder, demultiplexer, encoder, multiplexer, comparator.

SECTION B

Sequential Logic Circuit & Design - flip flop, shift register, asynchronous and synchronous counters.

Digital Logic Families and Their Characteristics : RTL, DTL, TTL, Schottky TTL, ECL, MOS and CMOS, Fan in, Fan out.

SECTION C

Semiconductor Memories : RAM, ROM, PROM, EPROM, BJTRAM Cell, MOS RAM Cell, Organization of RAM, Charge Coupled devices (CCD), storage of charge and transfer of charge in CCD.

D/A Converter : Weighted resistance D/A, R-2R Ladder Converter. DAC 0800 D/A Chip, D/A Converter specification.

A/D Converter : Analog to Digital Converter, Parallel Comparator Converter, Counting Converter, Successive Approximation Converter, Dual Slope converter A/D converter specification, sampling and hold circuit, ADC 0804 Converter chip.

Text/Reference Books:

1. Digital Principles and Applications by C. P. Malvino and D. P. Leach, Mc-Graw Hill, 1985.
2. Digital logic and computer design by M. M. Mano, Tata Mc-Graw Hill.
3. Digital Integrated Circuits by Taub and Shilling, Tata Mc-Graw Hill
4. Computer Architecture and Organization by J. P. Hayes, Mc-Graw Hill 1988.
5. Digital Fundamentals by Floyd, Mc-Graw Hill.
6. Digital Ic by K. R. Botkar, Mc-Graw Hill.

Classical Mechanics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successfully completed course, Student will be able to :

Have a deep understanding of Newtonian mechanics and able to solve the Newton equations for simple configurations using various methods

Define and understand basic mechanical concepts related to discrete and continuous mechanical systems.

Describe and understand the vibrations of discrete and continuous mechanical systems

Describe and understand planar and spatial motion of a rigid body

Describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism.

Section A

System of particles: Conservation laws, Constrained motion, Constraints, Degree of freedom, Generalised co-ordinates.

generalized force, Principle of virtual work, D'Alembert's principle, Applications of D'Alembert's principle, Deduction of Lagrange's equations of motion by different methods, Lagrange's equation for conservative and non-conservative forces, Symmetry properties for space and time and conservation laws, Hamilton's variational principle, Euler-Lagrange differential equation, Applications of Lagrange's equations of motion: Lagrangian for a charged particle in an electromagnetic field, Small oscillation and Normal modes

Section B

Hamiltonian Dynamics: Hamiltonian Dynamics: Generalized momentum and cyclic coordinates, Hamiltonian, Hamilton's canonical equations of motion, Hamilton's canonical equations of motion in different co-ordinate systems, Applications of Hamiltonian's equation of motion. Hamiltonian for a charged particle in an electromagnetic field, Principle of least action, Canonical transformations. Legendre transformation, Generating function, Infinitesimal contact transformation, Jacobi's identity, Lagrange's brackets, The angular momentum and Poisson brackets, Hamilton's equation in terms of Poisson's brackets, Poisson bracket in Quantum Mechanics, Phase space and the motion of the system, Liouville's theorem, Hamilton-Jacobi method, H-J equation for Hamilton's characteristic function, Application of H-J method: Solution of one dimensional harmonic oscillator, Action and angle variables

Section A

Motion under Central Force: Equivalent one body problem, General features of central force motion, Equivalent one dimensional problem-features of orbits, Inverse square law-Kepler problem, Virial theorem, Rutherford scattering, Center of mass and Laboratory co-ordinates, Transformation of scattering problem to laboratory co-ordinates.

Four dimensional formulation-Minkowski space: Four vectors and its applications, Lagrangian and Hamiltonian formulation of relativistic mechanics, Covariant Lagrangian and Hamiltonian formulation.

Recommended Books:

1. Goldstein, H. (1980). *Classical Mechanics*, Addison-Wesley.
2. Sommerfeld, A. (1952). *Lectures on Theoretical Physics: Mechanics*. Academic Press
3. Upadhyaya J. C. (2003). *Classical Mechanics*, (Himalaya Publishing House)

Suggested web-resources:

1. <https://nptel.ac.in/courses/115103034/#>
2. <https://nptel.ac.in/courses/11510606/>

Mathematical Physics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completed this course, Student will be able to :

have a good grasp of the basic elements of complex analysis, including the important integral theorems.

Student will be able to determine the residues of a complex function and use the residue theorem to compute certain types of integrals.

be able to solve ordinary second order differential equations important in the physical sciences; solve physically relevant partial differential equations using standard methods like separation of variables, series expansion (Fourier-type series) and integral transforms.

have learned how to expand a function in a Fourier series, and under what conditions such an expansion is valid. Student will be aware of the connection between this and integral transforms (Fourier and Laplace) and be able to use the latter to solve mathematical problems relevant to the physical sciences.

Section A

Tensor: Introduction, rank and number of components of a tensor, contravariant and covariant tensors, transformation of covariant, contravariant and mixed tensors, addition, multiplication and contraction of tensors. Metric tensor, Coordinate transformation and Jacobian.

Complex Analysis: Function of complex variable, derivative and the Cauchy-Riemann differential equations, analytic function, line integral of complex function, Cauchy's integral theorem, Cauchy's integral formula, Taylor's and Laurent series, Cauchy's residues theorem, singular points of an analytic function, evaluation of residues, Liouville's theorem, evaluation of definite integrals.

Section B

Ordinary Differential Equations: Second-order homogeneous and nonhomogeneous differential equations with constant and variable coefficients.

Special Functions: Series solution method, solutions and basic properties like orthogonality, recurrence relations, graphical representation and generating functions of Bessel's, Hermite's Legendere's, Laguerre's and associated Legendre functions.

Second-order partial differential equations: Laplace, Poisson, Helmholtz, Wave and Diffusion equations.

Section C

Integral transforms: Laplace transforms - first and second shifting theorems, inverse Laplace transform-first and second shifting theorems, Laplace transform and inverse Laplace transform of derivative and integral of function, Convolution theorem.

Fourier series - Fourier series of arbitrary period, Summation of the Fourier series.

Fourier Transform - Fourier sine and cosine transform, inversion formula for Fourier sine and cosine transforms, change of scale property, shifting theorem, multiple Fourier transform, Convolution theorem, Fourier transform of the derivatives of a function.

Recommended Books:

Das, H. K., Verma, R (2014), *Mathematical Physics*, S. Chand and company.

Rajput B S, (2005), *Mathematical Physics* Pragati Prakashan.

Kreyszig E. (2015), *Advanced Engineering Mathematics*, John-Wiley.

Weber, H. J., & Arfken, G. B. (2003). *Essential Mathematical Methods for Physicists*, ISE. Elsevier.

Gupta B.D., (2010), *Mathematical Physics*, Vikas Publishing House Pvt. Ltd.

Suggested web-resources:

<https://nptel.ac.in/courses/115103036/#>

<https://nptel.ac.in/courses/115106086/>

Quantum Mechanics – I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Students who complete this course should

Have a deep understanding of the mathematical foundations of quantum mechanics

Be able to solve the Schrodinger equation for simple configurations

Understand the effect of symmetries in quantum mechanics

Section A

Why Quantum Mechanics? The quantum concept, Postulates of quantum mechanics Schrodinger equation: Derivation and Solution, Physical interpretation of wave function, Expectation values, Probability current density, Ehrenfest's theorem, Uncertainty principle, Complementarity principle.

One-dimensional problems: Wells and barriers, Harmonic oscillator by Schrodinger's equation, Applications of Schrodinger equation in Spherical Symmetric System: Rigid Rotator and Hydrogen Atom, Degeneracy.

Section B

Operators in QM: Orthogonal sets, Completeness, Different type of operators, Eigen values and Eigen functions, Operator formalism in QM, Commutation Algebra, Commutativity and simultaneous eigen functions.

Hilbert space, Operators as matrix, Matrix form of wave function, Schrodinger, Heisenberg and Interaction matrix representation, Dirac's Bra and Ket vectors, Direct sum and product of Hilbert space, Co-ordinate and momentum representation.

Identical particles, Symmetric and anti-symmetric wave functions, Particle exchange operator, Pauli exclusion principle, Spin angular momentum, Stern-Gerlach experiment, Spin matrices for electron, Commutation relations.

Section C

Angular momentum operator, Spin angular momentum, Total angular momentum operators, Commutation relations of total angular momentum, Eigen values of J^2 and J_z , J_+ and J_- , J_x and J_y , Addition of angular momenta, CG coefficients, Wigner-Eckart theorem.

Approximate method- Time independent perturbation theory, Non-degenerate and degenerate cases, Applications: – normal He atom, perturbed harmonic oscillator, Zeeman effect and Stark effect.

Recommended Books:

1. Schiff L. I.; Quantum Mechanics- III ed., (1968) Mcgraw-Hill
2. Ghatak, A.K. and Lokanathan, S.; *Quantum Mechanics Theory and Applications* (1997), Macmillan India Limited – IIIrd Ed.
3. Das, A and Misra, A.C.; *Quantum Mechanics: A modern approach* (1992) Gordon and Breach Science Publishers.
4. Grenier, W.; *Quantum Mechanics An Introduction* (1994) Springer – IIIrd Ed.
5. Sakurai, J.J; *Modern Quantum Mechanics* (1999) Addison-Wesley
6. Eisberg, R and Resnick, R.; *Quantum Physics* (atoms, molecules...) John Wiley and Sons

Suggested web-resources:

<https://nptel.ac.in/courses/115106066/>

<https://nptel.ac.in/courses/115103104/>

Computer Oriented Numerical and Statistical Methods

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course, Student will be able to:

Apply numerical methods to obtain approximate solutions to mathematical problems.

Using appropriate numerical methods, determine the solutions to given non-linear equations, systems of linear equations, interpolation, numerical differentiation and integration and numerical solution of ordinary differential equations.

Analyze the errors obtained in the numerical solution of problems.

Apply appropriate algorithms to solve selected problems, both manually and by writing computer programs.

Compare different algorithms with respect to accuracy and efficiency of solution.

Implement numerical methods algorithm using programming language.

Section A

Errors and Approximations in Digital Computers, Number representation, Floating point Arithmetic. Solution of systems of linear equations - direct method, Gauss Jordan & Gauss Elimination methods, Pivoting, Iterative methods - Jacobi & Gauss Seidel method.

Solution of Nonlinear equations in n variable : Localization of the roots, Bisection and Regula - Falsi methods, Newton-Raphson method, successive Approximation method, Rate of convergence and Aitkin's process.

Section B

Interpolation: Newton's Interpolation formulae - Forward and Backward difference formulae, Derivatives & tabulated functions, Lagrange's Interpolation formula.

Numerical Integration and Differentiation: Newton-Cotes formulae - Trapezoidal & Simpson's rule, change of interval of integration, Numerical Differentiation, derivatives from Newton-Goegory Forward Polynomial.

Numerical solution of ordinary Differential equations: ODE's, a system of first order ODE's, Euler's, Picards and Taylor series methods of real functions - Introduction and Polynomial Approximations, Least squares approximation.

Section C

Statistical Methods: Treatment of data, Frequency Distribution, measures of central tendency, dispersion & partition values.

Probability distribution - Binomial, Poisson & Normal.

Curve fitting by principle of least square, Correlation and regression.

Inference- Tests of significance for mean, variance, proportion, and correlation coefficient, Test of goodness of fit and independence of attributes. Analysis of variance for one way classified data.

Recommended Books:

1. Rajaraman, V. (2018) Computer Oriented Numerical Methods, PHI learning.
2. Sastry, S. S. (2012). *Introductory methods of numerical analysis*. PHI Learning Pvt. Ltd..
3. Gupta, S. P. (1994). *Statistical Methods*, Sultan Chand & Sons, New Delhi
4. Gupta, S. C., & Kapoor, V. K. (1997). *Fundamentals of Mathematical Statistics*, Ninth Extensively Revised Edition, Sultan Chand & Sons.

Reference Books:

1. Grewal, B. S. (2018). Numerical Methods in Engineering and Science: (C, and C++, and MATLAB). Stylus Publishing, LLC.

2. Krishnamurthy, E. V., & Sen, S. K. Numerical Algorithms: Computations in Science and Engineering. 2001. Affiliated East- West Press, New Delhi.
3. Govil R., *Kamputer se sankhyatmakReetiyen*, et.al. Pitamber Publications, New Delhi
4. Krishnamurthy, E. V., & Sen, S. K. (1976). *Computer-based numerical algorithms*. East-West Press.
5. Rao, K. S. (2017). *Numerical methods for scientists and engineers*. PHI Learning Pvt. Ltd..
6. Yule, G. U., & Kendall, M. G. (1987). *An Introduction to the Theory of Statistics* Universal Book Stall. New Delhi.
7. Agarwal, B. L. (2006). *Basic statistics*. New Age International.
8. Govil R. *Kamputer se sankhyatmakReetiyen*, et.al. Pitamber Publications, New Delhi

Suggested web-resources:

<https://nptel.ac.in/courses/122106033/>

Atomic and Molecular Physics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of this course the student will be able to :

Be able to understand about the transitions occur in the materials.

Understand the basic principles of spectroscopy where electromagnetic radiation interacts with matter and their results.

Section A

One electron atom, Electron spin and Vector model, Pauli's principle, Spin orbit interaction, Hydrogen fine structure, He atom and its spectrum, Multi-electron atoms – Hartree's field theory, Spectroscopic terms: L-S and J-J couplings, Normal and anomalous Zeeman effect, Paschen back effect, Stark effect.

Section B

Spectra of Alkali elements, Spectra of Alkaline earth elements, Hyperfine structure of spectral lines, Line broadening mechanism (general idea), X-ray spectra, Kossel's explanation of characteristic of X-ray spectra, Mosley law, Absorption spectra, Fine structure and doublets in X-ray spectra.

Section C

Molecular energy states and molecular spectra, Types of molecular spectra, Rigid rotator, Rotational energy levels of diatomic molecules, Rotational spectra, Vibrational energy levels of diatomic molecules, Pure rotational spectra, Vibrational-Rotational spectra, Electronic spectra: Frank-Condon Principle, Raman spectra.

Recommended Books:

1. White H. E. (1934) Introduction to atomic spectra (Mc-Graw Hill)
2. Kumar R (1997) Atomic and molecular spectra (Kedad Nath Ram Nath Publication)

Suggested web-resources:

<https://nptel.ac.in/courses/115101003/>

Classical Electrodynamics-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of this course the student will be able to :

Have deep understanding about the scientific, mathematical and engineering principles that enable them to understand forces, fields, and waves.

Learn the functioning of the devices that work on those principles and phenomena.

Section A

Electrostatics: Electric field, Gauss law, Differential form of Gauss law, and the scalar potential, surface distribution of charges and dipoles and discontinuities in the electric field and potential, Poisson and Laplace equations, Green's Theorem, Uniqueness of the solution with Dirichlet or Neumann Boundary conditions, Formal solution of electrostatic Boundary value problem with Green's Function, Electrostatic potential energy and energy density.

Boundary-Value Problems in Electrostatics: Methods of Images, Point charge in the presence of a grounded conducting sphere, Point charge in the presence of a charged insulated conducting sphere, Point charge near a conducting sphere at fixed potential, conducting sphere in a uniform electric field by method of images.

Section B

Multipoles, Electrostatics of Macroscopic Media Dielectrics: Multipole expansion, multipole expansion of the energy of a charge distribution in an external field, Elementary treatment of electrostatics with permeable media, Boundary value problems with dielectrics; Molar polarizability and electric susceptibility, Models of molecular polarizability, Electro-static energy in dielectric media, capacitance, dielectrics,

Magnetostatics : Introduction and definition, Biot and Savart law, the differential equations of magnetostatics and Ampere's law, Vector potential and Magnetic induction for a circular current loop, Magnetic fields of a localized current distribution, Magnetic moment, Force and torque on and energy of a localized current distribution in an external magnetic induction, Macroscopic equations, Boundary conditions on B and H.

Section C

Time varying fields Conservation Laws and Relativistic Electrodynamics: Energy in a magnetic field, Vector and Scalar potentials, Gauge transformations, Lorentz gauge, Coulomb gauge, Poynting theorem and conservation of energy and momentum for a system of charged particles and EM fields, Conservation laws for macroscopic media.

Mathematical properties of the space-time, special relativity, Invariance of electric charge covariance of electrodynamics, Transformation of electromagnetic fields, Electromagnetic field tensor, Transformation of four potentials and four currents, Tensor description of Maxwell's equation.

Recommended Books:

Jackson J. D., (2012) *Classical electrodynamics* (Wiley, India).

Panofsky & Philips (2006) *Classical Electricity and Magnetism*, Sarat Book house, New Delhi.

Griffiths, D. J. (2005) *Introduction to Electrodynamics* (Pearson Education).

Landau & Lifshitz, (1960) *Classical theory of Electrodynamics* (Pergaman Press, New York).

Landau & Lifshitz, (1960) *Electrodynamics of Continuous media* (Pergaman Press, New York).

Sadiku M. N. O. (1999) *Elements of Electromagnetics* by (Oxford Univ. Press).

Suggested web-resources: -

<https://nptel.ac.in/syllabus/115101005/>

<https://ocw.mit.edu/courses/findbytopic/#cat=science&subcat=physics&spc=electromagnetism>

Statistical Mechanics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completing of this course, Student will:

Have a deep understanding of physical statistics and its relation to information theory

Be able to solve statistical mechanics problems for simple non-interacting systems

Have a basic understanding of the phase transitions,

Be able to use linear response theory and kinetic equation approach

Section A

Foundations of Statistical Mechanics, Specification of states of system, Contact between statistics and thermodynamics, Classical ideal gas, Entropy of mixing and Gibb's paradox.

Microcanonical ensemble, Phase space, Trajectories and density of states, Liouville's theorem, Canonical and grand canonical ensembles, partition function, calculation of statistical quantities, Energy and Density fluctuations.

Section B

Density matrix, Statistics of ensembles, Statistics of indistinguishable particles, Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein statistics, Properties of ideal Bose and Fermi gases, Bose-Einstein condensation.

Expansion of classical gas, Virial equation of state, Ising model, mean-field theories of ising model in one dimensions, Exact solutions in one dimension.

Section C

Landau theory of phase transition, Critical indices, Scale transformation and dimensional analysis, Correlation of space-time dependent fluctuations, Fluctuations and transport phenomena, Brownian motion, Langevin theory, fluctuation dissipation theorem, The Fokker-Planck equation.

Recommended Books

1. Reif, F., (1985) *Fundamentals of statistical and thermal physics* (Mc Graw Hill).
2. Landau and Lifshitz (2005) *statistical physics* (Butterworth-Heinemann Oxford)
3. Huang K. (2004) *statistical physics* (John Willey)
4. Pathria R. K. (2005) *statistical mechanics* (Elsevier)

Suggested web-resources:

<https://nptel.ac.in/courses/115103028/>

<https://ocw.mit.edu/courses/physics/8-044-statistical-physics-i-spring-2013/>

Nuclear Physics-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After completion of the course the student will be able to:

- Understand the concept of nuclear physics.
- Understand the structure of matter at the atomic level.
- Understand the interactions of the atom molecules and the building blocks.
- Understand the nuclear power generation and nuclear weapons technology.

Section A

Nuclear Properties: Radius, mass, angular momentum, magnetic moment, electric quadrupole moment, parity and binding energy.

Two nucleon system and Nuclear forces: General nature of the force between nucleons, saturation characteristic of nuclear forces, charge independence, spin dependence, concept of exchange forces, Yukawa theory (only qualitative description), general form of two nucleon interaction, central, non-central and velocity dependent potentials. Analysis of ground state of Deuteron using square well potential, range-depth relationship, excited state of Deuteron, discussion of ground state of Deuteron under non-central forces, calculation of electric quadrupole moment and magnetic dipole moment and the d-state admixture.

Section B

Nucleon-Nucleon scattering: Neutron-proton scattering at low energy assuming square well central potential, qualitative discussion in terms of partial wave, concept of scattering length, coherent scattering of neutron by proton in Ortho and Para Hydrogen molecules, the effective range theory in neutron-proton scattering and shape independence of nuclear potential, qualitative discussion of proton-proton scattering at low energy, general features of two nucleon scattering at high energy and effect of exchange forces.

Interaction of radiation and charge particle with matter: Law of absorption, attenuation coefficient for photo-electric effect, Compton scattering, pair production, energy loss of charged particle due to ionization and Brehmstrahlung, range energy curve and the straggling, interaction of Neutron with matter.

Section C

Experimental techniques:

Nuclear detector: Gas-filled counters, Neutron detector, Neutron time of flight method, Scintillation and Cherenkov counters, solid state detectors, nuclear emulsions, techniques of measurement and analysis of tracks, electronic circuits used with typical detectors.

Particle accelerator: Linear accelerator, cyclotron, synchro-cyclotron, betatron, electron-synchrotron, proton synchrotron

Recommended Books:

1. Kaplan I. (1992) *Nuclear Physics* (Addison Wesley Pub. Co.).
2. Roy R. R. and Nigam B. P. (1997) *Nuclear Physics Theory and Experiment* (New Age International Pub.).
3. Evans R.D. (1965) *Atomic Nucleus* (McGraw Hill).
4. Ghoshal S. N. (2006) *Nuclear Physics* (S. Chand, New Delhi),
5. Singru R. M. (1972) *Introduction to Experimental Nuclear Physics* (Wiley Eastern Pvt. Ltd.)
6. Patel S. B. (1992) *Nuclear Physics: an Introduction* (Wiley Eastern Ltd.).

Suggested web-resources:

<https://nptel.ac.in/courses/115104043/>

<https://nptel.ac.in/courses/115103101/>

Physics of Lasers and Laser Applications

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

SECTION-A

Spontaneous and Stimulated emission, Population inversion, Idea of laser. Gaussian beam and its properties, Stable and Unstable Optical Resonators, Longitudinal and Transverse modes of laser cavity, Gain in a regenerative laser cavity, Threshold for 3 and 4 level laser systems, Q-switching and mode locking – Pulse shorting – nano, pico and femtosecond operation.

SECTION-B

Ruby laser, He-Ne laser, carbon oxide laser, Excimer laser, X-ray laser, Dye laser, Neodymium : YAG and Neodymium : glass laser, Fiber laser, Semiconductor laser, Quantum-well laser, Diode – Pumped solid state laser.

SECTION-C

Laser fluorescence and Raman scattering, Laser induced multiphoton process, Ultrahigh resolution spectroscopy with lasers and its applications, Optical Fibers, Light wave communication, Holography: Construction of hologram and reconstruction of the image, Types of Hologram. Medical and Engineering applications of lasers, Potential of lasers in defense applications.

Text/Reference books:

1. Laser Fundamentals by William T. Silfvast (Cambridge University Press), 1998.
2. Optical Electronics by Ajoy Ghatak and K. Thyagarajan (Cambridge University Press), VII Reprint, 2006.
3. Lasers by Ajoy Ghatak and K. Thyagarajan, (Cambridge University Press)
4. Lasers by Orazio Svelto, (Springer Science Inc., USA), IV Ed, 1998.
5. Laser Spectroscopy by W. Demtroder, (Springer-Verlag), Berlin, III Ed., 2003
6. Optoelectronics: An Introduction, J. Wilson and J.F.B. Hawkes, (Prentice Hall International (UK) Limited), II Ed., 1989.
7. Optoelectronic Devices and Systems by S.C. Gupta, (Prentice Hall India), 2005
8. Laser Electronics by Joseph T. Verdeyen, (Prentice Hall of India Private Limited), II Ed., 1993.
9. Lasers: Principal and Applications by J. Wilson and J.F.B. Hawkes, (Prentice Hall International (UK) Limited).
10. Non linear Optics by B. B. Laud

Solid State Physics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course, Student will be able to:

Understand how the large-scale properties of solid materials result from their atomic-scale properties.

Seek various applications of solid state physics in technology of semiconductors and semiconductors based devices.

Section A

Lattice dynamics and optical properties of solids:

Interatomic forces and lattice dynamics of ionic & covalent crystals, and metals. Analysis of strain, elastic compliance and stiffness constants, elastic energy density, elastic stiffness constants of cubic crystals and elastic waves in cubic crystals.

Vibration of crystals with monatomic basis, two atoms per primitive basis, quantization of elastic waves, phonon momentum, inelastic scattering by phonons, phonon heat capacity, Planck distribution, density of states in one and three dimensions, Thermal properties of solids: Classical model, Einstein model, Debye model and, Debye T^3 law, thermal conductivity, phonon-phonon interaction-umklapp process, thermal expansion.

Section B

Band theory and semiconductors:

Nearly free electron model, origin and magnitude of energy gap, Bloch function, Kronig-Penney model, wave equation of electron in periodic potential.

Number of orbitals in a band, band gap of semiconductors, equation of motion, intrinsic carrier concentration, impurity conductivity, Tight bonding method for energy gap.

Superconductivity:

Meissner effect, type I & type II superconductors, heat capacity, microwave and infrared properties, isotope effect,

London equation, coherence length, Cooper pairs, BCS theory (no derivation), field quantization in a superconducting ring, duration of persistent current, high temperature superconductors

Section C

Diamagnetism and Paramagnetism:

Langevin Diamagnetism equation, quantum theory of diamagnetism of mononuclear systems, Paramagnetism, quantum theory of paramagnetism. Cooling by isotropic demagnetization, paramagnetic susceptibility of conduction electrons.

Ferromagnetism and Antiferromagnetism:

Ferromagnetic order, magnons, Neutron magnetic scattering, ferromagnetic order, Antiferromagnetic order, Ferromagnetic domains,

Nuclear magnetic resonance, Nuclear quadrupole resonance, ferromagnetic resonance, Electron paramagnetic resonance

Recommended Books:

1. Kittel C. (1995) *Introduction to Solid state Physics* (John Wiley).
2. Dekker A. J. (1965) *Solid State Physics* (Macmillan, London).
3. Pillai S. O. (2005) *Solid state physics* (New Age International Publishers).
4. Singhal R. L. (2001) *Solid State Physics* (Kedar Nath Ram Nath Publishers).

Suggested web-resources:

<https://nptel.ac.in/courses/115104109/>

<https://nptel.ac.in/courses/115105099/>

Condensed Matter Physics - I

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Structure Factor: Static structure factor and its relation with the pair correlation function, Determination of structure factor by X-ray and neutron scattering. Inelastic neutron scattering and dynamic structure factor, space time correlation function. Langevin's equation for Brownian motion and its modifications. Velocity auto-correlation function, mean square displacement, Relation between velocity auto-correlation function and diffusion coefficient.

Section B

Quantum Liquids: Distinction between classical and quantum liquids, criteria for freezing, Bose -Einstein Condensation and B-E condensate, Phase diagram of He⁴- He I and He II, Tisza's two fluid model, Entropy filter, Fountain effect, Viscosity and specific heat of He⁴, first second, third, fourth sounds. Basic differences in super fluidity in He³ and He⁴

Section C

Exotic Solids:

Structure and symmetries of liquids, liquid crystals and amorphous solids, aperiodic solids and quasicrystals. Fibonacci sequence and Penrose lattices, their extension to quasicrystals. Synthesis and properties of special carbon solids: fullerenes and carbon nanotubes (CNTs), formation and characterization of fullerenes and CNTs. Electronic properties of CNTs and CNT based electronic devices. Methods of synthesis of nano-structured materials: sol gel and co-precipitation method. Special experimental techniques for characterization of nanomaterials: X ray diffraction (XRD) and small angle x-ray scattering (SAXS) and small angle neutron scattering (SANS), Scanning probe microscopy SPM (AFM and STM), Scanning electron microscopy (SEM) and Transmission electron microscopy (TEM)

Text Books:

1. Hansen and McDonald: Theory of simple liquids
2. D. Pines and P. Nozier: The Theory of Quantum Liquids
3. J. Tilley and D. R. Tilley: Superfluidity and Superconductivity (Publisher: Taylor and Francis Group, 1990)
4. March, Tosi and Street: Amorphous Solids and Liquid State (Plenum, 1985)
5. Handbook of Nanostructured Materials & Nanotechnology (Ed. Hari Singh Nalwa, Vol. 1 to 4)

Fiber Optics Communication

L T P C
4 0 0 4
Max. Marks : 100
(CA: 40 + ESA: 60)

SECTION-A

Light propagation- total internal reflection, Acceptance angle and Numerical aperture. Fiber materials and Fabrication, Mechanical properties of Fiber, Fiber cables, comparison of Fiber cables with conventional metallic cables.

Optical Fibers- step index, single and multimode, graded index. Fiber losses and dispersions.

SECTION-B

Light Emitting diodes- spontaneous emission – surface emitting LED, edge emitters, semiconductor diode LASER- stimulated emission, Double hetero structure LASER, drivers for LED and LASER, Photo conductive – photo voltaic effect, Solar cells- p-n homojunction, heterojunction and amorphous Solar cells.

Fiber end preparations, Fiber splicing, Fiber connector, connection losses, Fiber couplers.

SECTION-C

Photo detectors- characteristics of photo detectors- photoconductor, p-n photodiode, PIN photodiode Schottky barrier photodiode, Avalanche photodiode, Phototransistor.

Integrated optics, Fiber Optic communication system- applications of Fiber Optics- long haul communications, local area network, under sea communication, sensors, medical applications.

Text/Reference Books:

1. Optical Fiber communication by John M. Senior, (Prentice Hall of India), II Ed., 2004.
2. Optical Fiber communication by John Gower, (Prentice Hall of India), II Ed., 1995.
3. Semiconductor Optoelectronics Devices by Pallab Bhattacharya, (Prentice Hall of India), 1994.
4. Optical Fiber communication by Gerd Keiser, (McGraw Hill), 2007.
5. Optoelectronics: An Introduction by J. Wilson and J.F.B. Hawkes, II Ed., (Prentice Hall International (UK) Limited), 1989.
6. Optoelectronic Devices and Systems, S.C. Gupta, (Prentice Hall India), 2005.
7. Fiber Optics Communication by J. C. Polais, (Pearson Education), 2008.
8. Understanding Fiber Optics, Jeff Hecht, (BPB Publishers), 2006.

Physics of Nano-structures and Nanotechnology - I

L	T	P	C
4	0	0	4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A:

Introduction to Quantum Mechanics: Matterwaves, Schrodinger equation, idea of quantum well structure, quantum dots, quantum wires, density of states for 0-d solid, 1-d quantum wire, 2-d and 3-d potential box.

Charge and Current densities, Introduction to Density Functional Theory, Optical measurements of Band gap.

Structure and bonding: arrangement of atoms, two and three dimensional crystals, symmetry elements in crystals, plane in crystals, reciprocal lattice, quasi crystals.

Surface crystallography, Surface symmetry, Surface energy, surface reconfiguration, surface reconstruction and relaxation.

Section B:

Synthesis of Nanomaterials: Physical methods- high-energy ball milling, melt mixing, Method based on evaporation, Sputter deposition, chemical vapor deposition, molecular beam epitaxy.

Synthesis of Nanomaterials: Chemical methods- Colloids and colloids in solution, synthesis of metal and semiconductor nanoparticles by colloidal route, Langmuir–Blodgett method, microemulsions, sol-gel method.

Nano Lithography- lithography using photon, lithography using particle beam, Scanning probe lithography, Soft lithography.

Section C:

Analysis techniques:

Microscopes: optical, confocal, electron microscopes (SEM & TEM), scanning probe microscopes (SPM)- scanning tunneling microscope, scanning near-field optical microscope, atomic force microscope.

Diffraction techniques: X-ray diffraction-Bragg's law of diffraction, diffraction from different types of samples, diffraction from nanoparticles.

Spectroscopies: Optical absorption spectrometer, infrared spectrometer (dispersive, Fourier transform), photoluminescence spectrometer, X-ray photoelectron spectroscopy, and Auger electron spectroscopy.

Text/Reference books:

1. Solid State Physics by S.O. Pillai, (New Age International), 2007.
2. Nano technology; principle and practices by S.K.Kulkarni, (Capital Publishing Company), 2007.
3. Physics of semiconductor nanostructures by K. P. Jain., (Narosa Publishers), 1997.
4. Quantum dot heterostructures by D.M. Garundmann and N.N. Ledentsov, (John- Wiley), 1998.
5. Introduction to Nanotechnology by C.P.Poole, F.J.Owens, (Wiley-Interscience), 2003.
6. Nanotechnology: Basic Science & Emerging Technologies by M.Wilson, K.Kannangara, G.Smith, M.Simmons and B.Raguse, (Chapman & Hall/CRC Press), 2002.

Microwave Electronics

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

SECTION-A

Transmission Lines: Introduction to Microwaves & its applications. General equation, input independence characteristic, Reflection & transmission coefficient, standing wave ratio, resonant and anti resonant line impedance matching, smith chart & its applications, coaxial, twin, strip & microstrip lines & baluns.

SECTION-B

Wave Guides: Wave propagation in rectangular & circular wave guides, wave guide modes, Q of wave guides, wave guide coupling. Microwave Passive Components: s-parameter representation and analysis of microwave component such as tees, two hole direction coupler attenuators, phase shifter, Rectangular cavity resonator, circulator & isolator.

SECTION-C

Microwave Tube Devices: Conventional Vacuum tubes at microwave, Slow-wave devices, O-type device-Klystron two cavity, Reflex- Klystron, M-type device-Magnetron, Introduction to TWT (Travelling Wave Tubes), Microwave Semiconductor Devices IMPATT, TRAPATT, Gun Diode, Introduction of fast wave device : Gyrotrons (Concepts only)

Text/Reference Books:

1. Microwave Circuits & passive devices, Sisodia-Raghuvanshi (Wiley-eastern), 1987.
2. Microwave devices & circuits, S.Y. Liao, III Ed., (Prentice Hall), 2002
3. Foundation of microwave engineering, Collin, (Mc Graw Hill), II Ed., 1992.
4. Basic MW techniques & lab manual, Sisodia-Raghuvanshi, (Wiley-Eastern), 1987.
5. Microwave Principles, Herbert J. Reach, (CBS Publishers & Distributors), 1999.
6. Microwave Engineering, Passive Circuits, P.A. Rizzi, (Prentice Hall), 1998.

Solid State Electronics Devices

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section-A

Energy Bands, direct and indirect semiconductors, Effective Mass, Intrinsic and Extrinsic Semiconductors, Occupation Probability and Carrier Concentration, Temperature Dependence of Carrier Concentration, Fermi Levels and Quasi Fermi levels, mobility and conductivity, Hall Effect, four probe method of resistivity measurement.

Generation and Recombination of Charges, diffusion, Continuity equation, Injected minority charge carriers, the potential variation within a graded semiconductor, Schottky Junction and Ohmic Contact.

PN junction diode, Zener diode, Zener and Avalanche breakdown, Tunnel diode, Semiconductor Photo diode and Light-emitting diode.

Section -B

Bipolar junction transistor:- Types, Current components, CB, CC, CE configuration, Ebers-Moll model of transistors.

Concept of load line and Operating point, Thermal stability of transistor, Fixed-Bias, Emitter-Bias, Voltage divider Bias, Collector feedback Configuration.

Transistor Hybrid model, analysis of a transistor amplifier circuit using h-parameters, Simplified hybrid model for CE, CB and CC configuration, The Common-Emitter amplifier with an emitter resistance, Emitter follower, Darlington emitter follower,

Junction field effect transistor and Depletion and Enhancement type MOSFET; V-I characteristic, operation methods, FET Biasing: Fixed, Self and Voltage-divider Bias. low and high frequency model (just reference).

Section C

Operational amplifiers and its applications, inverting and non-inverting amplifiers, adder, integrator, differentiator, wave-form generator, comparator, Schmitt trigger.

Four layer diode (P-N-P-N), SCR, Principle of operation, transistor analogy, methods of turning On and Turning Off (just reference), Gate characteristic, DIAC, TRIAC, light activated thyristor, Applications of SCR in the following areas: Over voltage protection, Zero voltage switch, Logic and Digital Circuits, Pulse circuits.

Text/Reference Books:

1. Integrated Electronics by J. Millaman and C. Halkias, (McGraw Hill, New York), 1972
2. Electronic Devices and circuits by Malvino
3. Solid State Electronic Devices and Integrated Circuits by Ben. G. Sterectman, (Prentice Hall Inc.), 1995.
4. Physics of Semiconductors Devices by S.M. Sze (John Wiley & Sons), 1999.

Analog and Digital Communication

L	T	P	C
4	0	0	4

Max. Marks : 100

(CA: 40 + ESA: 60)

SECTION-A

Spectrum Analysis: Fourier series, Sampling, functions. Normalized power, Fourier transform. Parsevals theorem, Convolution, Signal transmission through linear time invariant systems, correlation and power spectrum, Random signals and noise, Basic information theory.

Analog Modulation Systems: Amplitude modulation, depth of modulation, spectrum of an A.M. signal, square law modulator, Balanced modulator, D.S.B.S.C. modulation, S.S.B. modulation, vestigial sideband modulation.

SECTION-B

Frequency modulation, phase modulation, relationship between phase and frequency modulation. Spectrum of F.M. Signal, generation and detection of F.M. signal. Comparison of AM & FM. Digital modulation systems: Sampling theorem, PAM, PWM, PPM, quantization of signals, quantization error, Pulse-code modulation, companding, DPCM, Delta modulation, adaptive delta modulation, ASK, FSK, PSK, DPSK.

SECTION-C

Satellite Communication - History of orbital satellites, Geostationary Satellites, Orbital patterns, Look Angles, Orbital spacing and Frequency allocation, Radiation Patterns: Footprint, Satellite System link models, Satellite system parameters, FDM/FM satellite systems. Introduction to Communication systems: Radio, T.V., Telegraph & Telex, EPABX, FAX, Cellular telephones, Telemetry.

Text/Reference Books :

1. Principles of Communication Systems by Taub H and Schilling D L, (McGraw Hill), 2nd Edition.
2. Electronics Communication Systems by Davis B and Kennedy G, (Mc-Graw Hill), IV Edition.
3. An Introduction to Analog & Digital Communications by Haykins S., (John Wiley & Sons), 2001.
4. Principles of Communications- Systems, Modulation & Noise by R.E. Zimer & W.H. Tranter, (Jaico Publishing House).
5. Electronics Communications by Roddy D, Coolen J, (PHI), III Edition.
6. Analog and Digital Communications, Schaum's outline series, (Mc Graw Hill)
7. Electronics Communications by Schoenbeck Robert J., (Universal Book Stall), 1995.

GENERAL MICROBIOLOGY

L	T	P	C
4	0	0	4
Maximum Marks 100			
(CA: 40 + ESA: 60)			

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Significance of Micro-organisms and Historical background.
- Classification of Bacteria (up to sections based on bergey's Manual), Ultrastructure and morphology of Bacteria.
- Composition of Cell wall of archaeobacteria & eubacteria, L-forms, cell membrane, capsules, reserve food materials, nutrition and reproduction.
- Brief Idea about Prochlorons & cyanelles.

Section-B

- Classification of fungi and algae.
- Ultrastructure and characteristics of Fungi, nutrition and metabolism, reproduction, heterothallism, physiological specialization.
- Brief idea about Cyanobacteria, Mycorrhiza and Lichens.

Section-C

- Classification of Viruses (Plant, animal and bacteriophage)
- Distinct properties of viruses.
- Morphology and ultrastructure of viruses
Animal, plant and bacteriophages, one step growth curve, replication of viruses, cultivation of viruses.
- Serological and immunological assay of viruses.
- Brief idea about prions.

Books Recommended :

- Bergey's Manual of Systematic Bacteriology - P.H.A. Sneath, N.S. Mair, M. Elizabeth.
- General Microbiology : RY Stainer, JL Ingham, ML Wheelis, PR Painter (1999) Macmillan Educational Ltd. London.
- Microbiology : MJ Pelczar, ECS Chan, NR Kreig, Mc Graw Hill.
- Microbiology : B.D. Davis, R. Dulbecco, H.N. Eisen and H.S. Guisberg. Harper and Row Publishers, Hagerstorn, 3rd Ed.
- Microbiology, A Laboratory Manual : Cappuccino, J.G. and Sherman, N., Addison Wesley.

MICROBIAL TECHNOLOGY LAB - I

L	T	P	C
0	0	12	6

Maximum Marks 100
(CA: 40 + ESA: 60)

- To obtain standard curve of p-nitrophenol solution.
- To prepare a sample of enzyme extract.
- To determine activity of acid phosphatase from peas/moong seedlings.
- Purification of an enzymatic protein by salt precipitation.
- Determination of kinetic properties (K_m and V_{max} values) of an enzyme.
- To check time and protein linearity of an enzymatic reaction.
- Immobilization of an enzyme.
- Blood film preparation and identification of leucocytes.
- Lymphoid organs and their microscopic organization.
- Immunization, collection of serum.
- Double diffusion and immuno-electrophoresis.
- ELISA : Determination of antibody titre.
- Immunodiagnosics (Demonstration using commercial kits).
- Clinical tests : eg. malarial parasite and widal test.
- Extraction and estimation of RNA.
- Extraction and estimation of DNA.
- To find λ max for nucleic acids.
- Preparation of metaphase chromosomes.
- Detection of ADH activity in tissue/cells by cytochemical staining using *Drosophila*.
- Statistical problem.
- Genetic problem - (chromosome mapping).

MICROBIAL PHYSIOLOGY AND GENETICS

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Metabolic diversity among micro-organisms
- Photosynthesis in micro-organisms, Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; chemolithotrophy; Hydrogen-iron-nitrite-oxidising bacteria; Nitrate and sulfate reduction; Methanogenesis and Acetogenesis.
- Nitrogen metabolism
- Nitrogen fixation
- Hydrocarbon transformation

Section-B

- Microbial development, sporulation and morphogenesis, hyphae vs. yeast forms and their significance.
- Respiratory metabolism - Embedden - Mayerhoff-Parnas pathway, Entner-Duodroff pathway, Glyoxylate pathways, Krebs Cycle, Oxidative and substrate level phosphorylation, ATP generation.
- Prokaryotic genome : Organization of DNA into chromosomes.
- Gene unit of structure and function : complementation test.

Section-C

- Genetics of bacteriophages.
- Mapping of bacterial chromosomes.
- Gene transfer mechanisms - conjugation, transduction and transformation.
- Transposable genetic elements.
- Regulation of gene expression in prokaryotes (*lac* & *trp*), genetic code, extrachromosomal inheritance.

Books Recommended :

- Microbial Genetics : Maloy et. al., Jones & Bartlett Publishers.
- Molecular Genetics of Bacteria : J.W. Dale, John Wiley & Sones.
- Microbial Physiology and Metabolism : D.R. Caldwell, Brown Publishers.
- Microbial Physiology : A.G. Moat & J.W. Foster, Wiley.
- Microbial Genetics : D. Friefelder.
- Genetics of Bacteria and their Bacteriophages : W. Hayes.

MEDICAL MICROBIOLOGY AND IMMUNOLOGY

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Innate and Acquired Immunity
- Antigens : types of Antigens, Antigen specificity, haptens, Antibody structure and functions
- MHC, Complement System
- Cell mediated cytotoxicity : Origin, maturation and characterization of T-lymphocytes, Monocytes & Macrophages, Mechanism of T cell and NK cell mediated lysis, ADCC, Macrophage mediated cytotoxicity, lymphokines - the product of T cell activation.
- Humoral immune response : Origin, maturation and characterization of B-lymphocytes, Activation and proliferation of B-cells, Formation of plasmablast, Plasma cells and memory cells, Interaction of B and T cells.

Section-B

- Hypersensitivity, Monoclonal antibodies and its applications.
- Radioimmunoassay, Enzyme linked immunosorbent assay, immunoblotting, immunofluorescence and flowcytometry
- Characteristics of infectious diseases, Herd immunity.
- Disease cycle (Source of disease, reservoir, carriers)
- Transmission of pathogens (Air borne, contact transmission and vector transmission).

Section-C

- Bacterial Diseases : Epidemiology, Pathogenicity, Laboratory diagnosis, Prevention & control of the following diseases : Anthrax, Tuberculosis, Typhoid, Whooping cough, Tetanus, Diphtheria, Leprosy.
- General Account of fungal diseases : Mycosis, Subcutaneous and deep.
- General Account of viral & protozoan diseases : Pneumonia, Influenza, Mumps, Measles, Polio, Hepatitis B, Chickenpox, AIDS and Malaria, Leishmaniasis.
- Brief account of sexually transmitted diseases.

Books Recommended :

- Text Book of Microbiology : R. Ananthanarayanan and C.K. Jayaram Panicker, Orient Longman, 1997.
- Medical Microbiology, Vol, 1 : Microbial infection : Mackie and McCartney, Churchill Livingstone, 1996.
- Bailey and Scott's Diagnostic Microbiology : Baron EJ, Peterson LR and Finegold, SM Mosby, 1990.
- Essential immunology (1995) : Roitt, I.M. Black well Scientific Publications, Oxford.
- Fundamental immunology : W.E. Paul 1984, Raven Press, New York.
- Fundamentals of Immunology : R.M. Coleman, M.F. Lombord and R.E. Sicard (1992) - 2nd ed. C. Brown publishers.
- Immunology : D.M. Weir and J Steward 7th Ed. (1993).
- Broude A.I. (1981) : Medical "Microbiology" : and Infectious Diseases W.B. Saunders & Co. Philadelphia.

- Immunology : Janis Kuby.
- An Introduction to Immunology : Ian R. Tizard.
- Immunology Introductory text book : Nandini Shetty.
- A Basic Course in Immunology : Benjamini
- The Elements of Immunology : Fahim H. Khan, Pearson Education

Microbial Technology Lab-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

After successful completion of the course, students should be able to:

Perform production and scale up of some industrially relevant bioactive molecules from microbes.

Demonstrate gene transfer and tissue culture techniques.

Identify microbes in specific habitats and their role in environmental processes.

Bioprocess Engineering and Technology

Production of citric acid from *Aspergillus* sp. and its estimation by titration.

Estimation of K_{La} by sodium sulphite method.

Production of alpha amylase from *Bacillus* sp. and its estimation.

Scale up of alpha amylase production from 100 ml to 1 L.

Immobilization of enzyme by sodium alginate method.

Estimation of growth and product yield in a bioconversion process.

Comparison between aerobic and anaerobic process.

Genetic Engineering

Preparation of competent cells (*E. coli* DH5 α strain).

Transformation of *E. coli* with plasmid and calculation of transformation efficiency.

Isolation of plasmid DNA from *E. coli* by alkaline lysis method.

Restriction digestion of plasmid DNA and its electrophoretic separation.

To transfer plasmid PJB3JI from J53 strain of *E. coli* to HB101 strain of *E.coli*.

Microbial Ecology and Diversity

Biochemical tests for identification of bacteria- (IMVic tests, carbohydrate fermentation).

Degradation of pesticide in soil & estimation of its residue.

Study of diversity in rhizosphere soil.

Antagonistic activity of *Trichoderma* against selected fungal strains.

Suggested Books:

Cappuccino, J. G. & Welsh, C. (2016). *Microbiology: A Laboratory Manual*. USA: Benjamin-Cummings Publishing Company.

Collins, C. H., Lyne, P. M., Grange, J. M. & Falkinham, J.O. (2004). *Collins and Lyne's Microbiological Methods* (8th ed.). London, UK: Arnold.

Green, M. R. & Sambrook, J. (2012). *Molecular Cloning: a Laboratory Manual*. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

Kulandaivel, S. & Janarthanan, S. (2012). *Practical Manual of Fermentation Technology*. New Delhi, India: I. K. International Publishing House Pvt. Ltd.

Suggested e- Resources:

Harisha, S. Biotechnology procedures and experiments handbook

<http://site.iugaza.edu.ps/mwhindi/files/BIOTECHNOLOGY-PROCEDURES-AND-EXPERIMENTS-HANDBOOK.pdf>

Introduction to biotechnology

http://www.austincc.edu/awheeler/Files/BIOL%201414%20Fall%202011/BIOL1414_Lab%20Manual_Fall%202011.pdf

Microbial Ecology and Diversity

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

Describe microbial diversity with special reference to microbial ecosystem.

Identify various habitats of extremophiles and their mechanism of survival.

Explain microbial interactions of relevance in environmental remediation.

Section –A

Brief historical overview of microbial ecology and its scope, Microbial community dynamics (r and K selection, succession within microbial communities), species diversity indices, Microbial ecosystem models.

Different types of microbial interactions (Microbe-microbe, Plant-microbe, Animal-microbe).

Biogeochemical cycling of sulphur, iron, ammonia & hydrogen.

Unculturable bacteria & approaches to culture, Conventional & modern methods to study microbial diversity.

Section –B

Extremophiles: Adaptations of Psychrophiles, Acidophiles, Alkaliphiles, Hyperthermophiles, Barophiles & Osmophiles.

Halophiles, membrane variation, electron transport.

Methanogens & Biogas production, Rumen microbiology - action of rumen microorganisms, microbial fermentation in the rumen.

Applications of thermophiles & extremophiles.

Section-C

Stress response systems in microbes: Heat shock response, envelope stress response, cold shock response, starvation strategies.

Methanotrophs and Methylotrophs.

Bioleaching - Microbes and mechanism of Bioremediation of iron and copper ores, metal microbe interaction: biosorption, bioaccumulation, redox transformation and biomineralization.

Catabolic pathway of recalcitrant molecule degradation and mineralization (halocarbons, nitroaromatic, petroleum hydrocarbons, pesticides).

Suggested Books:

Atlas, R.M. & Bartha, R. (1998). *Microbial Ecology: Fundamentals and Applications* (4th ed.). UK: Pearson Education.

Barton, L.L. & Northup, D.E. (2011). *Microbial Ecology*. Hoboken, NJ: Wiley Blackwell.

Mitchell, R. & Gu, J.D. (Ed.). (2010). *Environmental Microbiology* (2nd ed.). Hoboken, NJ: Wiley Blackwell.

Satyanarayan, T. & Johri, B.N. (2005). *Microbial Diversity: Current Perspectives and Potential* (1st ed.). New Delhi, India: I.K International Publishing House.

Suggested e- Resources:

Microbial Ecology: History & Importance

<https://study.com/academy/lesson/microbial-ecology-history-importance.html>

Modern methods to study microbial diversity

<https://www.highveld.com/microbiology/microbial-ecology.html>

Biogeochemical cycle, Catabolic pathway of recalcitrant molecule degradation

<https://bit.ly/2E7X66l>

Microbial Ecology

<https://onlinelibrary.wiley.com/doi/book/10.1002/9781118015841>

Environmental Microbiology

<https://onlinelibrary.wiley.com/doi/book/10.1002/9780470495117>

Fundamentals of Bioentrepreneurship

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

Understand role of entrepreneurship in promoting innovation and wealth generation.

Develop skills for writing business models for new ideas and market segments.

Explain various financial, marketing, sales and legal issues associated with entrepreneurship.

Section-A

Concept of entrepreneurship; Classification and types of entrepreneurship; Myths about entrepreneurship; Role of entrepreneurship in wealth building and creating an impact; Society, Technology and Entrepreneurship.

Creativity and Innovation; Types and forms of Innovation; Sources of innovative opportunity; Entrepreneurship as a career option.

Section-B

Introduction to the Design Thinking Process; Problem identification; Idea Generation; Value Proposition; Lean Canvas.

Identifying Customer Segments; Idea Validation; Developing Business Model; Sizing the opportunity; Building MVP; Concept of Start-up, Importance of Incubation.

Section-C

Financial and Non financial support: Revenue streams; Pricing and Costs; Sources of funds; Importance of project management.

Marketing and Sales: Positioning; Channels and Strategy; Sales Planning.

Team: Importance of teambuilding; Complementary skill sets.

Legal issues: Brief overview of- intellectual property rights, patents, trademarks, copy rights, trade secrets, licensing and GI.

Business Plan writing.

Policies and Initiatives to promote Entrepreneurship in India.

Suggested Books:

Desai, V. (2011) *Dynamics of Entrepreneurial Development & Management* (6th ed.). Mumbai: Himalaya Publishing House.

Drucker, P. (2015). *Innovation and Entrepreneurship* (1st ed.). Routledge Classics.

Gupta, A.K. (2016). *Grassroots Innovations (Minds on the Margin Are Not Marginal Minds)*. Random House.

Gupta, C.B. & Srinivasan N.P. (2013). *Entrepreneurship Development in India*. Sultan Chand & Sons.

Hisrich R. D., Manimala, M. J., Peters Michael P. & Shepherd D. A. *Entrepreneurship* (9th ed.). McGraw Hill Publication.

Jain, P.C. (2001). *Hand Book for New Entrepreneurs*. UK: Oxford University Press.

Khanka, S.S. (2007) *Entrepreneurial Development*. New Delhi: S. Chand & Company Ltd.

Kotler, P & Keller, K.L. (2017). *Marketing Management* (15th ed.). Pearson Publications.

Mohanty, S K. (2005). *Fundamentals of Entrepreneurship*. EEE Prentice Hall India Learning Private Limited.

Patzelt, H., & Bernner, T. (Eds.). (2008). *Handbook of Bioentrepreneurship*. Berlin, Germany: Springer.

Robert, D. H., & Peters, M. P. (2002). *Entrepreneurship*. New York, USA: McGraw-Hill Education.

Roy, R. (2011). *Entrepreneurship* (2nd ed.). UK: Oxford University Press.

Shane, S. (2004). *Academic Entrepreneurship: University Spinoffs and Wealth Creation*. Northampton, M.A.: Edward Elgar.

Suggested e-Resources:

Entrepreneurship

<https://www.startupcommons.org/what-is-startup-ecosystem.html>

<https://getproductmarketfit.com/how-to-select-test-to-get-market-validation-for-new-product-or-business-idea/>

<https://www.coursera.org/learn/wharton-launching-startup>

<https://www.coursera.org/learn/wharton-entrepreneurship-opportunity>

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.463.4354&rep=rep1&type=pdf>

Accounts and Bioentrepreneur

<https://www.nature.com/bioent/2003/031101/full/bioent779.html>

Bioentrepreneurship

www.birac.nic.in/webcontent/jk.pdf

Biotechnology and entrepreneurship

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.463.4354&rep=rep1&type=pdf>

Food Process and Biotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

After successful completion of the course, students should be able to:

Explain strategies of food preservation, spoilage and quality assessment.

Understand various policies related to GM food and its safety assessment.

Demonstrate the principles for production of various processed food.

Section-A

Introduction and development of food biotechnology; Current status of transgenic crops for crop improvement & enhanced agronomic performance.

International and National guidelines for safety assessment of genetically modified (GM) foods.

Contemporary food related policy issue & their implications.

General principles of food spoilage, factors affecting spoilage; Methods of food preservation. Food products with enhanced shelf-life.

Section-B

Mechanism of enzyme function and reactions in food processing; Enzymic bioconversions e.g. starch and sugar conversion process; HFCS; Interesterified fat, hydrolysed protein etc. and their downstream processing.

Baking by amylases; Deoxygenation and desugaring by glucose oxidases; Beer mashing and chill proofing.

Various enzyme catalysed actions in food processing - fermented dairy products (cheese, yogurt, kefir), alcoholic beverages, fermented vegetables, oriental foods, meat products, fish & poultry products. Bacteriocin from lactic acid bacteria.

Section-C

Bioconversion of process wastes to useful products -whey, molasses, starch substrates and other food wastes.

Biotechnology applications in the production of additives/ingredients: enzymes, carotenoids, amino acids, organic acids, vitamins, colouring flavours and nutraceuticals.

Production of new protein foods- Single cell proteins (SCP), mushroom, algal proteins.

Quality control of food- detection system, Enzyme Immunoassay and Radio-immunoassay.

Suggested Books:

Adams, M. R. & Moss, M. O. (2007). *Food Microbiology*. UK: Royal Society of Chemistry.

Banwart, G.J. (1989). *Basic Food Microbiology*. New Delhi, India: CBS Publishers.

Frazier, W.C. & Westhoff, D.C. (2003). *Food Microbiology*. New York, USA: Tata McGraw Hill.

Joshi, V. K. & Pandey, A. (1999). *Biotechnology: Food Fermentation*. New Delhi, India: Asiatech Publishers Inc.

Pandey, A., Larroche, C., Soccol, C. R. & Dussap, C. (2008). *Advances in Fermentation Technology*. New Delhi, India: Asiatech Publishers, Inc.

Robinson, R.K. (1990). *Dairy Microbiology*. London, UK: Elsevier Applied Sciences.

Stanbury, P.F., Hall, S. J. & Whitaker, A. (1999). *Principles of Fermentation Technology*. Oxford, UK: Butterworth-Heinemann, Elsevier.

Suggested e- Resources:

Quality control of food detection system

<https://www.engineersgarage.com/Contribution/Arduino-based-Smart-IoT-Food-Quality-Monitoring-System>

Food Preservation

<https://sciencesamhita.com/methods-of-food-preservation/>

History of microorganisms in food

<https://faculty.weber.edu/coberg/class/3853/3853%20HistoryofFood.htm>

Genetically modified food

<http://anrcatalog.ucdavis.edu/pdf/8180.pdf>

Comparative Public Law

L T P C
4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives: Constitutional Law and administrative Law together make Public Law. Public Law was first defined by Romans as "res publica" which meant Public Good. Public Law regulates the relationship between individual and the State. However with changing dimensions of the State the ambit of Public Law needs to be revisited. This course highlights the various aspects of Public Law which has become significant due to the concept of "Welfare State". It enlightens the students about the various systems of governance which have evolved worldwide. The course further provides a comparative approach which enables the students to make a critical analysis of the various systems.

UNIT-I : Concept of Constitution and Study of Comparative Constitutional Law

1. Meaning and Idea of Constitution, Nature and Goals
2. Living Constitution
3. Constitution as Supreme Law
4. Relevance
5. Problems and Concerns in Using Comparison

UNIT-II: Constitutional foundations of powers

1. Supremacy of Legislature in Law Making
2. Rule of law- Dicey's Concept of Rule of Law, Position of Rule of Law under the Indian Constitution, Modern Concept of Rule of Law, Social and economic rights as part of rule of law
3. Separation of Powers, Checks and Balances - Meaning & Concept, Montesquieu's theory of Separation of Powers; Models of Separation of Powers & Checks & Balances- USA & India.

UNIT-III: Governance and Forms of Governments

1. Meaning & Concept of Governance
2. Forms of Government- Federal and Unitary Forms· Features, Advantages and Disadvantages
3. Models of Federalism- USA, India and Concept of Quasi-federalism, Role of Courts in Preserving Federalism
4. Parliamentary and Presidential Forms of Government- Features, Advantages &
5. Disadvantages, Models of Parliamentary and Presidential forms of Government - UK, India & USA.

UNIT-IV: Constitutional Review

1. Concept and Origin of Judicial Review
2. Methods of Constitutional Review- Judicial and Political Review, Concentrated and Diffused Review, Anticipatory and Successive Review
3. Limitations on Judicial Review

UNIT-V: Amendment of Constitution

1. Various Methods of Amendment
2. Limitations on Amending Power: Comparative Perspective
3. Theory of Basic Structure: Origin and Development

Suggested Readings*

1. A.V. Dicey, Introduction to Law of the Constitution, (Macmillan & Co. Ltd. London & New York).
2. B. Schwartz- American Administrative Law: Case Book, (Aspen Publishers 2006).
3. Bignami, Francesca: Comparative Law (Ch. 7 (PP-145 170 at Cambridge University Press 2012).
4. Christopher Forsyth, Mark Elliott, Swati Jhaveri, Effective Judicial Review: A Cornerstone of Good Governance (Oxford University Press, 2010).
5. D.D. Basu, Comparative Constitutional Law (2nd ed., Wadhwa Nagpur).

6. David Strauss, *The Living Constitution* (Oxford University Press, 2010)
7. Dr. Subhash C Kashyap, *Framing of Indian Constitution* (Universal Law, 2004)
8. Elizabeth Giussani, *Constitutional and Administrative Law* (Sweet and Maxwell, 2008).
9. Erwin Chemerinsky, *Constitutional Law, Principles and Policies* (3rd ed., Aspen, 2006)
10. I.P. Massey, *Administrative Law*, (Eastern Book Co., Lucknow, Latest Edition).
11. Ivor Jennings, *Law & the Constitution*, (University of London Press, 1964).
12. Louis Leventhal Jaffe, *Judicial Control of Administrative Law*, (Little Brown, 1965).
13. K. S. Shukla & S. S. Singh, *Lokayukta-A Socio-Legal Study*, (Indian Institute of Public Administration, New Delhi, 1988).
14. Mahendra P. Singh, *Comparative Constitutional Law* (Eastern Book Company, 1989).
15. M.P. Jain, S. N. Jain, *Principles of Administrative Law*, (2 Vols.: Lexis Nexis, 7th Edition, 2013).
16. M.P. Jain, *Cases & Materials on Administrative Law*, (3 Vols.).
17. M. Shukla, *Judicial Accountability: Welfare & Globalization*, (Regal Publications, New Delhi, 2010).
18. M.V. Pylee, *Constitution of the World* (Universal, 2006).
19. Neal Devins and Louis Fisher, *The Democratic Constitution* (Oxford University Press, 2010)
20. R.K. Gupta & P. K. Saini, *Right to Information Act 2005: Implementation & Challenges*, (Deep & Deep Publications Pvt. Ltd., New Delhi, 2009).
21. S.K. Aggarwal, *Towards Improving Governance*, (Academic Foundation, New Delhi, 2008).
22. S.K. Aggarwal, *Public Interest Litigation in India: A Critique*, (The Indian Law Institute, New Delhi).
23. S.N Ray, *Judicial Review and Fundamental Rights* (Eastern Law House, 1974).
24. Sudhir Krishna Swamy, *Democracy and constitutionalism in India - A Study of the Basic Structure Doctrine* (Oxford University Press, 2009)
25. Sunil Khilnani, Vikram Raghavan, Arun Thiruvengadam, *Comparative Constitutionalism in South Asia* (Oxford University Press, 2013).
26. Tom Bingham, *The Rule of Law*, (Penguin Publication, 2011).
27. Vikram David Amar, Mark Tushnet, *Global Perspectives on Constitutional Law* (Oxford University Press, 2009).
28. Zachary Elkins, Tom Ginsburg, James Melton, *The Endurance of National Constitutions* (Cambridge University Press, 2009).

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

International Intellectual Property Law and Policy

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Objective: Intellectual Property is hardly a static conception but is in constant evolution and reconsideration. The first English laws were public in nature, but by the 19th century, intellectual property had become classified as a type of private law. Again, TRIPS agreement has reinforced the public nature of intellectual property rights leading many developing countries to change their laws and policies on Intellectual Property. Besides, one can always see old rights changing and new rights being created all the time. Thus, this paper aims in understanding the international perspective of IP law, their dispute redressal mechanism and various issues attached with the International IP law.

UNIT I : Introduction

1. World Intellectual Property Organisation (WIPO), 1967 - Object of the WIPO, Function, Membership, Organs of the WIPO
2. Relation between WIPO and WTO
3. Trade Related Aspects of Intellectual Property (TRIPS), 1994 (Agreement of the WTO)
4. TRIPS and Intellectual Property Conventions
5. Relation of TRIPS to other WTO Agreements

UNIT II: Various International Treaties related to IPR (Brief Account)

1. Treaties on Industrial Property

- (i) Paris Convention for the protection of Industrial Property, 1883
- (ii) Madrid Agreement Concerning the International Registration of Marks, 1891 and the Protocol, 1899
- (iii) Hague Agreement Concerning the International Deposit of Industrial Designs, 1934 and 1960
- (iv) Budapest Treaty on International Recognition of the Deposit of Micro-organisms for the purpose of Patent Procedure, 1977
- (v) Convention on Biological Diversity, 1992
- (vi) Nagoya Protocol on access to Genetic Resources and Equitable Sharing of Benefits, 2010

2. Treaties on Copyright

- (i) Berne Convention for Protection of Literary and Artistic Works, 1886/Universal Copyright Convention, 1952
- (ii) Rome Convention for Protection of Phonograms and Broadcasting Organisations, 1961
- (iii) Geneva Convention for protection of Producers of Phonograms, 1971
- (iv) Treaty on International Registration of Audiovisual Works, 1989
- (v) WIPO Copyright Treaty, 1996
- (vi) WIPO Performance and Phonograms Treaty, 1996

3. Treaties on Trademark

- (i) Trademark Law Treaty, 1994
- (ii) Singapore Treaty on the Law of Trademarks, 2006

UNIT III :

1. International IP Disputes & Mechanism post-WTO

- (i) Dispute Settlement Understanding
- (ii) TRIPS, Vienna Convention and DSU
- (iii) Role of WIPO

- (iv) Domestic law standards and WTO mandates
- (v) Reporting to TRIPs Council and compliance issues

2. **ADR and IP disputes**

- (i) Out of court settlement and competition issues
- (ii) Judicial scrutiny post dispute settlement
- (iii) Hostile Patent take-overs
- (iv) International competition regime in IP matters
- (v) Statutory mandate in India

UNIT IV: Indian Response to International Developments

1. Protection of Plant Varieties : Indian Scenario
2. Plant Variety Protection and Patent Act
3. The Unique Aspects of the Indian sui generic Act
4. New Varieties, Extant Varieties and Farmers varieties
5. Criteria for Protection under Indian Act - Novelty, Distinctiveness, Uniformity, Stability
6. Disqualification of Terminator Gene
7. National Gene Fund
8. Compulsory license
9. Offences, Penalty and Appeal.

UNIT V : Contemporary Issues

1. Anti-dumping Agreement
2. Competition and IPR
3. Human Rights and IPR
4. Public Health and IPR - Pharmaceutical, Genetic Engineering, etc.
5. UNESCO and IPR - Protection of Traditional Knowledge, Folklore, Cultural Expression, etc.
6. Sustainable Development and IPR
7. Software and IPR
8. Access to Genetic Resources and Benefit Sharing

Suggested Readings:

1. "Hand Book on WIPO on Intellectual Property Rights", 2nd Edition, WIPO publication, Geneva, 2004.
2. Hugh C. Hansen, International Intellectual Property Law & Policy, Juris Publication.
3. Matthew Kennedy, WTO Dispute Settlement and the TRIPS Agreement, Cambridge University Press, 2016.
4. Melville B. Nimmer - Copyright and other Aspects of literary , musical and Artistic Works, 2nd Edn.
5. Baxi, U. The Law of Intellectual Property : Copyright law in India (1989)
6. P. Narayanan - Copyright and Industrial Design, 2nd Edn. 1995.
7. P. Narayanan - Trademark, Trade name and Passing off Cases 2nd Edn. Vol. I & II, 1997.
8. Thairani, K- Copyright: The Indian Experience (1987).
9. Lal's Copyright Act, 3rd Edn. 1995 Law Publications
10. Report on an Analysis of the Economic/Legal Literature on Intellectual Property (IP) Rights: A Barrier to Entry? Committee on Development & Intellectual Property, World Intellectual Property Organization, Available on http://www.wipo.int/edocs/mdocs/mdocs/en/cdip_8/cdip_8_inf_6_corr.pdf
11. Valentine Korah, "An Introductory Guide to EC Competition Law and Practice", 8th Edition, Oxford & Portland, Oregon, 2004, Chapter 10, 291-313
12. Mahev M.Dabbah, "EC & UK Competition Law, Commentary, Cases & Materials", 1st Edition, 2004, Cambridge University press, Chapter 6, pp. 199-231

13. Mark Furse, "Competition Law of the EC & UK", 4th Edition, Oxford University Press, Oxford, Chapter 14, pp. 259-262.
14. Nuno Piresde Carvalho, "The TRIPs Regime on Patent Rights", 2nd Edition, Kluwer Law International, The Hague, Netherlands, 2005, Preamble, pp.48-51, Part - V, pp. 401-416
15. Palmeter and Mavroidis, "Dispute Settlement in WTO : Practice and Procedure", 2nd Edition, Cambridge University Press, Newyork, 2004
16. Ravindra Pratap, "India at the WTO Dispute Settlement System", 1st Edition, Manak Publications Private Limited, New Delhi, 2004
17. "Hand Book of WIPO on Intellectual Property Rights", 2nd Edition, WIPO Publication, Geneva, 2004, Chapter - V, pp. 241-366
18. "WTO Dispute Settlement Procedures : A Collection of the Relevant Legal Test", 2nd Edition, A WTO Secretariat Publication, Cambridge University Press, Newyork, 2004
19. "Resource Book on TRIPs and Development", UNCTAD-ICTSD, 1st Edition, Cambridge University Press, U.S.A., 2005, Part - V, pp.637-704
20. "Anti-dumping, subsidies, safeguards: contingencies, etc", Understanding the WTO: the Agreements, can be accessed from https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm8_e.htm
21. "Intellectual property: protection and enforcement" Understanding the WTO; can be accessed from https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm
22. Cornish.W.R & Llewelyn.D, Intellectual Property: Patents, Copyright, Trademarks and Allied Rights, Thomson Sweet & Maxwell, London, 2003
23. Chisum Donald S, Chisum on Patents, Matthew Bender Publications, New York, 2003
24. Elizabeth Verkey, Law of Patents, Eastern Book Company, Lucknow, 2005
25. Philip W. Grubb, Patents for Chemicals Pharmaceuticals and Biotechnology, Oxford University Press, New York, 2004.
26. Matsushita, Mavroidis, the World Trade Organisation, Law, Practice, and Policy, Oxford University Press, 2003.
27. Sheela Rai, Anti-Dumping Measures under GATT/WTO, Eastern Book Company, 2005.
28. Edwin Vermulst, The WTO Anti-Dumping Agreement, Oxford University Press, 2005.
29. Michael Blakeney, "Protection of Plant Varieties and Farmers' Rights", European Intellectual Property Review, 2004, 24(1), 9-19
30. Seshia, "Plant Variety Protection & Farmers' Rights in India : Law-Making & the Cultivation of Varietal Control", <http://www.gapresearch.org/governance/EPWarticleShaila.pdf>
31. Anitha Ramanna, "India's Plant Variety & Farmers' Rights Legislation : Potential Impact on Stake Holders Access to Genetic Resources", <http://www.igidr.ac.in/facu/anithar.htm>

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

Law and Justice in a Globalizing World

L	T	P	C
4	0	0	4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective: The main objective of the course is to enable students to understand and seek solutions to pressing problems in the domain of global justice. By the end of the term, students are expected to have become familiar with the multiple dimensions of the theoretical literature and be able to critically evaluate the liberal, republican, and discursive democratic attempts to make sense of, and to ameliorate, prevailing instances of injustice in the world. This will be imparted through theoretical and philosophical debates advanced by various scholars and the institutional mechanism that need to be accelerated to achieve the objectives of global justice.

UNIT-I : Introduction

1. Meaning, Significance & Dimensions of Globalization;
2. Concept of Justice in a Globalized world-Globalization and Universal Values, Concept of Global Justice, Cosmopolitanism
3. Models to Achieve Global justice- Social justice/Distributive justice-John Rawls Theory of Justice; Gandhian model of justice.

UNIT-II : Globalization and Legal Theory

1. Globalization and legal theory, the need for the study of concept of law from a global perspective.
2. Basic concepts of law in western legal thought. A brief analysis of positivist, normative and realist theories of law in western tradition.
3. The concept of justice and its relation to law in Western and Indian Legal thought and concept of Dharma as a legal tradition. The relation between law and justice.
4. Normative Jurisprudence, the western heritage, classical utilitarianism, Benthamite and modified Benthamite utilitarianism.

UNIT-III : Impact of Globalization & Central Challenges to Global Justice

1. Impact on sovereignty of States, on federalism and Democratic Law making
2. Impact on Environment & Natural Resources- Displacement for Development
3. Impact of globalization on Human Rights and Trade Law

UNIT-IV : Globalization and Economic Development in India

1. Economic development and economic justice
2. Impact of WTO and TRIP's on Indian Economy- WTO & Indian Agricultural Challenges
3. Industrial Reforms: - Free enterprise versus State regulation.

UNIT-V : Globalization and Reforms in Justice Delivery System in India

1. Concept of Plea Bargaining
2. Justice to victims of crime shift from adversarial system to accusatorial & inquisitorial system
3. ADR's UNCITRAL Model

Suggested Readings*

1. Amartya Sen, Development of Freedom, (Oxford University Press, 1999).
2. Amartya Sen, The Idea of Justice, (Oxford, 2009).
3. Amit Bhandari, Development with Dignity, (National Book Trust of India, New Delhi, 2005).
4. Andrew Kuper, Democracy Beyond Borders: Justice and Representations in Global Institutions (OUP, 2006).
5. Anthony McGrew, David Held (eds.), Governing Globalization: Power, Authority and Global Governance (Polity Press, 2002).
6. Ashok Nathan, Economic Liberalization and its Implication for Employment, (2002).
7. Boaventura de Sousa Santos, Cesar A. Rodriguez-Garavito (eds.), Law and Globalization from Below (Cambridge University Press, 2005)
8. D. R. Saxena (ed.), Law, Justice and Social Change, (Deep & Deep Publication, New Delhi, 1996).

9. David B. Goldman, *Globalization and the Western Legal Tradition: Recurring Patterns of Law and Authority* (Cambridge University Press, 2008).
10. David Held, *A Globalizing World? Culture, Economics, Politics* (2004).
11. David Kinley, *Civilizing Globalization: Human Rights and the Global Economy* (Cambridge University Press, 2009).
12. David Schzeiderman, *Constitutionalizing Economic Globalization: Investment Rules and Democracy's Promise* (Cambridge University Press, 2008).
13. Eleotrora Kofman & Gillian Youngs (eds.), *Global Station: Theory and Practice*, (2nd edn-Continuum, London, 2003).
14. Jean-Marc Coicaud, Michael W. Doyle et al (eds.), *The Globalization of Human Rights* (United Nations University Press, 2003).
15. John Baylis, Steve Smith, et al (eds.) *The Globalization of World Politics: An Introduction to International Relations* (OUP, 2008).
16. Johan Rauls: *A Theory of Justice*, (Harvard University Press, 1971).
17. Johan Rauls: *Justice as Fairness: A Restatement*, (Harvard University Press, 2001).
18. Karl-Heinz Ladeur (ed.), *Public Governance in the Age of Globalization* (2004).
19. Laura Valentini, *Justice in a Globalizing World: A Normative Framework* (OUP, 2011).
20. Martha Nussbaum, *Frontiers of Justice*, (Cambridge, Mass: Harvard University Press, 2006).
21. M. Abouharb, David Cingranelli, *Human Rights and Structural Adjustment* (Cambridge University Press 2007).
22. N. R. Madhava Menon (ed.), *Social Justice and Social Process in India*, (Indian Academy of Social Sciences, Allahabad, 1988).
23. P. Ishwara Bhat: *Law & Social Transformations*, (Eastern Book Co., Lucknow 1st ed, 2009).
24. Pablo De Greiff and Ciaran Cronin (eds.), *Global Justice and Transnational Politics: Essays on the Moral and Political Challenges of Globalization* (MIT Press, 2002).
25. Percy E. Corbett, *The Growth of World Law* 184 (1971).
26. Rosalyn Higgins, *Development of International Law through the Political Organs of the United Nations* (1963).
27. Simon Coney, *Justice Beyond Borders: A Global Political Theory* (Oxford University Press, 2005).
28. Upendra Baxi, *The Future of Human Rights* (OUP, 2002).
29. Warner Menski, *Comparative Law in Global Context: The Legal Systems of Asia and Africa* (Cambridge University Press, 2006).
30. Wenhua Shan, Penelope Simons et al., *Redefining Sovereignty in International Economic Law* (Hart Publishing, 2008).
31. William Twining, *General Jurisprudence: Understanding Law from a Global Perspective* (Cambridge University Press, 2009).
32. World Commission on Social Dimension of Globalization, *A Fair Globalization: Creating Opportunities for All* (2004).

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

Law of Patents

L T P C
4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective: This paper is aimed to give students a detailed account of the mandates in relation to patentability and patent eligibility which will equip them as better practitioners and researchers. The paper aims to give adequate emphasis to the procedural aspects of patent law in relation to acquisition and transfer of rights.

UNIT-I : Introduction to Patents

1. Overview
2. Historical development
3. Concepts: Novelty, Utility, Inventiveness/Non-obviousness

UNIT-II: Patentable subject-matter

1. Patent Act 1970 - amendments of 1999, 2000, 2002 and 2005
2. Pharmaceutical products and process and patent protection
3. Software Patents
4. Business Method
5. Protection of Plant Varieties and Farmers' Rights Act, 2001
6. Patenting of Micro-organism

UNIT-III: Procedure for Obtaining of Patents

1. Contents of a Patent Application. 3.2 Specification:
2. Provisional 3.2.2 Complete
3. Disclosure aspects 3.4 Claims
4. Principal 3.4.2 Dependant 3.4.3 Omnibus
5. Examination of application.
6. Opposition of Application
7. Sealing of Patents

UNIT-IV: Working of Patents - Compulsory License

1. Commercialization of Inventions
2. Licence- Terms of License Agreement 4.1.2 Assignment of patents
3. Revocation of Patents.

UNIT-V: Infringement

1. Meaning of Infringement, Method of determination of Infringement, Infringer- Direct, Contributory, and Induced
2. Defences to Infringement - Research exemption , invalidity , misuse failure to mark, , laches and estoppel, and first sale doctrine.

Suggested Readings :

1. W.R. Cornish, Intellectual Property, Sweet & Maxwell, London (2000)
2. Terrell On Patent, 2000
3. P. Narayana, Patent Law, Wadhwa Publication.
4. Merges, Patent Law and Policy: Cases and Materials, 1996
5. Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993
6. Brinkhof (Edited), Patent Cases, Wolters Kluwer
7. Prof. Willem Hoyng & Frank Eijsvogels, Global Patent Litigation, Strategy and Practice, Wolters Kluwer

8. Gregory Stobbs, Software Patents Worldwide, Wolters Kluwer
9. Feroz Ali Khader, The Law of Patents - with a special Focus on Pharmaceuticals in India, LexisNexis Butterworths Wadhwa, Nagpur.
10. Sookman, Computer Law, 1996
11. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

Research Methods and Legal Writing

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective: The main objective of this course is to acquaint the student of law with the scientific method of social science research. This course is expected to provide the knowledge of the technique of Selection, collection and interpretation of primary and secondary data in socio-legal research. Emphasis would be laid on practical training in conducting research in this course.

UNIT-I Meaning, objectives and kinds of Research

1. Meaning and objectives of research
2. Legal Research - Meaning, scope and purpose. Relation between law and society
3. Research methods vis a vis Research Methodology
4. Types/kinds: Doctrinal and Non-Doctrinal (empirical)

UNIT-II : Research Design

1. Research Design
2. Various Steps in Research: Research Process
3. Research Problem: Identification and Formulation
4. Hypothesis -Formulation of Hypothesis - Its Importance and Kinds
5. Use of Library
6. Database for Legal Research: Legislations, Judicial Decisions, Juristic Writings and Traditional and Online Database.

UNIT-III Research Techniques

1. Use of Modern Technology/ Computer Assisted Research
2. Tools and Techniques for Collection of Data· Primary and Secondary Sources
3. Literature Review· Observation Method· Questionnaire· Interview· Case study Sampling· Jurimetrics

UNIT-IV : Data Processing Report Writing

1. Data Analysis and Interpretation -Use of Deductive and Inductive Methods in Research
2. Report Writing
3. Supervision
4. Guidelines for researchers
5. Research Ethics

UNIT-V: Legal Writing

1. Essentials of Good Legal Writing
2. Structured Legal Writing: Organization of Legal Materials
3. Framing of Write Up: Research Question, Title, Identifying relevant areas of law,
4. Identifying Literature and Case Laws, Analysis, Discussion, Recommendations and Conclusion
5. Kinds: Informative, Persuasive; Writing for Individual Purposes; Writing for Academic Purpose; Writing for Court Purposes: Briefs, Complaints etc.; Writing for Publication: reviews, articles, books etc.; Judicial writing
6. Citation, Reference and Footnoting
7. Editing and Proof reading
8. Writing of Research Proposal
9. Dissertation/ Thesis Writing

Suggested Readings*

1. Blue Book - A Uniform System of Citation, Nineteenth Edition.
2. Bruce L. Berg, Qualitative Research Methods For The Social Sciences (London, Allyn and Bacon, 2001).
3. C.R. Kothari, Research Methodology: Methods and Techniques (New Delhi: Wiley Eastern Ltd., 1985).
4. Dawn Watkins & Mandy Burton (Eds.), Research Methods in law.
5. Dennis P. Force and Stephen Richer (ed.), Stages of Social Research
6. Contemporary Perspectives (New Jersey : Prentice Hall Inc., Englewood Cliffs, 1970).
7. Devendra Thakur, Research Methodology in Social Sciences, Deep & Deep Publications, 2009.
8. Frederic Charles Hicks, Materials and Methods in Legal Research (Lawyers Cooperative Publishing, New York).
9. Goode and Hall, Methods in Social Research (Singapore : MacGraw Hill Book Co., 1985).
10. Harvard Law Review Association, The Bluebook: Uniform system of Citation (Harvard Law Review, Harvard).
11. Janathan Anderson, Thesis and Assignment Writing (Wiley Eastern Ltd., New Delhi).
12. Johan Galtung, Theory And Methods of Social Research (London: George Allen & Unwin Ltd., 1970).
13. John W. Creswell, Research design, 3rd Edition Sage South Asia Edition.
14. Leon Festinger (ed.), Research Methods in Behavioral Sciences (Holt, Rinehart and Winston, New York, 1953).
15. Pauline V. Young, Scientific Social Surveys and Research (New Delhi : Prentice Hall of India Pvt. Ltd., 1984).
16. Richard K Neumann, Jra Sheila Simon, Legal Writing, Wolters Kluwer.
17. Robert Watt, Concise Legal Research, Universal Law Publishing Co., 5th Edition, 2009.
18. Ranjit Kumar, Research Methodology, Sage Publications, 3rd Edition, (2011).
19. Vijay K. Gupta, Decision Making In The Supreme Court of India (A Jurimetric Study)- Alternatives in Judicial Research (Delhi : Kaveri Books, 1995).

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings

Corporate Law

L T P C
4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective: The Corporation today is not only the most effective vehicle for carrying out industrial and commercial activities, but, it is also the major social and economic institution of stupendous size and power affecting the lives of the members of the entire society. The course is designed to develop an understanding on the regulation of constitution, compliance and working of Corporations in India and to provide a thorough knowledge of the various provisions of the Company Law and other related laws applicable to Corporations.

UNIT I : Company Nature and Incorporation

1. Structure of Corporate Management in India with Comparative Study of England and USA.
2. Kinds of Company and their incorporation, Corporate Personality, Corporate veil & its lifting.
3. Constitutional documents of a Company: MOA & AOA, Clauses in Memorandum of Association, Approval of Name, Alteration in MOA and AOA, Effect of Incorporation, The Doctrine of Ultra Vires, Constructive Notice & Indoor Management.
4. Importance of Promoters: Position, Duties & Liabilities.

UNIT II : Corporate Capital Unit

Prospectus: Meaning, Consequences of Misstatements in Prospectus.

1. Capital, Kinds of Capital; Shares, Modes of Capital Raising.
2. Procedure for issue of Shares & Share Certificates; Procedure for increase and reduction of Share Capital;
3. Debt Capital; Meaning and Kinds of Debt; Charge: Creation of Charges, Secured and Unsecured borrowings, Floating charge and Fixed charge; Debentures: Issue of Debentures, Kinds of Debentures, Rights of Debenture Holders.
4. Loan from directors and Loan to directors; Restriction on borrowing powers of the company; Corporate Guarantees; Inter-Corporate Loans and Guarantees;

UNIT III: Management and Control of Companies:

1. Directors: Kinds, Appointment & Removal; Legal position of directors; powers of directors and restrictions thereof; Contract with directors; duties and liabilities of directors;
2. Meetings; Kinds of Meetings of Directors, Majority rule and minority Rights; Protection of Minority Shareholders;
3. Oppression and Mismanagement and remedies in case of Oppression & Mismanagement, Class Action Suit.
4. National Company Law Tribunal (NCLT) and National Company Law Appellate Tribunal (NCLAT).

UNIT IV: Corporate Governance, Social Responsibility and Corporate Crimes:

1. Importance of Corporate Governance
2. Legislative framework for Corporate Governance under the Companies Act, 2013, Case Study: Enron and Satyam.
3. Corporate Crimes and Criminal Liability of the officers of the Company, Insider Trading, Price Sensitive Information.
4. Legal Reforms of Corporate Governance in India.
5. Corporate Social and Environmental Responsibility.

UNIT V : Law Relating to Multinational Corporations:

1. Meaning and Definition of Multinational Corporation, Problems of definitions and criteria of Determination.
2. Regulation of MNC's.

Suggested Readings:

1. Dube Inderjit, Corporate Governance, Lexis Nexis Butterworths Wadhwa,
2. Kotler Philip, Nancy Lee, Corporate Social Responsibility, John Wiley & Sons Inc. 2005.
3. Raman BS, Company Law & Secretarial practice, United Publishers
4. Bagrial Ashok K, Company Law, Vikash Publishing
5. Palmer, Palmers Company Law, Sweet & Maxwell
6. Paul L. Davies, Grower and Davies Principles of Modern Company Law, Sweet & Maxwell.
7. Richard Smerdon, A Practical Guide in Corporate Governance, Sweet & Maxwell.
8. Singh Avtar, Indian Company Law, Eastern Book Company, Lucknow.
9. Mazumdar A.K, Kapoor G.K & Dalmia Sanjay, Company Law & Practise, Taxmann.

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

Emerging Forms of Intellectual Property Rights

L T P C
4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objective: This paper aims in understanding the emerging forms of Intellectual Property Rights, their nature and various issues attached with the emerging forms of intellectual property rights like human rights, concept of traditional knowledge, moral issues and issues concerns of developing countries.

UNIT-I : Intellectual Property Rights and Human Rights

1. Right to Health as Basic Human Rights and IPR
2. Right to Food as Basic Human Rights and IPR
3. Protection of the rights of indigenous people
4. Protection of human rights of impoverished masses

UNIT-II: Protection of Traditional Knowledge and IPR

1. Concept of Traditional Knowledge
2. Issues Concerning Traditional Knowledge
3. Bio-Propecting & Bio-Piracy
4. Need for A Sui Generis Regime
5. Traditional Knowledge Digital Library.

UNIT-III: Biodiversity and IPR

1. Biodiversity and Sustainable Development
2. Genetic Resources and Biotechnology
3. Benefit Sharing
4. Bonn Guidelines.

UNIT-IV: IPR and Transfer of Technology

1. Transfer of Technology and Economic Development
2. Issues and Concerns of Developing Countries.

UNIT-V: Biotechnology and Bioethical Implication of IPR

1. Moral Issues in Patenting Biotechnological Inventions
2. Human Genomes

Suggested Readings:

1. Silke von Lewinski (Edited), Indigenous Heritage and Intellectual Property, Genetic Resources, Traditional Knowledge and Folklore, 2nd Edition, (2008), Wolters Kluwer.
2. Paul L.C. Torremans (edited), Intellectual Property and Human Rights, Enhanced edition of Copyright and Human Rights, (2008), Wolters Kluwer.
3. Jayashree Watal, Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, 2001
4. Duggal Pavan, Legal Framework on Electronic Commerce & Intellectual Property Rights, Universal Publishing House, 2014
5. Steven D Anderman, Interface Between Intellectual Property Rights and Competition Policy, Cambridge University Press, 2007.
6. Philippe Cullet, Intellectual Property Protection and Sustainable Development, Lexis Nexis, 2005.

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

Law of Copyright

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Objective: Copyright is the guardian of most precious skill: Imagination. The syllabus discusses some of the specific issues which have brought copyright reform to the forefront in recent times; the approach undertaken is industry specific, that is, an attempt is made to discover as to how the present legal framework can be better utilized to benefit the interests of the right holders.

Unit I: Introduction

1. Concept of property; Is Intellectual Rights a property?
2. Introduction to Copyright: The economic importance of Copyright, Nature and Its Scope
3. Justification of copyright as an intellectual property.
4. Historical development of copyright law.
5. International Treaties: Berne Convention, Universal Copyright Convention, 1952 , Rome convention, TRIPs, Geneva Convention, 1971, WIPO Copyright Treaty, 1996 , International Copyright Order, 1999 and Beijing Treaty on Audiovisual Performances, 2012.

Unit II : Subject matter of Copyright and the Rights of the Owners of Copyright:

1. Concept of Originality and Idea Expression, dichotomy fixation and other doctrinal requirement.
2. Works Protected: Literary, Musical, Artistic, Dramatic works; Computer Programs and Database; Cinematography films, Sound recordings, UNESCO - protection of folklore/cultural expressions
3. Rights of the owner's of the Copyright: a. Economic Rights, The Right of Reproduction, Right to communicate the work to the public, Right to distribute the Work, Right of adaptation translation etc., Rights of Broadcasting organizations and of Performers, Moral Rights.
4. Authorship: Ownership & Licensing and Assignment of Copyrighted work: (a) who owns the work? (b) Duration of Copyright (c) Assignment of Copyright (d) Licensing of Copyright: Voluntary license (e) Statutory license (f) Compulsory license

Unit III: Infringement of Copyright And provision of Fair Dealings and Remedies for Infringement:

1. Enforcement of Copyright at National and International Level
2. Elements of infringement of Copyright
3. Secondary liability of infringement; Exceptions; Fair dealing
4. Remedies for infringement: Civil remedies, Criminal Remedies, Administrative remedies

Unit IV: Registration of Copyright & Authorities:

1. Procedure of Registration
2. Effect of Registration and its protection outside India.
3. Termination of Copyright & its effects; Authorities; Copyright office
4. Copyright Board, Copyright Societies.

Unit V: Contemporary Issues in Copyright law:

1. Copyright: A human right and Free Speech implications
2. First Sale Doctrine, Exhaustion of Copyright and Doctrine of Fair Dealing
3. Copyright and Contract: Technological protection / Digital Rights Management (DRM)
4. Concept of Orphan works
5. Developments in WIPO on traditional knowledge and traditional cultural expressions.

Suggested Readings:

1. Kevin Garnett, Jonathan Rayner James, Gillian, Copinger and Skone James on Copyright, Sweet & Maxwell, London, 2013.
2. P. Narayanan, Copyright and Industrial Designs, Third Edition, Eastern Law House, New Delhi, 2007.
3. David Nimmer, Nimmer on Copyright, Lexis Nexis, 2010.

4. W R Cornish, Intellectual Property: Patents Copyright Trademarks and allied rights, Sweet & Maxwell, London, 2010.
5. S. Sivakumar & Lisa P. Lukose, Broadcasting Reproduction Right in India: Copyright and Neighboring Right Issues, ILI, New Delhi, 2013.
6. A.K. Kaul & V.K.Ahuja, Law of Copyright: From Gutenberg's Invention to Internet, University of Delhi, Delhi, 2001.
7. Ananth Padmanabhan, Intellectual Property Rights Infringement and Remedies, Lexis Nexis, 2012.
8. Mira Sundara Rajan, Moral Rights: Principles, Practice, and New Technology, Oxford University Press, 2011.
9. Paul Goldstein , International Copyright: Principles, Law, and Practice, Oxford University Press, 2012.
10. Neil Weinstock Netanel, Copyright's Paradox, Oxford University Press, 2008. Robert A Gorman, Jane C. Ginsburg, Copyright Cases and Materials, Foundation Press, 2011

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

Law of Trademarks and Geographical Indications

L T P C
4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives: This paper aims in understanding the important aspects of law of trademark and geographical indications, their nature and various issues attached with these laws. Both trademark and geographical indications are unique devices which can be viewed as an unique tool in recognising exclusive intellectual property rights.

UNIT-I An Introduction to Trademarks

1. Historical development of the concept of trademark and trademark Law-National and International -- Introduction to Trademarks
2. Need for Protection of Trademarks
3. Kinds of Trademarks
4. International Legal Instruments on Trademarks
5. Well known Trademark.

UNIT-II Registration of Trademarks

1. Grounds of refusal of registration
2. Absolute grounds
3. Relative grounds.
4. Procedure for registration of Trademarks:
5. Application.-intent to use ,Opposition
6. Registration
Rights of Registered trademark owners.
3.1 Assignment and licensing of Trademarks

UNIT-III Infringement of Trademarks

1. Passing Off
2. Defences.
3. Remedies for Infringement and Passing Off
4. 1 Civil remedies.
5. Criminal remedies.

UNIT-V Geographical Indications-I

1. Introduction
2. Evolution
3. Justification
4. International Treaties:
(i) Paris Convention
(ii) Madrid Agreement
(iii) Lisbon Agreement
(iv) TRIPS Agreement

UNIT-V Geographical Indications-II

1. Protection of GI at National Level
2. Geographical Indication of Goods (Protection & Registration) Act, 1999
3. Higher Level of Protection of GIs and TRIPS, Article 23 Controversy
4. Procedure for Registration, Duration of Protection and Renewal Infringement, Penalties and Remedies

5. Genericides of Geographical Indications

Suggested Readings:

1. W.R. Cornish, Intellectual Property, Sweet & Maxwell, London (2000)
2. Kerly's Law of Trade Marks and Trade Names, 14th Edition, Thomson, Sweet & Maxweel.
3. A. K. BanSal, Law of Trade Marks in India (2009 Edition) Institution of Constitutional and Parliamentary Studies and Centre for Law, Intellectual Property and Trade, New Delhi.
4. Christoher Wadlow, The Law of Passing Off, 1995
5. Marsha A. Echols, Geographical Indications for Food Products, International Legal and Regulatory Perspectives (2008), Wolters Kluwer.
6. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow.

* Suggested Readings are not exhaustive. Need to be supplemented with additional readings.

Digital CMOS IC Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

- Gain in-depth understanding of designing and analysis of CMOS inverters
- Explain the fabrication process and layout design of CMOS digital IC
- To describe the operation of semiconductor memories and low power circuits.

Section-A

CMOS Logic, MOS Inverter, CMOS Inverters, Transmission Gate, MOS Inverter's Switching Characteristics & Interconnect Effects: Delay Time, Interconnect Parasitic, Capacitances (Gate & routing capacitance), Resistance, RC Delay, Wire Delays, Inductances, Gate Delays, Stage Ratio, Power Dissipation, CMOS Logic Gate Design, Transmission Gate, BiCMOS circuits.

Section-B

Combinational Circuits Design: NAND Gate, NOR Gate, Transient Analysis of NAND& NOR gates, Sequential MOS Logic Circuits: Behaviour of Bitable element, pass transistor logic CMOS Latches & Clocked Flip-flop, Clock Skew, Clocking Strategies.

CMOS technology.n-well, pwell process., CMOS process enhancement. Interconnect and circuit elements. Layout design rules. Latch up.

Section-C

CMOS Dynamic Logic Circuit: Transfer; Charge storage and Leakage, Voltage Bootstrapping, High performance dynamic CMOS circuits: Domino CMOS logic, NORA CMOS logic, zipper CMOS circuits, TSPC dynamic CMOS. Semiconductor Memories: ROM, DRAM, SRAM, PLA, Cell, Leakage Circuit and Input/Output Circuit Low power circuits: overview of power consumption, low power design through Voltage estimation and optimization of switching activity, reduction of switched capacitor, adiabatic logic circuits.

Recommended Books:

1. Weste, Neil. H. E., & Eshraghian, K. (1993). *Principles of CMOS VLSI Design*. Boston: New York: Addison Wesley Publication.
2. Weste, Neil. H. E., & Eshraghian, K. (1998). *Principles of CMOS VLSI Design*. Boston: New York: Addison Wesley Publication.
3. Backer, Jacob., Harry, W. Li., & Boyce, David. E. (1999). *CMOS Circuit Design, Layout and Simulation*. New Delhi: PHI Publication.
4. Kang, Sung-Mo., & Leblebici, Yusuf. (2002). *CMOS Digital Integrated Circuits- Analysis and design*. New Delhi: Tata McGraw-Hill Publication.
5. Pucknell, Douglas. A., & Eshragian, K.(2000). *Basic VLSI Design*. New Delhi: PHI Publication.

Suggested E-resources:

Computation Structures - Part 1: Digital Circuits by Chris Terman <https://www.edx.org/course/computation-structures-part-1-digital-mitx-6-004-1x-0>

CMOS Digital VLSI Design by Prof. S. Dasgupta https://onlinecourses.nptel.ac.in/noc19_ee25/preview

HDL Based System Design

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

4 0 0 4

Learning Outcomes: After successful completion of this course, students will be able to:

Analysis and Design of Synchronous and Asynchronous sequential machines.

Draw a FSM chart for digital designs and describe it using HDL.

Detect and diagnosis different errors in digital circuit descriptions.

Design the digital systems through VHDL and Verilog HDL.

Section-A

Introduction to hardware design: Digital system design process, hardware description languages, hardware simulation, hardware synthesis, level of abstraction

HDL Background: HDL History, Existing Languages, HDL Requirements, the HDL Language.

Design Methodology Based On HDL: Elements of HDL, Top down Design, Top down Design with HDL, Conventions and Syntax.

Basic concepts of hardware description languages. Hierarchy, Concurrency, Logic and Delay modeling. Structural, Data-flow and Behavioural styles of hardware description. Architecture of event driven simulators.

Section-B

Structural Specification of Hardware: Parts Library, Wiring of Primitives and Iterative Networks, Modeling a Test Bench.

Design Organization and Parameterization: Definition and Usage of Subprograms, Packaging Parts and Utilities, Design Parameterization, Design Configuration, Design Libraries.

Utilities for High-Level Descriptions:

Type Declarations and Usage, VHDL Operators, Subprogram Parameter Types and Overloading, Other Types and Type Related Issues, Predefined Attributes, User Defined Attributes.

Dataflow Descriptions in VHDL: Multiplexing and Data Selection, State Machine Description, Three State Bussing.

Behavioral Description of Hardware: Process Statement, Assertion Statement, Sequential Wait Statements, MSI based design

Section-C

Syntax and Semantics of Verilog. Variable types, arrays and tables. Operators, expressions and signal assignments. Modules, nets and registers, Concurrent and sequential constructs. Tasks and functions, Examples of design using Verilog. Synthesis of logic from hardware description

Introduction: FPGA Design flow, Programmable Technology: Antifuse, Metal-Metal antifuse, static RAM, EPROM & EEPROM Technology, Specification

Recommended Books:

1. Navabi, Z. (1997) *VHDL: Analysis and Modelling of Digital Systems*. New Delhi: McGraw Hill Publication.
2. Bhaskar, J. (2015). *A VHDL Primer*. New Delhi: Pearson Publication.
3. Lipsett, R., Schaefer, C., & Ussery, C. (1993) *VHDL Hardware Description and Design*. Menlo Park, California: Kluwer Academic Publishers.
4. Pick, J. (1996) *VHDL: Techniques, Experiments and Caveats*. New Delhi: McGraw Hill Publication.
5. Ott, Douglas E., & Wilderotter, J. (1994). *A Designer's Guide to VHDL Synthesis*. Berlin: Springer.
6. Palnitkar, S. (2003). *Verilog HDL: A Guide to Digital Design and Synthesis*. New Delhi: PHI Publication.
7. Smith, M.J.S. (1997). *Application- Specific Integrated Circuits*. Boston, New York: Addison Wesley Publication.

Suggested E-resource:

Hardware Modeling using Verilog by Prof. Indranil Sengupta, Department of Computer Science and Engineering, Indian Institute of Technology, Kharagpur <https://nptel.ac.in/courses/106105165/1>

IC Fabrication Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

- Understand thin film deposition and vacuum evaporation process.
- Differentiate dry and wet oxidation process and printing methods.
- Perform measurement techniques for extracting electrical properties of devices.
- Understand diffusion and ion implantation process.

Section-A

Crystal Growth & Wafer Preparation, Processing Considerations: Chemical wafer Cleaning, Gettering and Thermal Stress Factors.

Epitaxy: Vapour Phase Epitaxy - basic transport processes and Reaction Kinetics, doping and auto-doping, equipments and safety considerations, buried layers, epitaxial defects, Molecular Beam Epitaxy - equipment used, film characteristics, SOI structures.

Section-B

Oxidation: Growth Mechanism and Kinetics, Silicon Oxidation Model, Interface Considerations, Orientation dependence of Oxidation Rates, Thin and thick Oxides. Oxidation techniques and systems dry & wet Oxidation, Plasma Oxidation, masking properties of SiO₂

Lithography: Optical Lithography - Optical resists, contact and proximity printing, projection printing, electron lithography - resists, mask generation. Electron Optics - Roaster scan and Vector scan, variable beam shape, X-ray lithography - resists and Printing, X-ray sources and masks, ion-lithography.

Section-C

Etching: Reactive plasma etching, AC and DC plasma excitation, plasma properties, chemistry and surface interactions, feature size control and anisotropic etching, ion enhanced and induced etching, properties of etch processes. Reactive - Ion - Beam - Etching. Specific etch processes: PolySi/Polycide. Trench etching, SiO₂ & Si₃N₄, Diffusion, ion implantation, annealing and sintering, Metalization and patterning. Fabrication steps of NMOS, PMOS, CMOS (n & p well), BJT.

Recommended Books:

- Sze, Simon. (2017). *VLSI Technology*. New Delhi: McGraw Hill Publication
- Gandhi, S. K. (1994). *The Theory and Practice of Microelectronics*. New Delhi: John Wiley Publication.
- Nagchoudhuri, D. (2002). *Microelectronics technology*. New Delhi: Pearson Publication.
- Chang, C. Y., & Sze, Simon. (1996). *ULSI Technology*. Singapore, Tata McGraw Hill Publication.

Suggested E-resources:

- Introduction to IC fabrication** by Prof. Hardik J Pandya S, Department of Electronic Systems Engineering, IISC, Bangalore. <https://nptel.ac.in/courses/108108111/3>.
- MOSFET Fabrication for IC** by Dr. Nandita Dasgupta Department of Electrical Engineering, Indian Institute of Technology, Madras. <https://nptel.ac.in/courses/117106093/3>.

Analog and Mixed Signal IC Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

- Design basic cells like current sources, current mirrors and reference circuit.
- Explain stability issues and design compensated IC operational amplifiers.
- Design and analyse comparators and sample-and-hold circuits.
- Illustrate the operation of commonly used data conversion circuits.

Section A

Review of Small Signal MOS Transistor Models, Analog MOS Process, Voltage and Current Sources/sink, Voltage and Current References, Current Mirrors (simple, widler, wilson and cascode), Differential Amplifier, small signal and large signal analysis, non-linear properties, Introduction to analog BiCMOS circuits.

Section B

Operational Amplifier: Theory and Design; Definition of Performance Characteristics; Design of compensated and non-compensated 2-stage CMOS Operational Amplifier, Frequency response, comparators, Analog Buffers, Source Follower.

Section C

Analog Filters (Continuous- time and Switched-Capacitor); Digital Filters, Digital-to-Analog (D/A) and Analog-to-Digital (A/D) Converters. Sample-and-Hold Circuits, Sigma-Delta Converters

Recommended Books:

- Allen, Phillip.E., & Holberg, Douglas. R. (2002). *CMOS Analog Circuit Design*. New York: Oxford University Press.
- Johns, D. A., & Martin, Key (1997). *Analog Integrated Circuit Design*. New York: John Wiley and Sons.
- Baker, R.J. (2008). *CMOS Mixed Signal Circuit Design*. New York: Wiley/IEEE Press
- Gregorian, R., & Temes, G. C. (1986). *Analog MOS Integrated Circuits for Signal Processing*. New York: John Wiley Publication.
- Gray, Paul. B., & Meyer, Robert.G. (2001). *Analysis and Design of Analog Integrated Circuits*. New York: John Wiley Publication.
- Geiger, R. L., Allen, P. E., & Strader, N. R. (1990). *VLSI Design Techniques for Analog & Digital Circuits*. New Delhi: McGraw Hill Publication.

Suggested E-resource:

Analog Integrated Circuit Design by Prof. Nagendra Krishnapura, Department of Electrical Engineering, Indian Institute of Technology, Madras. <https://nptel.ac.in/courses/117106030/>

ASIC Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

- Analyze the concept of Full Custom ASIC and Semi-Custom ASIC, Cell Libraries, Data Logic Cells, Low-level Design Entry and Low Level Design Languages
- Explain ASIC I/O Cell: DC Output, AC Output, DC Input, AC Input, Clock Input, Power Input and PLA Tools.
- Describe Programmable ASIC Logic Cell, FPGA Logic Cells, and Programmable Interconnects to Solve the RC delay of routing resources for each ASIC.

Section-A

Introduction: Full Custom with ASIC, Semi-custom ASICS, Standard Cell based ASIC, Gate array based ASIC, Channeled gate array, Channel less gate array, structured get array, Programmable logic device, FPGA design flow, ASIC cell libraries

Data logic cells: Data Path Elements, Adders, Multiplier, Arithmetic Operator, I/O cell, Cell Compilers

ASIC library Design: Logical effort: practicing delay, logical area and logical efficiency logical paths, multi stage cells, optimum delay, optimum no. of stages, library cell design.

Low-level design entry: Schematic Entry:

Hierarchical Design. The cell library, Names, Schematic, Icons & Symbols, Nets, schematic entry for ASIC'S, connections, vectored instances and buses, Edit in place attributes, Netlist, screener, Back annotation

Section-B

Programmable ASIC logic cell, ASIC I/O cell (DC output, AC output, DC input AC Input, Clock input. Power input, Xilinx I/O block, other I/O block).

A brief introduction to low-level design language, EDIF, PLA Tools, an introduction to CFI designs representation.

Section-C

FPGA Basic Logic Cells: Actel Act: Shannon's expansion theorem, ACT1, ACT2, ACT3 logic Modules.

Xilinx LCA: XC3000 CLB, XC4000 series, XC 5200 series.

Altera FLEX: FLEX 8000 series logic expenders, timing model, and comparison chart of logic cells.

FPGA interconnect: Actel ACT: Routing recourses, Elmore's constant, RC delay in Antifuse connection, ACT2 ACT 3 interconnect Xilinx LCA, Xilinx EPLD, Altera MAX 5000 and 7000, Altera max 9000, Altera FLEX.

Recommended Books:

Smith M. J. S. (2006). *Application Specific Integrated Circuits* USA:Pearson Publication

Ismail, Mohammed. &Terri, Fiez. (1994). *Analog VLSI signal and Information processing*. New York: McGraw-Hill Publication.

Wolf,Wayne. (2005). *FPGA based System Design*. New Delhi: PHI Publication.

Brown, Andrew. (1991). *VLSI Circuits and Systems in Silicon*. New York: McGraw-Hill Publication.

Haskard, Malcom. R., & May, Lan C. (1998). *Analog VLSI Design - NMOS and CMOS*. New Delhi: PHI Publication.

Geiger, Randall. L., Allen, Phillip E., & Strader, Noel.K. (1990). *VLSI Design Techniques for Analog and Digital Circuits*. New Delhi: PHI Publication.

France, Jose.E.,& Tsividis,Yannis. (1994). *Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing*. New Delhi: PHI Publication.

Brown, S.D., Francis, R.J., Rox, J., &Uranesic, Z.G. (1992). *Field Programmable Gate Arrays*. Menlo Park, California: Kluwer Academic Publishers.

Suggested E-resource:

Digital VLSI Systems Design by Prof. S. Srinivasan, Department of Electrical Engineering, Indian Institute of Technology, Madras. <https://nptel.ac.in/courses/117106092/>

CAD for IC Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

Understand Basic concept of describing VLSI design problems

Understand graph theory and its utilization in finding solution for VLSI design problems.

Understand algorithms to solve various VLSI design problem like floorplaning, scheduling, placement, routing etc.

Section A

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methods for combinatorial optimization.

Graph Optimization Problems and Algorithms:-The shortest and longest path problems, Clique Covering and Clique Partitioning

Boolean Algebra and Applications:-Boolean functions and their representations (Tabular Forms, Expression Forms and Binary decision Diagrams-OBDD, ROBDD)

Abstract Models: - Structures, Logic Networks, State Diagram, Data flow and Sequencing Graph.

Section B

Architectural-Level Synthesis and Optimization:-Introduction, Circuit Specification for Architectural Synthesis, the Fundamental Architectural Synthesis Problems, Area and Performance Estimations, Strategies for Architectural Optimization

Scheduling Algorithms:-A model for the Scheduling Problems, Scheduling without Resource Constraints, Scheduling with Resource Constraints (ILP, LIST, FDS)

Two-Level Synthesis and Optimization: - introduction, Logic optimization Principles

Section C

VLSI PHYSICAL DESIGN:-Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms – partitioning

Floorplanning concepts - shape functions and floorplan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

Recommended Books:

1. Gerez, S.H. (2002). *Algorithms for VLSI Design Automation*. New York: John Wiley Publication.
2. Sherwani, N.A. (2002). *Algorithms for VLSI Physical Design Automation*. Boston, New York: Kluwer Academic Publishers.
3. Drechsler, R. (1998). *Evolutionary Algorithms for VLSI CAD*. Boston, New York: Kluwer Academic Publishers.
4. Hill, D., Shugard, D., Fishburn, J., & Keutzer, K. (1989). *Algorithms and Techniques for VLSI Layout Synthesis*. Boston, New York: Kluwer Academic Publishers.
5. Micheli, Giovanni.De.(2003). *Synthesis and Optimization of Digital Circuits*. New Delhi: TMH Publication.

Suggested E-resource:

CAD for VLSI Design I by Prof. Prof. V. Kamakoti and Prof Shankar Balachandran, Department of Computer Science and Engineering, Indian Institute of Technology, Madras <https://nptel.ac.in/courses/106106088/>

RF IC Design

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

- Understand basics concepts of radio frequency integrated systems and their performance parameters.
- Identify design trade-off used in various transmitters and receivers architecture with wireless standards.
- Perform VLSI implementation of oscillators, Mixers and Power amplifiers.

Section-A

Introduction to RF and Wireless Technology: Complexity, design and applications. Choice of Technology. Basic concepts in RF Design: Nonlinearly and Time Variance, intersymbol Interference, random processes and Noise. Definitions of sensitivity and dynamic range, conversion Gains and Distortion.

Analog and Digital Modulation for RF circuits: Comparison of various techniques for power efficiency. Coherent and Non coherent deflection. Mobile RF Communication systems and basics of Multiple Access techniques. Receiver and Transmitter Architectures and Testing heterodyne, Homodyne, Image-reject, Direct-IF and sub-sampled receivers. Direct Conversion and two steps transmitters.

Section-B

BJT and MOSFET behavior at RF frequencies Modeling of the transistors and SPICE models. Noise performance and limitation of devices. Integrated Parasitic elements at high frequencies and their monolithic implementation.

Basic blocks in RF systems and their VLSI implementation : Low Noise Amplifiers design in various technologies, Design of Mixers at GHz frequency range. Various Mixers, their working and implementations, Oscillators: Basic topologies VCO and definition of phase noise. Noise-Power trade-off. Resonatorless VCO design. Quadrature and single-sideband generators,

Section-C

Radio Frequency Synthesizers: PLLS, Various RF synthesizer architectures and frequency dividers, Power Amplifiers design. Linearisation techniques, Design issues in integrated RF filters.

Some discussion on available CAD tools for RF VLSI designs.

Recommended Books:

1. Razavi, B. (2011). *RF Microelectronics*. New Delhi: PHI Publication.
2. Lee, T.H. (1998). *The Design of CMOS Radio-Frequency Integrated Circuits*. New York: Cambridge University Press.
3. Baker, R. Jacob., Li, H.W., & Boyce, D.E. (1998). *CMOS Circuit Design, Layout and Simulation*. New Delhi: PHI Publication.
4. Tsividis, Y.P. (1996). *Mixed Analog and Digital VLSI Devices and Technology*. New York: McGraw Hill Publication.

Suggested E-resources:

RF System - Basic Architectures by Prof. Dr. S. Chatterjee, Department of Electrical Engineering Indian Institute of Technology, Delhi. <https://nptel.ac.in/courses/117102012/>.

RF integrated Circuits by S. Aniruddhan, Department of Electrical Engineering, IIT Madras. http://www.ee.iitm.ac.in/~ani/2011/ee6240/pdf/ee6240_lec32.pdf.

Embedded System Design

Max. Marks : 100
(CA: 40+ ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

- Explain the challenges in the design of embedded system
- Describe the Hardware and Software Tools for Embedded System
- Describe the Features of OS and language for Embedded System

Section A

Introduction to Embedded Systems; Design Challenges: Optimizing Design Metrics; Processor Technology - General Purpose, Single Purpose and Application-Specific Processors; Architectural Issues: RISC, CISC and VLIW Architectures; Custom Single Purpose Processor Design - Combinational, Sequential and RT-Level Components; Design of Controller and Datapath using Sequential Program / FSM; RT-Level Single-Purpose Processor Design; Optimizing Custom Single-Purpose Processors; Application Specific Instruction Set Processors (ASIPs) - Microcontrollers, DSPs; Standard Single -Purpose Processors: Timers, Counters, Watchdog Timers; UART, PWM, LCD Controller, Keypad Controller, Stepper Motor Controller, A/D Converters, Real Time Clocks.

Section B

Types of Memories for Embedded Systems; Component Interfacing: Interrupts, DMA, I/O Bus Structures, Communication Protocols; Introduction to IC Technologies: VLSI, ASIC and PLD IC Technologies; Basic Hardware and Software Tools for Embedded System Design: Linker, Loader, Assembler, Compiler, Simulator, Emulator, In System Programmer, Logic Analyzer etc.

Section C

Digital Camera Example for various Embedded System Implementations; Features of OS for Embedded Systems, Real Time Issues, Windows CE and QNX; Features of Languages for Embedded Systems Specification; Use of UML, Features and difference between VHDL, Verilog and SystemC; Introduction to Generic Co-design Methodology; Testing for Embedded Systems.

Recommended Books:

- Wolf, M. (2012). *Computers as components: principles of embedded computing system design*. Elsevier.
- Vahid, F., & Givargis, T.D.(2002) *Embedded System Design:A unified Hardware/ software Introduction*. New Jersey: Wiley Publication.
- Gannsl, J. (2008) *The Art of Designing Embedded System*. New Delhi: Newnes Publication.
- Staunstrup, J.,& Wolf,W. (1997) *Hardware /software Codesign: Principles and Practice*. Boston, Massachusetts: Springer Publications.
- Gajski, D.D., Vahid, F., Narayan, S., & Gong, j. (2007). *Specification design of Embedded System*. New Delhi: Pearson Education India.

Suggested E-resources:

1. **Embedded Systems - Shape The World: Microcontroller Input/Output** by The University of Texas at Austin (UTAustinX), <https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-inputoutput>
2. **Embedded Systems** by Georgia Tech as CS, 8803 <https://in.udacity.com/course/embedded-systems--ud169>
3. **Embedded System Design** with ARM by Dr. Kamalika Datta Indian Institute of Technology, Kharagpur, https://onlinecourses.nptel.ac.in/noc19_cs22/preview

Real Time Systems

Max. Marks : 100
(CA: 40+ ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

To present the mathematical model of the system.

Analyse multi task scheduling algorithms.

To explain Reliability Evaluation techniques and Real time communication algorithms.

Section-A

Introduction to Real-time computing: Characterizing Real-time system & tasks; Performance measures of real time systems, estimation of program run time, Real-time system design: Hardware requirement, system-development cycle, data transfer techniques, synchronous & asynchronous data communication, standard interfaces.

Section-B

Task Assignment and Scheduling: Priority scheduling, scheduling with fixed priority dynamic priority scheduling, Real-time programming languages & Tool: desired language characteristics, data typing, control structure, run time error handling, overloading & generics, run time support, Real-time databases.

Section-C

Real time communication algorithms, Fault tolerance techniques: Causes of failure, fault types, fault detection, redundancy, integrated failure handling Reliability Evaluation techniques: Parameter values, reliability model for hardware redundancy, software error model, Clock synchronization.

Recommended Books:

Krishna, C.M., & Shen, K.G. (2008). *Real Time Systems*. New Delhi: McGraw Hill Publication.

Lawrence, P.D., & Mauch, K.(1998). *Real Time Microcomputer Design: An Introduction*. New York: McGraw Hill Publication.

Mathai, Joseph.(1996). *Real Time systems: Specification, Verification & Analysis*. London, PHI Publication.

Stuart, Bennet.(1994). *Real Time Computer Control*. ,New Jersey: PHI Publication.

Low Power VLSI Design

Max. Marks : 100
(CA: 40+ ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

Learn the design techniques low voltage and low power CMOS circuits for various applications.

Design and implementation of various design structures of flip flop for low power applications.

Design the different types of memory circuits and various CMOS static and dynamic logic circuits.

Understand the mechanisms of power estimation and datapath width adjustment.

Section A

CMOS Device Technology Trends for Power-Constrained Applications, low Power CMOS VLSI Design, Power Estimation - Physics of Power Dissipation in CMOS FET devices, design of low power CMOS Circuits Design and test of low voltage CMOS Circuits.

Section B

Flip-Flop and clock Networks Design Methods for low power, Introduction to low Power Memory Design, Low Power Static ram architectures, low - power Memory design SRAM/DRAM Design

Section C

Power estimation, synthesis for low power, power optimization by Data Path Width adjustment.

Recommended Books:

Roy, Kaushik. & Prasad, Sharat. C. (2009). *Low Power CMOS VLSI Circuit Design*. Dublin: Willey Publications.

Pal, Ajit. (2015). *Low Power VLSI Circuits and Systems*. New Delhi: Springer Publications.

Pedramand, M., & Rabaey, J.M. (2002) *Power Aware Design Methodologies*. Boston, Massachusetts: Kluwer Academic Publishers.

Kang, Sung – Mo., & Leblebici, Yusuf. (2002). *CMOS Digital Integrated circuits- Analysis and Design*. New Delhi: TMH Publications.

Suggested E-Resources:

Low Power VLSI Circuits and Systems by Prof. Ajit Pal, Department of Computer Science and Engineering, IIT Kharagpur. <https://nptel.ac.in/syllabus/106105034/>

Introduction to MEMS

Max. Marks : 100
(CA: 40+ ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

Families with the important concepts applicable to MEMS, their fabrication.

Fluent with the design, analysis and testing of MEMS.

Describe micro fabrication, micro actuators and surface micromachining and applications.

Section A

Historical Background: Silicon Pressure sensors, Micromachining, MicroElectroMechanical Systems Microfabrication and Micromachining: Integrated Circuit Processes, Bulk Micromachining: Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)

Section B

Physical Microsensors : Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples : Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors Microactuators : Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors-Microactuator systems : Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector

Section C

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Polysilicon surface micromachining, Other compatible materials, Silicon Dioxide, Silicon Nitride, Piezoelectric materials, Surface Micromachined Systems : Success Stories, Micromotors, Gear trains, Mechanisms Application Areas: All-mechanical miniature devices, 3-D electromagnetic actuators and sensors, RF/Electronics devices, Optical/Photonic devices, Medical devices e.g. DNA-chip, micro-arrays.

Recommended Books:

Senturia, Stephen. D. (2001) *Microsystem Design*. Norwell, Massachusetts:Kluwer Academic Publishers.

Madou, Marc.(1997). *Fundamentals of Microfabrication*. California: CRC Press.

Kovacs, Gregory. (1998) *Micromachined Transducers Sourcebook*. Boston, Massachusetts: WCB McGraw-Hill Publication.

Bao, M.-H. (2000). *Micromechanical Transducers: Pressure Sensors, Accelerometers, and Gyroscopes*. New York: Elsevier Publication

Suggested E-resources:

MEMS and Microsystems Prof. Santiram Kal Department of Electronics and Electrical Communication Engineering Indian Institute of Technology, Kharagpur. <https://nptel.ac.in/courses/117105082/4>

Microsensors by Prof. G.K. Ananthasuresh, Department of Mechanical Engineering Indian Institute of Science Bangalore. <https://nptel.ac.in/courses/112108092/module1/lec03.pdf>

High Level Synthesis

Max. Marks : 100

(ESA: 100)

L	T	P	C
0	0	0	2

This course expose students to the advanced HDL design techniques, methodology and industrial standard EDA tools in electronic design. This course also discusses the new ideas and techniques in high level synthesis, essential issues in synthesis, architectural model, and guidelines for HDL design. Students will be expected to explore design methodology for high level synthesis, chip synthesis and physical design methodology.

Suggested e-resource:

High level Synthesis by IIT Guwahati. [https://nptel.ac.in/courses/ 117103125/4](https://nptel.ac.in/courses/117103125/4).

Synthesis of Digital Systems by Dr. Preethi Ranjan Panda, Department of Computer Science & Engineering, Indian Institute of Technology, Delhi. <https://nptel.ac.in/courses/106102181/7>

Organic Electronic Devices

Max. Marks : 100
(ESA: 100)

L	T	P	C
0	0	0	2

Organic electronic devices are quickly making their way into the commercial world, with innovative thin mobile devices, high-resolution displays, and photovoltaic cells. Purpose of the course is to learn about this highly promising technology, which is based on small molecules and polymers, and to discuss how these materials can be implemented successfully in established organic electronic modules. In this course students will gain the ability to tie molecular transport phenomena with macroscopic device response such that you will be well-prepared to analyse troubleshoot, and design the next generation of organic electronic materials and devices.

Suggested e-resources:

Organic Electronic Devices by Dr. Bryan W. Boudouris, Purdue University.
<https://www.edx.org/course/organic-electronic-devices-purdue-nano515x>

Discrete Time Signal Processing

Max. Marks : 100
(CA: 40+ ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After successful completion of this course, students will be able to:

Apply discrete-time signal processing techniques analysis to perform various signal operations.

Apply the principles of Fourier transform analysis to describe the frequency, and characteristics of discrete-time signals and systems.

Understand the design techniques of various digital and analog filters.

Section A

General concepts of Digital processing: Typical Signal processing operation, example of typical signals, signal processing application basic elements of DSP, overview of DSP systems, Advantages and disadvantages of DSP. Time domain Characteristic of Directed time System: Elementary sequences like unit sample, unit modulation, addition, multiplication, delay and advance, Classification, of discrete time system in terms of linearity, time invariance, causality, stability and passivity; input output relationship and impulse response, response of LTI to any input, Convolution sum and its properties, Cascade and Parallel interconnection of LTI system, stability and response type of LTI system, constant coefficient difference equation for LTI system and its solution using homogenous and particular solution.

Section B

Transform domain analysis of LTI systems: Frequency response, frequency domain characterization of LTI system, transfer (Systems) function, derivation of transfer function (Using difference equation) interrelation, between frequency response and transfer function of higher order filters (cascaded section) Comb filter, zero phase and linear phase FIR transfer functions, all pass transfer function and its properties, minimum phase transfer function, stability test using stability triangle, stability test procedure.

Discrete Fourier Transform : Review of discrete Fourier transfer, DFT as a linear transformation, circular shift and circular convolution of sequences, use of DFT in linear filtering of long data sequences, overlap-save and overlap method, add method, Goertzel and chirp z transform algorithms, radix 2 and radix 4 decimation in time and decimation in frequency FFT algorithm.

Section C

Structures for discrete time system: Basic building block of a discrete time system, pick off node, adder, multiplier, unit delay, structures for FIT systems, direct form, cascaded form frequency sampling and lattice transposed structures, cascade form, parallel form and lattice -ladder structure.

Design of filters: Digital filter specification and selection, FIT filter

Design using window (fixed and adjustable), frequency Sampling approach and Chebyshev approximation method: Design of IIR filter from analog filters using impulse invariance

and Bi-linear transformation technique; Frequency transformation (to low-pass, high-pass, band-pass) in analog and digital domain.

Introduction to Multi-rate Digital Signal Processing: Needs of multi-rate DSP, Sampling rate conversion by a factor I/D Filter and implementation for sampling rate conversion of low-pass signals.

Recommended Books:

Proakis, J.G. & Manolakis, D.G. (2014). *Digital Signal Processing: Principles, Algorithms and Applications*. New Jersey: Pearson Publication.

Nagarath, I.J., Sharan, S.N., Ranjan, R., & Kumar, S. (2009). *Signals and Systems*, New Delhi: TMH Publication.

Oppenheim, A.V., Schaffer, R.W., & Buck, J.R. (1998). *Discrete-Time Signal Processing*. New Jersey: PHI Publication.

Suggested E-resources:

Discrete Time Signal Processing by Prof. Mrityunjoy Chakraborty, Department of Electronics and Electrical Communication Engineering Indian Institute of Technology, Kharagpur.
<https://nptel.ac.in/courses/117105134/>.

Digital Signal Processing by Prof: S. C. Dutta Roy, Department of Electrical Engineering Indian Institute of Technology, Delhi. <https://nptel.ac.in/courses/117102060/>.

DSP and ASIP Architecture

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Review of Basic DSP Operations and their Implementations (Adders, Multipliers, Dividers); Discrete Fourier Transform Implementation; Fixed-Point versus Floating-Point Operations; Pipelining and Parallelism; Re-timing, Unfolding, and Folding.

Section B

Systolic/Array Architectures; Programmable DSP Architectures; Memory Structures and Addressing.

Section C

ASIP Related Terms: Power/Energy/Performance Issues: ASIP Design Space; ASIP design Flow; Hardware-Software Boundary and trade-Offs; Case studies.

Text Books:

1. P.Lapsley, J.Bier, A.Shoham and E.A Lee, DSP Processor Fundamentals: Architectures and Features,Wiley/IEEE,2001.
2. P.Pirsch, Architectures for Digital signal Processing, Wiley, 1998.
3. T.Gloker and H.Meyr, Design of Energy-Efficient Application Specific Instruction Set Processors, Kluwer, 2004.

Reference Books:

1. K.K. Parhi, VLSI Digital Signal Processing Systems: Design and Implementation Wiley,1999.
2. V.K. Madisetti, VLSI Digital Signal Processors, Butterworth-Heinemann/IEEE Press, 1995.
3. M. Mehendale and S.D. Sherlekar, VLSI Synthesis of DSP Kernals, Kluwer, 2001.
4. Bateman and I. Paterson-Stephens, The DSP Hand book, PH/ Pearson,2002.
5. S. M Kuo, Digital Signal Processors: Architectures, Implementations and Applications,PH/Pearson,2004.
6. L. Wanhannar, DSP Integrated circuits,AP,1999.
7. M. A. Richards, A .J. Gadiant and G.A Frank, Rapid prototyping of Application Specific Signal Processors, Kluwer, 1997.
8. A.Venkataramani and M. Bhasker, Digital Signal processors: Architecture, Programming and Applications, TMH,2002.
9. E.E. Swartzlander, DSP with FPGAs, Springer-Verilog, 2001.

DSP Integrated Circuits

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section-A

Digital Signal Processing: Digital signal processing, Sampling of analog signals, Selection of sample frequency, Signal-processing systems, Frequency response, Transfer functions, Signal flow graphs, Filter structures, Adaptive DSP algorithms, DFT-The Discrete Fourier Transform, FFT-The Fast Fourier Transform Algorithm, Image coding, Discrete cosine transforms.

Dsp Integrated Circuits And Vlsi Circuit Technologies

Standard digital signal processors, Application specific IC's for DSP, DSP systems, DSP system design, Integrated circuit design. MOS transistors, MOS logic, VLSI process technologies, Trends in CMOS technologies.

Section-B

Digital Filters And Finite Word Length Effects: FIR filters, FIR filter structures, FIR chips, IIR filters, Specifications of IIR filters, Mapping of analog transfer functions, Mapping of analog filter structures, Multirate systems, Interpolation with an integer factor L, Sampling rate change with a ratio L/M, Multirate filters. Finite word length effects -Parasitic oscillations, Scaling of signal levels, Round-off noise, Measuring round-off noise, Coefficient sensitivity, Sensitivity and noise.

Dsp Architectures And Synthesis Of Dsp Architectures: DSP system architectures, Standard DSP architecture, Ideal DSP architectures, Multiprocessors and multicomputers, Systolic and Wave front arrays, Shared memory architectures. Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit - serial PEs.

Section-C

Arithmetic Units And Integrated Circuit Design: Conventional number system, Redundant Number system, Residue Number System .Bit-parallel and Bit-Serial arithmetic, Basic shift accumulator, Reducing the memory size, Complex multipliers, Improved shift-accumulator. Layout of VLSI circuits, FFT processor, DCT processor and Interpolator as case studies

Reference Books:

1. Lars Wanhammar, "DSP Integrated Circuits", Academic press, New York 1999.
2. A.V.Oppenheim et.al, 'Discrete-time Signal Processing' Pearson education, 2000.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, " Digital signal processing - A practical approach", Second edition, Pearson education, Asia 2001.
4. Keshab K.Parhi, 'VLSI digital Signal Processing Systems design and Implementation' John Wiley & Sons, 1999.

Fault Tolerance in VLSI

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Motivation of fault tolerance in arithmetic systems. Fault and error models in VLSI arithmetic units. Reliability and fault tolerance definitions. Reliability and availability modeling, Estimation of the reliability and availability of fault tolerant systems

Fault diagnosis. Fault tolerance measurement. Fault tolerance strategies: detection, correction, localization, reconfiguration. Error recovery, Error detecting and correcting codes

Section B

Detection/correction techniques: modular redundancy, time redundancy (e.g., RESO, RERO, REDWC, RETWV, REXO), datacoding (e.g., AN codes, residue codes, gAN codes, RBR codes, Berger codes, residue number systems), algorithm-based techniques. Reconfiguration techniques.

Applications to arithmetic units and systems (e.g., convolvers, inner product units, FFT units, neural networks). Application levels: unit, processing element, subsystem, system. Cost/benefit analysis. Fault-tolerant transaction processing systems. Fault-tolerant Networks. Redundant disks (RAID).

Section C

Software reliability models, Software fault-tolerance methods: N-version programming, recovery blocks, rollback and recovery

Architecture and design of fault tolerant computer systems using protective redundancy

Reference Books:

1. Victor P. Nelson and Bill D. Carroll, Tutorial: Fault-Tolerant Computing, IEEE Computer Society Press, 1987, ISBN: 0-8186-06770
2. D.K. Pradhan (ed.), Fault Tolerant Computer System Design, Prentice-Hall, 1996.
3. D.P. Siewiorek and R.S. Swarz, A.K. Peters, Reliable Computer Systems: Design and Evaluation, 1998.
4. B.W. Johnson, Design and Analysis of Fault-Tolerant Digital Systems, Addison-Wesley, 1989

High Level System Design and Modeling

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Introduction to Design Representation of Digital Systems, levels of abstraction, design methodologies, System level methodologies, System specification and design.

Model Taxonomy: State-Oriented models - finite-state machine, Petri net, Hierarchical concurrent finite state machine; Activity-oriented models - Dataflow graph, flow charts; Heterogeneous model - control/data flow graph, Object oriented model, Program-state machine;

Architectural Taxonomy: Application specific architectures - Controller Architecture, Data path architecture, Finite-state machine with data path; Processors - Complex instruction set Computer, Reduced instruction set Computer; Vector machine - Very long instruction word Computer; Parallel processors.

Section B

A Specification example of Telephone answering machine : Specification capture with spec-charts, Sample test bench, Advantage of executable specifications; Strengths of the PSM model - Hierarchy, State transitions, Programming Constructors, Concurrency, Exception handling, Completion.

System Partitioning: Structural versus functional Partitioning. Partitioning issues - Specification Extraction level, Granularity, System Component allocation, Metrics and Estimations, Objective functions and closeness functions, Partitioning Algorithm, Output. Basic Partitioning algorithms - Random mapping, Hierarchical clustering, Multistage Clustering, Group Migration, Radio cut and Simulated Annealing.

Section C

System –Level Design: System design challenges, Abstraction levels, Modeling – Model of computation, system design languages, and system modeling –processor and communication modeling. System models.

Books:-

1. Embedded System Design- Modeling, Synthesis, Verification by Dainel D.Gajaski, Samer Abdi Springer.
2. Specification and Design of Embedded Systems by Daniel D. Gajski, PTR Prentice Hall Englewood New Jersey

High Power Semiconductor Devices

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Basic device models: Theory of bipolar and MOS transistors. Small-signal models of bipolar and MOS transistors, Gummel-Poon model.

High current effects in diodes: Dependence of lifetime on high-level injection, non-uniform current distribution under high current injection.

Section B

Power bipolar transistors: Onset of high-current effects in transistors; Theories of Kirk effect, crowding, pinch-in effects, second breakdown, etc; Emitter geometries for high current and HF operation. SCR : Theories of operation; Relation between shorted emitter and dv/dt ratings; Gate turn-off devices, inverter grade SCRs, special diffusion techniques for SCRs.

Section C

Power VMOS devices, Heat transfer in power devices; Power MOS devices : VMOS & DMOS device structure and models; device packaging.

Texts/References Book:

- S.M. Sze, Physics of Semiconductor Devices, 2nd ed., Wiley, 1981

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High Speed VLSI Design

**LTPC
4004**

**Max. Marks : 100
(CA: 40 + ESA: 60)**

Section A

Clocked Logic Styles, Single-Rail Domino Logic Styles, Dual-Rail Domino Structures, Latched Domino Structures, Clocked Pass Gate Logic

Non-Clocked Logic Styles, Static CMOS, DCVS Logic, Non-Clocked Pass Gate Families.

Section B

Circuit Design Margining, Design Induced Variations, Process Induced Variations, Application Induced Variations, Noise.

Latching Strategies, Basic Latch Design, and Latching single-ended logic, Latching Differential Logic.

Section C

Race Free Latches for Pre-charged Logic Asynchronous Latch Techniques.

Signalling Standards, Chip-to-Chip Communication Networks, ESD Protection

Clocking Styles, Clock Jitter, Clock Skew, Clock Generation, Clock Distribution, Asynchronous Clocking Techniques.

Reference Books:

1. Kerry Bernstein & et. al., High Speed CMOS Design Styles, Kluwer, 1999.
2. Evan Sutherland, Bob stroll, David Harris, Logical Efforts, Designing Fast CMOS Circuits, Kluwer, 1999.
3. David Harris, Skew Tolerant Domino Design.

Image Processing Algorithms and Architecture

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Introduction; Digital Image Fundamentals; Image Acquisition; Spatial and Frequency Domain Issues; Transformations; Colors versus Grey-scale Images.

Section B

Basic Image Processing Algorithms; Convolution; Filtering; Edge and Boundary Detection.

Section C

Image Restoration; Image Enhancement. Image Compression. Architectures for Image Processing.

Text Book:

- R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, PH/Pearson, 2002.

Reference Books:

1. M. Seul, L. O' Gorman and M.J. Sammon, Practical Algorithms for Image Analysis, CUP, 2002.
2. J.R. Jensen, Introductory Digital Image Processing, PH/Pearson, 2004.
3. J.C. Russ, The Image Processing Handbook, Forth Edition, CRC Press, 2002.
4. W.K. Pratt, Digital Image Processing Third Edition, Wiley, 2001.
5. Bovik, Handbook of Image and Video Processing, AP, 2000.
6. J.R. Parker, Algorithms of Image Processing and Computer Vision, Wiley, 1996.
7. K.R. Castleman, Digital Image Processing, Second Edition, PH, 1996.
8. IEEE Transactions on Image Processing.

Integrated Electronic System Design

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Electronics Systems; Sensors and Actuators; Microcomputers and Microcontrollers. Packaging of Digital Systems: ICs, PCBs, Chassis and cabinets, Back_ planes and Mother boards, Wires and cables, Connectors.

Section B

Noise in Digital Systems; Clocking and Timing Issues.

Section C

System Design using 8051 Microcontroller (or 68HC12 Microcontroller), Bus based System Design ,Real time System Design Issues.

Text Books:

1. W.J.Dally and J.W.Poulton, Digital System Engineering, CUP, 1998.
2. N.Storey, Electronics: A System Approach, AW/Pearson, 1998/2000.
3. S.D.Burd, System Architectures, Thomson, 2001.

Reference Books:

1. G.Lipovski, Introduction to Micro-Controllers (MC 68HC12), AP, 1999.
2. G.Lipovski, Single and Multi-Chip Micro-Controller Interfacing (MC 68HC12), AP, 1999.
3. F.M.Cady, Microcontrollers and Microcomputers: Principles of Software and Hardware Engineering, OUP, 1997.
4. M.Predko, Handbook of Microcontrollers, MH, 1998.

Nanoelectronics

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

Section B

Resonant Tunneling Transistors, Single electron ,transistors, new storage, optoelectronic, and spintronics devices.

Atoms-up approaches: Molecular electronics involving single molecules as electronic devices, transport in molecular structures, molecular systems as alternatives to conventional electronics.

Section C

Molecular interconnects; Carbon, nanotube electronics, bandstructure & transport, devices, applications.

Reference Books:

1. Introduction to Nanotechnology, C.P. Poole Jr., F.J. Owens, Wiley (2003).
2. Nanoelectronics and Information Technology (Advanced Electronic Materials and Novel Devices), Waser Ranier, Wiley-VCH (2003)
3. Nanosystems, K.E. Drexler, Wiley (1992)
4. The Physics of Low-Dimensional Semiconductors, John H. Davies, Cambridge University Press, 1998
5. Research Papers

Neural Networks and Applications

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section-A

Basic learning algorithms:

Biological Neuron - Artificial Neural Model - Types of activation functions - Architecture: Feed forward and Feedback - Learning Process: Error Correction Learning -Memory Based Learning - Hebbian Learning - Competitive Learning - Boltzman Learning - Supervised and Unsupervised Learning - Learning Tasks: Pattern Space - Weight Space - Pattern Association - Pattern Recognition - Function Approximation - Control - Filtering - Beam forming - Memory - Adaptation - Statistical Learning Theory - Single Layer Perceptron - Perceptron Learning Algorithm - Perceptron Convergence Theorem - Least Mean Square Learning Algorithm - Multilayer Perceptron - Back Propagation Algorithm - XOR problem - Limitations of Back Propagation Algorithm.

Radial-basis function networks and support vector machines:

radial basis function networks:

Cover's Theorem on the Separability of Patterns - Exact Interpolator - Regularization Theory - Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks - Applications: XOR Problem - Image Classification.

Section B

Support Vector Machines:

Optimal Hyperplane for Linearly Separable Patterns and Nonseparable Patterns - Support Vector Machine for Pattern Recognition - XOR Problem - ϵ -insensitive Loss Function - Support Vector Machines for Nonlinear Regression - Committee Machines:

Ensemble Averaging - Boosting - Associative Gaussian Mixture Model - Hierarchical Mixture of Experts Model(HME) - Model Selection using a Standard Decision Tree - A Priori and Postpriori Probabilities - Maximum Likelihood Estimation - Learning Strategies for the HME Model - EM Algorithm - Applications of EM Algorithm to HME Model

NEURODYNAMICS SYSTEMS:

Dynamical Systems - Attractors and Stability - Non-linear Dynamical Systems- Lyapunov Stability - Neurodynamical Systems - The Cohen-Grossberg Theorem.

Section C

Attractor Neural Networks:

Associative Learning - Attractor Neural Network Associative Memory - Linear Associative Memory - Hopfield Network - Content Addressable Memory - Strange Attractors and Chaos - Error Performance of Hopfield Networks - Applications of Hopfield Networks - Simulated Annealing - Boltzmann Machine - Bidirectional Associative Memory - BAM Stability Analysis - Error Correction in BAMs - Memory Annihilation of Structured Maps in BAMS - Continuous BAMs - Adaptive BAMs - Applications.

Adaptive Resonance Theory:

Noise-Saturation Dilemma - Solving Noise-Saturation Dilemma - Recurrent On-center -Off-surround Networks - Building Blocks of Adaptive Resonance - Substrate of Resonance Structural Details of Resonance Model - Adaptive Resonance Theory - Applications.

Self Organizing Maps:

Self-organizing Map - Maximal Eigenvector Filtering - Sanger's Rule - Generalized Learning Law - Competitive Learning - Vector Quantization - Mexican Hat Networks - Self-organizing Feature Maps - Applications

Pulsed Neuron Models:

Spiking Neuron Model - Integrate-and-Fire Neurons - Conductance Based Models - Computing with Spiking Neurons.

Text and Reference Books:

1. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2004.
2. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2ed., Addison Wesley Longman (Singapore) Private Limited, Delhi, 2001.
3. Martin T.Hagan, Howard B. Demuth, and Mark Beale, "Neural Network Design", Thomson Learning, New Delhi, 2003.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms,
5. Applications, and Programming Techniques, Pearson Education (Singapore)

Representation and Analysis of Random Signals

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Random variable, distribution functions and probability densities-Expected value and moments of random variables-coefficient of variation, skewness and kurtosis-of random variables conditional mean and variance-moment generating function. Discrete random variables and their distribution - Binomial, Negative Binomial, Hyper geometric and multinomial distributions-Poisson distribution Relationship between distributions of various discrete type random variables.

Section B

Continuous random variable and their distribution- Normal,

Lognormal , multivariate normal distribution , γ , exponential,

Chi-square, Weibull , Rayleigh distribution Relationship between distribution of various continuous type random variables. Stochastic processes-classification Stationary processes-Independent increment processes- Markov processes -counting processes- Narrow -band process- Stochastic processes for analysis of physical phenomena- Normal (Gaussian), Wiener- Levy , Poisson Bernoulli and shot noise processes -Auto correlation function.

Section C

Transformation of single random variable- Transformation of

several random variable function of random variables- Sum, Difference, product and ratio of random variable- Transformation through characteristic function.

Text Book:

- Michel .K Ochi , Applied Probability and Stochastic Processes in Engineering and Physical Sciences, Wiley, 1992.

Reference Books:

1. A. Papoulis , Probability , Random Variables and Stochastic Processes, MH, 1985.
2. K.S. Trivedi , Probability and Statistics with Reliability, Queuing and Computer Science Application, PH, 1982.

Speech Signal Processing

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Introduction to digital speech processing, digital transmission and storage of speech, speech synthesis system, speaker verification and identification, speech recognition system. Digital models for speech signal process of speeds production, Acoustic theory of speech production, Digital models for speech signals.

Section B

Time domain models for speech processing, Digital representation of speech waveform. Short-time Fourier analysis, Homo-morphic speech processing.

Section C

Linear predictive coding ,basic principles of linear predictive analysis, computation for gain, solution of LPC equations, comparison between methods of solution of the LPC analysis equation ,Prediction error signals, Frequency domain linear predictive analysis ,speech parameters and their relationships, Application LPC parameters.

Text Books:

1. L.R.Rabiner and R.W.Schafer, Digital Processing of Speech Signals, PH, 1978.
2. C.Plett, J.W.M.Rogers and M.A.Copeland, Radio Frequency Integrated Circuit Design,Artech,2003
3. R.E.Best, Phase-Locked Loops: Design, Simulation and Application , Fifth Edition,MH,2003
4. D.H.Wolaver, Phase-locked Loop Circuit Design, PH, 1991.

Reference Books:

1. J.R. Deller ,J.H.L .Hansen and J.G. Proakis, Discrete-time Processing of Speech signals,Wiley/IEEE,2000.
2. T.F. Quatieri, Discrete-Time Speech Processing: Principles and Practices, PH, 2001.

VLSI Architecture

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Complex Instruction Set Computers (CISC) ,Instruction Set, Characteristics and Functions, Addressing Modes, Instruction Formats, Architectural Overview, Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining.

Section B

Pentium Processor, PowerPC Processor. Reduced Instruction Set Computers (RISC) Instruction execution Characteristics, Register Organization, Reduced Instruction Set, Addressing Modes, Instruction Formats, Architectural Overview, RISC Pipelining, Motorola 88510, MIPS R4650, RISC Vs. CISC. DSP Processors, Instruction Set, Addressing Modes, Instruction Formats, Architectural Overview.

Section C

Pipeline Processing: Basic Concepts, Classification of Pipeline Processors, Instruction and Arithmetic Pipelining: Design of Pipelined Instruction Units, Pipelining Hazards and Scheduling, Principles of Designing Pipelined Processors. Superscaler Processors, Overview, Design Issues, PowerPC, Pentium.

Reference Books:

1. William Stallings, Computer Organization and Architecture - Designing for Performance, 4th Edition, PHI.
2. J. L. Hennessy and D. A. Patterson, Computer Architecture - A quantitative Approach, Kaufmann Publishers.
3. K. K. Parhi, VLSI Digital Signal Processing Systems : Design and Implementation, John Wiley.
4. J. P. Hayes, Computer Architecture and Organization, McGraw Hill.
5. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill

VLSI Circuits for Télécommunication Applications

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction; impact of VLSI on communications systems; Noise considerations.

Section B

A-to-D converters for telecommunications; Modulators and Demodulators.

Section C

Circuits for ISDN, Circuits for visual communications and TV. Circuits and protocols for mobile telephone. Circuits for optical communications.

Text Books:

1. J.R.Smith, Modern communications Circuits, Second edition, MH, 1998,
2. J.E.Franca and Y.Tsividis, Design of Analog-Digital VLSI circuits for telecommunications and signal processing, PH, 1994.

Text /Reference Books:

1. R.Georgian and G.C.Temes, analog MOS Integrated Circuits for Signal Processing, Wiley, 1986.
2. E.N.Farag and M.I.Elmasry, Mixed-Signal VLSI Wireless Design: Circuits and Systems Kluwer, 1999.
3. B.Leung, VLSI for Wireless Communications, PH, 2002.
4. R.E.Best, Phase-Locked Loops: Design, Simulation and Applications, Fifth edition, MH, 2003.
5. H.J.R.Liu and H.Yao, High performance VLSI Signal Processing: Innovative Architectures and Algorithms, Volume 2(Systems design and applications), IEEE Press, 1998.
6. B.Razavi, Design of Integrated Circuits for Optical communications, MH, 2002.
7. R.Goyal, High-Frequency Analog Integrated Circuit Design, Wiley, 1995.

VLSI Signal Processing

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Introduction To DSP Systems -Typical DSP algorithms; Iteration Bound - data flow graph representations, loop bound and iteration bound, Longest path Matrix algorithm; Pipelining and parallel processing - Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power.

Retiming - definitions and properties; Unfolding - an algorithm for Unfolding, properties of unfolding, sample period reduction and parallel processing application; Algorithmic strength reduction in filters and transforms - 2-parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, parallel architectures for rank-order filters, Odd- Even Merge- Sort architecture, parallel rank-order filters.

Section B

Fast convolution - Cook-Toom algorithm, modified Cook-Toom algorithm; Pipelined and parallel recursive and adaptive filters - inefficient/efficient single channel interleaving, Look- Ahead pipelining in first- order IIR filters, Look-Ahead pipelining with power-of-two decomposition, Clustered Look-Ahead pipelining, parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters, pipelined adaptive digital filters, relaxed look-ahead, pipelined LMS adaptive filter.

Scaling and roundoff noise- scaling operation, roundoff noise, state variable description of digital filters, scaling and roundoff noise computation, roundoff noise in pipelined first-order filters; Bit-Level Arithmetic Architectures- parallel multipliers with sign extension, parallel carry-ripple array multipliers, parallel carry-save multiplier, 4x 4 bit Baugh- Wooley carry-save multiplication tabular form and implementation, design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement.

Section C

Numerical Strength Reduction - subexpression elimination, multiple constant multiplications, iterative matching. Linear transformations; Synchronous, Wave and asynchronous pipelining- synchronous pipelining and clocking styles, clock skew in edge-triggered single-phase clocking, two-phase clocking, wave pipelining, asynchronous pipelining bundled data versus dual rail protocol; Programming Digital Signal Processors - general architecture with important features; Low power Design - needs for low power VLSI chips, charging and discharging capacitance, short-circuit current of an inverter, CMOS leakage current, basic principles of low power design.

VLSI Sub System Design

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Review of Transistor, Inverter Analysis, CMOS Process and Masking Sequence, Layer Properties and Parasitic Estimation.

VLSI Design Flow, Design Methodologies, Abstraction Levels.

Design of Data Processing Elements: Adder Architectures, Multiplier Architectures, Counter Architectures, ALU Architectures, Design of Storage Elements: Latches, Flip-Flops, Registers, Register Files.

Section B

Design of Control Part: Moore & Mealy Machines, PLA Based Implementation, Random Logic Implementation, Micro-programmed Implementation.

Structuring of Logic Design: PLA Design, PLA Architectures, Gates Array Cell Design, Concept of Standard Cell Based Design, Cell Library Design.

Section C

Memory Design: SRAM cell, Various DRAM cells, RAM Architectures, Address Decoding, Read/Write Circuitry, Sense Amplifier and their Design, ROM Design.

Clocking Strategies, Clock Skew, Clock Distribution and Routing, Clock Buffering, Clock Domains, Gated Clock, Clock Tree.

Synchronization Failure and Meta-stability.

Text /References Books:

1. Neil H. E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design - A Systems Perspective, Addison Wesley.
2. Wayne Wolf, Modern VLSI Design, Prentice Hall.
3. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley.
4. J. P. Uyemura, Circuit Design for CMOS VLSI, Kluwer Academic

VLSI Testing and Design for Testability

L T P C
0 0 4 2

Max. Marks : 100
(CA: 40 + ESA: 60)

SECTION-A

Physical defects and their modeling; stuck at faults; Bridging Faults; Fault collapsing

Fault Simulation Deductive, Parallel and Concurrent; Critical Path Tracing; Test Generation for Combinational Circuits : D-Algorithm, Boolean Difference, PODEM

Random, Exhaustive and Weighted Random Test Pattern Generations Aliasing and its effect on Fault coverage

SECTION-B

PLA Testing: cross-point Fault Model, Test Generation, easily testable design,

Memory testing: Permanent Intermittent and Pattern Sensitive Faults; Delay Faults and Hazards; Test Generation Techniques

SECTION-C

Test Generation for Sequential Circuits: Time Frame Expansion;

Controllability and Observability Scan Design. Scan path and LSSD, boundary Scan, BILBO, Boundary Scan For Board Level Diagnosis.

Concept of Redundancy, spatial redundancy. Time redundancy.

References:

1. M. Abramovici, M.A. Breuer and R.D. Friedman, Digital Systems Testing and Testable Design, Revised Edition, IEEE Press, 1995.
2. V. Agarwal and S. C. Seth, Test Generation for VLSI Chips, IEEE CS Press, 1989.
3. E. J. McCluskey, Logic Design Principles, Prentice Hall, 1986.

Advanced Digital Signals Processing

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Modeling of filter: power Spectrum: sample random filter order:

Markov parameter; identification linear prediction and signal modeling; minimal phase signals and filter, minimum delay property; spectral factorization theorem

Section B

Linear estimation: Linear estimation of signals; Stationary Wiener filters; Kalman filter; Construction of Wiener filter, Kalman filter.

Linear prediction: Auto representative model levenson - Analysis and synthesis of lattice filters; Schur algorithm - FIR Wiener filter least square wave shaping and spiking filters. Spectrum estimation: Spectrum estimation by auto regressive modeling; spectral analysis of sinusoids in noise Maximum likely-hood method; spatial smoothing.

Section C

Adaptive filters: Adaptive implementation of wiener filter; Adaptive linear combiner; Adaptive FIR Wiener filter ; Adaptive Channel equalizer; Adaptive echo canceling; Adaptive noise canceling ; Adaptive linear prediction.

Text Books:

1. S.J.Orfanids, Optimum Signal Processing: An Introduction, Second edition, MacMillian/MH, 1988. (Out of Print)
2. J.G.Proakis, C.M.Rader,F.Ling and C.I.Nikias, Advanced Digital Signal Processing,MacMillian,1992.(Out of Print)

References Books:

1. D.G.Manolakis, V.Ingle and S.Kogon, Statically and Adaptive Signal Processing, MH, 2000.
2. J.G.Proakis, C.M.Rader, F.Ling, M.Moonen, I.K.Proudlar and C.I.Nikias, Algorithms for Statistical Signal Processing, PH/Pearson, 2002.
3. J.V.Candy, Signal Processing, MH,1986.(Out of Print)
4. B.Mulgrew and C.F.Cowan,Adaptive Filters and Equalizers, Kulwer,1998.(Out of print)

Advanced Digital System Design

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section-A

Basic theorems: Shannon's expansion theorem, consensus theorem, Octal designation, Reed Murler expansion, Ex-OR Operations, Inhibit & Inclusion & Inclusion operations.

Isomorphic system: Synthesis of multiple output combinational logic by product method.

Minimization method: Prime implicants, Quine-McCluskey decomposition method.

Section-B

Contact Network: Analysis and synthesis: Series parallel network.

Decomposition: Functional decompositions, decomposition by expansion, test for decomposability, decomposing charts.

Symmetric Network: Properties, synthesis, Identification of symmetric.

Threshold logic: Concept capabilities & limitations, properties, synthesis, Linear-Reparability, Identification & realization.

Section-C

Finite state machine: Mealy & Moore model, capabilities and limitation, state equivalence and machine minimization, incompletely specified machine.

Asynchronous sequential circuits: Fundamental mode, synthesis, state assignment, pulse mode circuit, essential hazard & dynamic hazard.

PLA: Introduction, minimization, PLA folded, Maximum folded large PLA's.

Text Books:

1. Brian Holdworth & Clive Wood, "Digital logic Design" - Elsevier-2005.
2. Nripendra N. Biswas, "Logic Design theory, "PHI, 2005.
3. ZVI Kohavi, "Switching and Finite Automata theory", second edition, Tata Mcgraw Hill, 2001.
4. William I. Fletcher, "An Engineering Approach to Digital Design, PHI, 2003.
5. Randall L. Geiger, Phillip E. Allen, Noel k strader, "VLSI Design Techniques for Analog Digital circuits, "McGraw hill, 1990.
6. John F. Warkerly, "Digital Design Principles & practices, III editions, Pearson, education, 2005.

Microwave Electronics

Section-A

Transmission Lines: Introduction to Microwaves & its applications. **Transmission Lines:** General equation, input independence characteristic independence, Reflection & reflection coefficient, standing wave ratio, resonant and anti resonant line impedance matching, smith chart & its applications, coaxial, twin, strip & micro strip lines & baluns.

Section-B

Wave Guides: Wave propagation in rectangular & circular wave-guides, wave-guide modes, Q of wave-guides, wave-guide coupling. Microwave Passive Components: s-parameter representation and analysis of microwave component such as tees, two hole direction coupler attenuators, phase shifter, Rectangular cavity resonator, circulator & isolator.

Section-C

Microwave Tube Devices: Conventional Vacuum tubes at microwave, O type device - Klystron (two cavity & reflex). M type device magnetron, Introduction to TWT (Traveling Wave Tubes). Microwave Semiconductor Devices IMPATT, TRAPATT & Gum Devices.

Text Books:

1. Microwave Circuits & passive devices, Sisodia-Raghuvanshi (Wiley-eastern).1st edition.1987
2. Microwave devices & circuits, S.Y. Liao (Prentice Hall).1st Edition 1995,
3. Foundation of microwave engineering, Collins (Mc Graw Hill) 2nd Edition 1992
4. Microwave P.A. Rizzi, (Prentice Hall). 1st Edition 1998

Microwave Lab

1. Determine the operating frequency of reflex klystron.
2. Draw the VI characteristics of Reflex klystron
3. Draw the characteristics of attenuator
4. To verify the wave-guide law.
5. To study the directivity and coupling coefficient of Directional Coupler.
6. To study the properties of magic Tea and also determine isolation and coupling coefficient.
7. To Measure the VSWR of (i) Short circuit (ii) Open circuit (iii) Matched Load (iv) Unmatched Load.
8. To study the properties of E-plane and H-plane Tea. Determine isolation and coupling coefficient

Principles of Digital Electronics

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section-A

Number system (binary, octal, decimal, hexadecimal) bits & bytes, representation of integers, real, positive and negative numbers. Binary Arithmetic, Simple concept of theorems of Boolean Algebra.

Representation of characters : BCD, ASCII, EBCDIC Codes. Weighted codes, self-complementary codes, Error detecting codes and error correcting codes (Parity, Gray, Hamming codes).

Logic Gates : Logic Gates and Boolean Algebra Representation and Simplification of functions by Karnaugh Maps. Combinational Circuits design. Combinational circuits - adder, subtractor, decoder, demultiplexer, encoder, multiplexer, comparator.

Section-B

Sequential Logic Circuit & Design - flip flop, shift register, asynchronous and synchronous counters.

Digital Logic Families and Their Characteristics: RTL, DTL, TTL, Schottky TTL, ECL, MOS and CMOS, Fan in, Fan out.

Section-C

Semiconductor Memories: RAM, ROM, PROM, EPROM, BJTRAM Cell, MOS RAM Cell, Organization of RAM, Charge Coupled devices (CCD), storage of charge and transfer of charge in CCD.

D/A Converter: Weighted resistance D/A, R-2R Ladder Converter. DAC 0800 D/A Chip, D/A Converter specification.

A/D Converter: Analog to Digital Converter, Parallel Comparator Converter, Counting Converter, Successive Approximation Converter, Dual Slope converter A/D converter specification, sampling and hold circuit, ADC 0804 Converter chip.

Text/Reference Books:

1. Digital Principles and Applications by Malvino C.P., Leach D.P.; Tata Mc-Graw Hill, 1985.
2. Digital Computer Fundamentals: Bartee, T.C.
3. Computer System Architecture: Mano, M.M., Prentice Hall, 1988
4. Digital Electronics: K M Bakwad, Vardhan Publication, 2010
5. Computer Architecture and Organization : Hayes John P., Mc- Graw Hill 1988 (International Edition)
6. Introduction to Computer Architecture Stone s., Galgotia Publications 1986.
7. Microprocessors, Architecture, Programming & Applications R. Gaonkar, Wiley Eastern - 1987.

Electronics Devices

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

SECTION-A

Intrinsic and Extrinsic Semiconductors, mobility of carriers, mobility and conductivity, Hall effect, Effective mass, Direct and Indirect semiconductors, Conductivity modulation, generation and recombination of charges, diffusion, the continuity equation, Injected minority carrier charge, the potential variation within a graded semiconductor four probe method of resistivity measurement.

P-N Junction relation, types of junctions, P-N junction diode, voltage current relationship, width of depletion region, junction capacitance, junction breakdown, switching of the diode, types of diode.

SECTION B

Bipolar junction transistor; Types, Current Components, CB,CC,CE configuration, DC and AC analysis, Hybrid model, current gain, voltage gain, input and output resistances, approximation model, High frequency model (Just reference),switching of transistors, load line concept, Basic concept of thermal stability of transistor.

Junction field effect transistor and MOSFET; Types, V-I characteristics, operation methods, low and High frequency model (Just Reference)

SECTION C

Four layer diode (P-N-P-N), SCR, Principle of operation, transistor analogy, methods of Turning On and Turning Off (Just reference), Gate characteristics, DIAC, TRIAC, light activated thyristor, Applications of SCR in the following areas: Over voltage protection, Zero voltage switch, Logic and Digital Circuits, Pulse circuits.

Text/Reference Books :

1. Integrated Electronics by J. Millaman and C. Halkias, McGraw Hill, New York, 1972
2. Electronic Devices and circuits by Malvino
3. Solid State Electronic Devices and Integrated Circuits(PHI) by Ben. G. Sterectman, Prentice Hall Inc., 1995
4. Physics of Semiconductors Devices by S.M. Sze (John Wiley & Sons, 1999).

Circuits and Signals

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

After completion of the course, students will be able to:

Predict the behaviour of any electrical and magnetic circuits.

Formulate and solve complex AC, DC circuits.

Explain response of RL, RC and RLC networks.

Realize the requirement of transformers in transmission and distribution of electric power and other applications.

Unit 1 Passive components and transient response: Resistance, Temperature Effect, Types of Resistors, Capacitance, Dielectric Strength, Leakage current, Types of capacitors, Inductors, Electromagnetic Induction, Self-inductance, Types of Inductors. Transient response of R-L, R-C & R-L-C circuits (D.C.)

Unit 2 Network Theorems and Two-Port Parameters: Series and Parallel combination of Resistors and Capacitors, Kirchhoff's Laws, Maxwell Loop current method, Superposition theorem, Thevenin's, Norton's, Miller's and Maximum Power Transfer Theorem. Z, Y, ABCD and h-parameters, Inter-relation between different parameters.

Unit 3 AC Fundamentals: Equation of the Alternating Voltage and Current, R.M.S. and Average Value of sinusoidal and non-sinusoidal periodic waves, Numerical problems based on AC Fundamentals, A.C. through Inductance, Resistance and Capacitance. Series A.C. Circuits: A.C. through Resistance and Inductance, Active, Reactive, Apparent power, Q-factor of coil.

Unit 4 A.C. through resistance and capacitance, R-L-C in series, Resonance in R-L-C circuits and graphic representation of resonance, Bandwidth and Q-factor of a series circuit. Resonance in Parallel circuits, graphic representation of parallel resonance and Q-factor of a parallel circuit.

Unit 5 Introduction, principle and construction; E.M.F. equation of a transformer, different losses in Transformer tests, (Open circuit and Short-circuit tests); Regulation of Transformer, Auto transformer, Application of instrument transformers.

Recommended Books:

Thareja, B.L. (2005). *A Text Book of Electrical Technology*. New Delhi: S Chand Publication.

Chakrabarti, A. (2018). *Circuit Theory Analysis and Synthesis*. New Delhi: Dhanpat Rai & Co.

Mehta, V.K. (2005). *Principles of Electrical Engineering*. New Delhi: S Chand Publication.

Suggested e-resources:

Basic Electrical Circuits by Dr Nagendra Krishnapura, Indian Institute of Technology, Madras.

<https://nptel.ac.in/courses/117106108/>

Basic Electrical Technology by Prof. T. K. Bhattacharya, Indian Institute of Technology, Kharagpur.

<https://nptel.ac.in/courses/108105053/>

Fundamentals of Electrical Engineering by Prof. Debapriya Das, Indian Institute of Technology, Kharagpur.

<https://nptel.ac.in/courses/108105112/1>

Principles of Electronics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After completion of the course, the students will able to:

Design various diodes circuits for various applications.

Differentiate various biasing methods used in BJTs and FET's

Analyse different kinds of oscillators and feedback circuits.

- Unit 1** Recapitulation of semiconductor Intrinsic and Extrinsic Semiconductor Physics including P-N diode, Diode Equation and Load Line Concept, Break down diodes, Zener Diode, Tunnel Diode, Light Emitting Diode, Varactor Diode, Photo Diode. Diode Applications: Clipping circuits, Comparators, Rectifiers, Capacitor Filters and Clamper circuit, Constant Voltage and Constant current Adjustable Regulated Power Supplies.
- Unit 2** BJT: Transistor current components, The Transistor as an Amplifier, CB configuration, Early Effect, I/O Characteristics, including ICBO & Circuit Considerations, Saturation region in detail, Typical Transistor Junction Voltage Values, CC Configuration, Photo transistor and Maximum Voltage Testing. Transistor Biasing and Bias Stabilization. Small signal low frequency Transistor model-Two Port devices & Hybrid Model, Analysis of Transistor Amplifier circuits using h-parameters & simple numerical, Cascading of the stages.
- Unit 3** FET-Operation and Characteristics of JFET, Enhancement & Depletion Mode MOSFET, Introduction to UJT and its applications
- Unit 4** Feedback in Amplifiers: General theory of feedback, Effect of Negative Feed-back on Gain, Stability, Bandwidth, Noise, I/P & O/P Resistance, Different Feedback Schemes (Voltage series feedback in detail).
- Unit 5** Oscillators: Basic principles of Feedback Oscillators; Barkhausen criteria, RC & LC Oscillators (Hartley, Colpitt, Wein bridge, R-C phase shift oscillator) Derivation for frequency of Practical oscillators

Recommended Books:

1. Parikh, Millman & Halkias. (2017). *Integrated Electronics: Analog & Digital Circuits and Systems*. New Delhi: McGraw Hill Education.
2. Boylestad, Robert L., & Nashelsky Louis. (2015). *Electronic Devices & Circuit Theory*. New Delhi: Pearson Publication.
3. Malvino, Albert. & Bates, David J. (2017) *Electronic Principles*. New Delhi: McGraw Hill Education.

Suggested E-resources:

Basic Electronics by Dr. Pramod Agarwal, Indian Institute of Technology, Roorkee.
<https://nptel.ac.in/courses/117107095/>

Fundamentals of Digital Electronics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

After completion of the course, the students will able to:

Develop a skill to build digital logic circuits, troubleshoot them and apply it to solve real life problems.

Analyse, design and implementation of various combinational and sequential circuits.

Differentiate various logic families.

Understand the operation and application of multi-vibrators.

UNIT 1 logic gates, number system: number system (binary, octal, decimal, hexadecimal) bits & bytes, representation of integers, real, positive and negative numbers. Bcd code. boolean algebra : use of basic theorems of boolean algebra, karnaugh map-use of karnaugh map in simplification of logic circuits. Combinational logic circuits: binary adder, subtractors, comparators, multiplexer, demultiplexer, encoder, decoder.

UNIT 2 arithmetic logic unit : full adder designs, binary coded decimal adder, addition and subtraction in the 2's complement system, shift operation, binary and decimal multiplication, division logical operations, high speed arithmetic parallel multipliers, floating point number system. Arithmetic operations with floating points number system.

UNIT 3 (i) Sequential circuits: flip-flops-r-s type, j-k, j-k (master slave), d-type and t-type.
(ii) Counters -asynchronous, synchronous and divide-by n counters. Shift registers, ring counter and twisted ring counter.

UNIT 4 Elements of logic families:

- (i) Bipolar families:
 - (a) DTL
 - (b) TTL
 - (c) ECL
- (ii) MOS families:
 - (a) PMOS
 - (b) NMOS
 - (c) CMOS

UNIT 5 (i) Bistable Multivibrators: fixed-bias and self-biased transistorized collector-coupled. Triggering methods, schmitt trigger & its applications.
(ii) Collector-Coupled Monostable Multivibrator.
(iii) Astable Multivibrator (collector-coupled).

Recommended Books:

1. Morris Mano, M., & ciletti, Michael d. (2018). *Digital Design*. New Delhi: Pearson Publication.
2. Singhal, Rajul. (2003). *Pulse & Linear Integrated Circuits*. New Delhi: Standard Publisher distributor.
3. Floyd, Thomas L. (2014). *Digital Fundamentals*. New Delhi: Pearson Publication.

Suggested E-resources:

Digital Circuits and Systems by Prof. Srinivasan Department of Electrical Engineering Indian Institute of Technology Madras. <https://nptel.ac.in/courses/117106086/>

Digital System Design by Prof. D. Roy Choudhury Department of Computer Science and Engineering Indian Institute of Technology, Kharagpur. <https://nptel.ac.in/courses/117105080/3>.

Electronic Instrumentation and Measurements

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

After completion of the course, the students will able to:

Understand and estimate various types of errors in measurements.

Explain the operating principle of various measuring instruments used to detect physical quantities.

Design op-amp circuits and understand SCR operation.

Unit 1 Transducers : Classification of Transducers, Selection of Transducers, Strain Gauge, Displacement Transducers, capacitive Transducers, Linearly variable differential Transformer (LVDT). Piezo-electric transducers, Temperature transducers-Resistance thermometer, Thermocouples and thermister, Photo-sensitive Devices: Phototubes, photo conductive cells and photo voltaic cells.

Unit 2 Operational Amplifiers: Basic principle, characteristics and applications as linear op-amp circuits (summer, Voltage-to current converters differential amplifier:BIBO, DC & AC Amplifier, integrator and differentiator) and non-linear op-amp circuits (comparators and schmitt-triggers.)

Unit 3 Thermistors: SCR characteristics, principle of operation, transistor analogy, methods of Turning On and Turning Off, improvement of device characteristics, Gate characteristics, Applications of SCR in the following areas: Static circuits breaker, Over voltage protection. Zero voltage switch, Logic and Digital Circuits, Pulse circuits.

Unit 4 (i) LCR Bridges-Measurement of Lumped circuit constants using bridges such as Wheatstone, Wein, Maxwell, Schering and Hay's Bridge.

(ii) Operation of universal counter and measurement errors.

Unit 5 (i) Digital instruments: A/D and D/A techniques, digital voltmeter.

(ii) Wave analyzer, spectrum analyzer, harmonic distortion analyzer.

(iii) Electronic voltmeters and Q-meter.

Recommended Books:

1. Ramamoorthy, M. (1991). *An Introduction to Thyristors & their Applications*. New Delhi: Affiliated East-West Press (Pvt.) Ltd.

2. Sawheny, A.K.(2015). *A Course in Electrical & Electronic Measurements and Instrumentation*. New Delhi: Dhanpat Rai & Co

Helfrick Albert D. & Cooper W.D. (2016). *Modern Electronic Instrumentation and Measurement Techniques (1/e)*. New Delhi: Pearson Publication.

Suggested E-resources:

Industrial Instrumentation by Prof. Alok Barua, Department of Electrical Engineering Indian Institute of Technology, Kharagpur. <https://nptel.ac.in/courses/108105064/7>

Analog Circuits by Prof. Pramod Agarwal, Department of Electrical Engineering Indian Institute of Technology, Roorkee. <https://nptel.ac.in/courses/117107094/1>

Basic Electronics by Prof. T.S. Natarajan, Department of Physics Indian Institute of Technology, Madras. <https://nptel.ac.in/courses/122106025/39>

Electrical and Electronic Measurements by Prof. V. Jagdeesh Kumar, Department of Electrical Engineering Indian Institute of Technology, Madras. <https://nptel.ac.in/syllabus/108106070/>

Microprocessors

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

After completion of the course, the students will able to:

Describe the general architecture of a microcomputer system and architecture & organization of 8085 & 8086 Microprocessor and understand the difference between 8085 and advanced microprocessor.

Distinguish the use of different instructions and apply them in assembly language programming.

Explain and realize the interfacing of memory & various I/O devices with 8085 microprocessor.

Unit 1 Evolution of microprocessors, microprocessor(8085) architecture, concept of address, data & control bus, Internal operation, addressing modes, instruction formats & execution timings.

Unit 2 Microprocessor instructions & programming: 8085 instruction set - data transfer, arithmetic, logical, rotate, compare, jump operations. Programming techniques, stack, subroutine, conditional call and return instructions.

Unit 3 Interfacing input keyboards, interfacing output displays, memory interfacing, memory mapped I/O. Interrupts - type & masking, 8257 DMA controller chip, 8255 programmable peripheral interface.

Unit 4 Internal organization of 8086, generating memory addresses, addressing modes, maximum and minimum modes.

Unit 5 8086 Instruction set: Data transfer, arithmetic, logical, shift, rotate, flag control instructions, compare, jump, string instructions, subroutine & subroutine handling, loop instructions.

Recommended Books:

Gaonker, R.S. (2013) *Microprocessor Architecture, Programming & Applications with the 8085*. Mumbai, Maharashtra: Penram International Publishing (India) Pvt. Ltd.

Douglas V. Hal., SSSP, Rao.(2012) *Microprocessor and Interfacing*. New Delhi: Mc-Graw Hill Publication

Ram B. (2018). *Fundamentals of Microprocessors and Microcomputers*. New Delhi: Dhanpat Rai & Co

Suggested E-resources:

Microprocessor by Dr. Pramod Agarwal, Department of Electrical Engineering, IIT Roorkee
<https://nptel.ac.in/courses/108107029/>

Microprocessors and Microcontrollers by Prof. Krishna Kumar, IISC Bangalore
<https://nptel.ac.in/courses/106108100/>

Communication Systems

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

After completion of the course, the students will able to:

Explain the working of communication system, Analog Modulation Techniques and their comparative analysis and applications suitability.

To analyze various methods of baseband/band pass Analogue transmission and detection.

To evaluate the performance of analogue communications in the presence of noise.

Explain the working of AM, FM transmitter and receiver.

- Unit 1** (a) Principle of Modulation: Definition of modulation, Need for modulation.
(b) Amplitude modulation: Theory, frequency spectrum of A.M. Wave, Representation of AM wave, Power relation in AM wave, Generation of AM Wave, Single Side Band Generation Techniques in Filter, Phase & Third method.
- Unit 2** (a) Frequency Modulation: Theory of frequency Modulation, Frequency Spectrum of FM wave, advantages of FM, comparison between AM and FM, Generation of FM wave
(b) Phase modulation: Theory of phase modulation, noise in FM, Noise triangle, pre-emphasis & de-emphasis, Adjacent Channel Interference, Co-channel Interference, Stereophonic FM Multiplex system.
- Unit 3 Radio Receivers:**
(a) Classification of Radio receivers and their salient features.
(b) AM receivers, super heterodyne receivers, frequency mixer for radio receivers, Intermediate Frequency Amplifier, Detection & Automatic gain control, Tone Control & tuning control.
(c) FM receivers: stages of FM radio receivers - Amplitude Limiting, basic FM demodulators: Foster seeley, balanced slope & ratio detectors.
- Unit 4 TV Transmitter:**
(a) Block diagrammatic description of transmitter (Black & White T.V.)
(b) T.V. receiver: block diagrammatic description of T.V. receiver (Black & White) composite video signal, scanning, blanking etc.
(c) Elementary idea of color T.V., Luminance & chrominance signal.
- Unit 5 Pulse modulation:** Introduction & types, pulse amplitude modulation, pulse time modulation (PPM & PWM), Pulse Code modulation: Principle, noise performance of PCM (Quantization & transmission noise), Compounding, advantages & applications of PCM, Application of pulse communication - Telegraphy & telemetry.

Recommended Books:

- Kennedy, George. (2017) *Electronics communication System*. New Delhi:Mc-Graw Hill Publication.
- Gulati, R. R. (2011) *Monochrome and colour Television*. New Delhi: New Age International Publication.
- Shilling, Taub. (2013) *Principles of Communication Systems*. New Delhi: Mc-Graw Hill Publication.
- Lathi,B.P., Ding, Zhi., & Gupta, Hari Mohan. (2017) *Modern Digital and Analog Communication Systems*. New Delhi: Oxford University Press.
- Sharma S.P. (2012). *Basic Radio & Television*. New Delhi: Mc-Graw Hill Publication.

Suggested E-resources:

Analog Communication by Prof. Goutam Das, G S Sanyal School of Telecommunications, IIT Kharagpur.
<https://nptel.ac.in/courses/117105143/>

Communication Engineering by Prof. Surendra Prasad, Dept. of Electrical Engineering, IIT, Delhi.
<https://nptel.ac.in/courses/117102059/>

Inorganic Chemistry-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes

On completion of course, the students will be able to:

derive Schrodinger wave equation and quantum numbers, predict shapes of orbital from probability curves and apply Slater's rule for calculating Z_{eff} .

explain periodic properties like atomic and ionic radii, ionization energy, electron affinity and electronegativity.

demonstrate bonding theories including valence bond theory, valence shell electron pair repulsion and molecular orbital theory and its applications.

determine ionic structure of solids with the help of radius ratio values for coordination numbers 3, 4 and 6 and have brief knowledge of metallic bond.

acquire knowledge of characteristic properties of 3d series elements and its comparison with 4d and 5d series.

apply the Werner's coordination theory and its experimental verification; to solve numerical problems based on effective atomic number concept.

Unit 1 Atomic Structure:

Schrodinger wave equation, significance of Ψ and Ψ^2 , quantum numbers, radial and angular wave function and probability distribution curves, shapes of *s*, *p*, *d* orbitals. Aufbau and Pauli principles, Hund's multiplicity rule, exchange energy, pairing energy, symmetrical distribution of charge, extra stability of half-filled and fully-filled orbitals, electronic configuration of elements up to atomic No. 71, effective nuclear charge, shielding effect, Slater's rules for evaluation of shielding constant.

Periodic Properties:

Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definition, methods of determination or evaluation, trends in periodic table, application in predicting and explaining the chemical behavior

Unit 2 Chemical Bonding:

Covalent bond: resonance, valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shell electron pair repulsion (VSEPR) theory with reference to BF_3 , BF_4^- , NH_3 , H_2O , H_3O^+ , PCl_5 , SF_4 , ClF_3 , I_3^- , SF_6 , IF_7 , ICl_2^- , and POCl_3 ; MO theory, simple LCAO theory; sigma, pi and delta molecular orbitals; homonuclear and heteronuclear (CO and NO) diatomic molecules and their ions, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Ionic Solids:

Ionic structure, radius ratio effect and coordination number, calculation of limiting radius ratio values for CN 3, 4 and 6; limitations of radius ratio rule, lattice defects, semi-conductors, lattice energy (excluding mathematical derivation), Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, metallic bond: free electron, valence bond and band theories; weak interactions: hydrogen bonding, Van der Waals interactions.

Unit 3 s-Block Elements:

Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies and an introduction to alkalis and interhalogen compounds, alkyls and aryls of s-block elements

p-Block Elements:

Comparative study (including diagonal relationship) of groups 13 to 17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13 to 16, hydrides of boron-diboranes and higher boranes, borazine,

borohydride; fullerenes, carbides, fluoroocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides

Chemistry of Noble Gases:

Chemical properties of noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Unit 4 Chemistry of Elements of First Transition Series:

Characteristic properties of *d*-block elements, properties of elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Chemistry of Elements of Second and Third Transition Series:

General characteristics, comparative treatment with their *3d*-analogues with respect to ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Unit 5 Valence Bond Theory:

Introduction, Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes, limitations of VBT.

Oxidation and Reduction:

Use of redox potential data, analysis of redox cycle, redox stability in water, Frost, Latimer and Pourbaix diagrams, principles involved in the extraction of the elements.

Acids and Bases:

Arrhenius, Lewis, Bronsted-Lowry, Lux-Flood and solvent system concepts of acids and bases.

Recommended Books

Lee, J. D. (1998). *Concise Inorganic Chemistry* (5th ed.). United Kingdom: Wiley/Oxford Publications.

Puri, B.R., Sharma, L.R. & Kalia, K.C. (2017). *Principles of Inorganic Chemistry* (33rd ed.). India: Vishal Publications.

Cotton, F. A., & Wilkinson, G. (1994). *Basic Inorganic Chemistry* (3rd ed.). United Kingdom: John Wiley Publications.

Bhagchandani, P. (2017). *Inorganic Chemistry*. India: Sahitya Bhawan Publications.

Malik, W. U., Tuli, G.D., & Madan, R. D.(2010). *Selected Topics in Inorganic Chemistry*. (Revised ed.).India: S. Chand Publications.

Suggested e-Sources

National Programme on Technology Enhanced Learning

<https://nptel.ac.in>

Online Chemistry Courses

<https://www.edx.org/learn/chemistry>

Free Online Education SWAYAM

<https://swayam.gov.in>

Inorganic Chemistry-I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes

On completion of course, the students will be able to:

understand the principles of working with laboratory equipments and ability to properly use them during chemistry experiments.

prepare standard solution of various secondary standard salts.

process purification of impure compounds by crystallization.

calibrate lab equipments like pipettes and burettes.

analyze, separate and identify inorganic ions from various groups.

Semi-micro Analysis: Anion and cation analysis, separation and identification of ions from groups Zero, I, II, III, IV, V and VI.

Calibration: fractional weights, pipettes and burettes, preparation of standard solutions (0.1 M to 0.001 M).

Volumetric Analysis

Determination of acetic acid in commercial vinegar using NaOH.

Determination of alkali content in antacid tablet using HCl.

Estimation of calcium content in chalk as calcium oxalate by permanganometry.

Estimation of copper using thiosulphate.

Recommended Books

Gurdeep, R (2016), Advanced Practical Inorganic Chemistry, revised Ed., Krishna Prakashan publication.

Svehla, G. (2010), Vogel's Qualitative Inorganic Analysis, 7th Edition, Prentice Hall.

Gurtu, J. N. and Gurtu, A (2011), Physical Chemistry Vol – I, Pragati Prakashan publication.

Suggested e-Sources

National Programme on Technology Enhanced Learning

<https://nptel.ac.in>

Online Chemistry Courses

<https://www.edx.org/learn/chemistry>

Free Online Education SWAYAM

<https://swayam.gov.in>

Organic Chemistry-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes

On completion of course, the students will be able to:

explain the organic reactions and their mechanisms.

explain the stereochemistry of the organic compounds including their optical activity, conformations and configurations.

explain physical and chemical properties of the hydrocarbons, alcohols, carbonyl compounds and carboxylic acids.

understand the basics of chemistry of aromatic compounds.

Unit 1 Organic Reactions and their Mechanisms:

Nature of fission of covalent bonds, notations of bond fission, types of reagents, types of organic reactions and energy considerations.

Reactive intermediates:

Carbocation, carbanion, free radical, carbene and nitrene.

Organometallic Compound:

Structure, synthesis and applications of Grignard reagent.

Unit 2 Stereochemistry of Organic Compounds:

Concept of isomerism, types of isomerism.

Geometrical isomerism: - *cis*- and *trans*- isomerism, E & Z system of nomenclature, determination of configuration of geometrical isomers, geometrical isomerism in oximes and alicyclic compounds.

Optical isomerism: - elements of symmetry, molecular chirality, stereogenic centre, optical activity, chiral and achiral molecules with two stereogenic centres- enantiomers, diastereoisomers, threo and erythro diastereoisomers, meso compounds; relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature; inversion, retention and racemization; resolution of enantiomers.

Conformational isomerism: -projection formulae (Fischer, sawhorse, Newman and flying wedge formulae), interconversion of projection formulae, difference between configuration and conformation, conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, conformation of monosubstituted cyclohexane derivatives.

Unit 3 Alkanes and Cycloalkanes:

Alkanes: Nomenclature, isomerism, methods of preparation (with special reference to Wurtz reaction, Corey-House reaction, Kolbe reaction and decarboxylation of carboxylic acids), physical properties, mechanism of free radical halogenation of alkanes, reactivity and selectivity.

(b) Cycloalkanes: Ring strain in cyclopropane and cyclobutane, Baeyer's strain theory and its limitation, theory of strainless rings with special reference to cyclopropane ring.

Alkenes:

Nomenclature, isomerism, relative stabilities, methods of preparation: dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vic-dihalides, pyrolysis of quaternary ammonium hydroxides; physical properties, chemical reactions: - catalytic hydrogenation, addition of hydrogen halides, hydroboration-oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation with KMnO_4 , substitution reactions at the allylic and vinylic positions,

polymerization; regioselectivity in alcohol dehydration, Saytzeff and Hofmann rules for elimination; industrial applications of ethylene and propene.

Dienes:

Classification, structure of allene and butadiene, chemical reactions:- electrophilic and free radical addition, polymerization, Diels-Alder reaction.

Alkynes:

Nomenclature, isomerism, structure and bonding in alkynes, methods of preparation, physical properties, chemical reactions-addition of hydrogen, mechanism of electrophilic and nucleophilic addition, acidity of alkynes, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

Unit 4 Aromaticity:

Nomenclature of benzene derivatives, aromatic nucleus, side chain, aryl group, structure of benzene: Kekule structure, MO diagram; aromaticity: Huckel rule, aromatic, anti-aromatic and non-aromatic compounds.

Aromatic Electrophilic Substitution Reactions: General mechanism, role of σ - and π -complexes, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction; activating and deactivating substituents, *ortho/para* ratio, orientation and methods of determination of the orientation.

Alkyl Halides and Aryl Halides:

Alkyl Halides: Nomenclature, classification and methods of preparation, chemical reactions: nucleophilic substitution and elimination reactions.

Aryl Halides: Nomenclature, classification, methods of preparation, chemical reactions: nucleophilic aromatic substitution reactions, low reactivity of vinyl and aryl halides, and high reactivity of allyl and benzyl halides; DDT and BHC.

Alcohols and Phenols:

Alcohols: Nomenclature and classification, dihydric alcohols: methods of preparation, physical properties, chemical reactions of vicinal glycols: acidic nature, reaction with phosphorous halides, reaction with HCl, esterification, oxidative cleavage [$\text{Pb}(\text{OAc})_4$ and HIO_4] and pinacol-pinacolone rearrangement; trihydric alcohols: methods of preparation, physical properties, chemical reactions of glycerol.

Phenols: Nomenclature, classification, structure and bonding, preparation of phenols, physical properties, chemical reactions: acidic character, comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion, electrophilic aromatic substitution, acylation and carboxylation, Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Unit 5 Aldehydes and Ketones:

Aldehydes and Ketones:

Nomenclature, structure of the carbonyl group, synthesis of aldehydes and ketones with particular reference to synthesis of aldehydes and ketones using acid chlorides and 1, 3-dithianes, synthesis of ketones from nitrile and carboxylic acids; physical properties; mechanism of nucleophilic additions to carbonyl group with particular emphasis on aldol, Perkin, Cannizzaro and Knoevenagel condensations; reactions with ammonia and its derivatives; Wittig reaction, Mannich reaction, Clemmenson reduction and Wolf-Kishner reduction; oxidation of aldehydes (reactions with Tollen's reagents, Fehling's solution and Benedict's solution) and ketones (Baeyer-Villiger oxidation).

Carboxylic Acids:

Nomenclature, structure and bonding, preparation, physical properties, effects of substituents on acid strength, chemical reactions of carboxylic acids: salt formation, formation of acid derivatives, reduction, reaction with Grignard reagent, decarboxylation and halogenation (Hell-Volhard-Zelinsky reaction).

Recommended Books

- Clayden, J., Greeves, N., Warren, S., & Wothers, P., (2001). *Organic Chemistry*. (2nd ed.). Oxford University Press.
- Sykes, P. (1986). *A guide book to mechanism in organic chemistry* (6th ed.). Pearson.
- Ingold, C. K. (1970). *Structure and mechanism in organic chemistry*. Cornell University Press.
- Morrison, R.T., Boyd, R.N. (2002). *Organic chemistry* (6th ed.). Prentice Hall: Englewood Cliffs, NJ.
- Nasipuri, D. (1994). *Stereochemistry of organic compounds*. (2nd ed.). New Age International
- Singh, M.S. (2005). *Advanced organic chemistry-reactions and mechanisms*. Pearson Education (Singapore) Pvt. Ltd.
- Wade, L.G., Singh, M.S. (2008). *Organic chemistry*. Pearson Education, Dorling Kindersley Pvt. Ltd.
- Singh, M.S. (2014). *Reactive intermediates in organic chemistry-structure, mechanism and reactions*. Wiley, VCH, & Weinheim.
- Eliel E. L., Wilen S. H., Manden L. N. (2005). *Stereochemistry of Carbon compounds*. Wiley & sons.

Suggested e-Sources

- National Programme on Technology Enhanced Learning
<https://nptel.ac.in>
- Online Chemistry Courses
<https://www.edx.org/learn/chemistry>
- Free Online Education SWAYAM
<https://swayam.gov.in>

Organic Chemistry-I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Laboratory Techniques:

To calibrate the thermometer using naphthalene (80-82°C), acetanilide (113.5-114°C), urea (132.5-133°C), water (100°C) as reference materials.

To Determine the boiling point of ethanol, cyclohexane, toluene, benzene.

To determine the mixed melting point of Urea-cinnamic acid mixture of various compositions (1:4, 1:1, 4:1).

Distillation

Simple distillation of ethanol-water mixture using water condenser.

Distillation of nitrobenzene and aniline using air condenser.

Crystallization

Concept of introduction of crystallization

Phthalic acid from hot water (using fluted filter paper and steamless funnel)

Acetanilide from boiling water

Naphthalene from ethanol

Benzoic acid from water

Decolorisation and Crystallization using Charcoal

Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.

Crystallization and decolorisation of impure naphthalene

Sublimation (Simple and Vacuum)

Qualitative Analysis:

Part-I Detection of extra elements (N, S and halogens) and functional groups (carboxylic, alcoholic, phenolic, carbonyl, ester, carbohydrate, amine, amide and nitro) in simple organic compounds

Part-II Identification of an organic compound through the functional group analysis, determination of melting points and preparation of suitable derivatives.

Stereochemical Study of Organic Compounds via Models:

R and S configuration of optical isomers.

E and Z configuration of geometrical isomers.

Conformational analysis of cyclohexanes and substituted cyclohexanes.

Paper Chromatography: Ascending and Circular:

Determination of R_f values and identification of organic compounds.

Separation of monosaccharides (a mixture of D-galactose and D-fructose) using n-butanol, acetone and water in 4:5:1 ratio, and spray reagent (aniline hydrogen phthalate).

Recommended Books

Leonard, J., Lygo, B., Procter, G. (2013). *Advanced Practical Organic Chemistry* (3rd ed.). CRC Press, Taylor & Francis Group.

Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. (1989). *Practical Organic Chemistry* (5th ed.). New York, John Wiley & Sons, Inc.

Suggested e-Sources

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Free Online Education SWAYAM

<https://swayam.gov.in>

Inorganic Chemistry-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes

On completion of course, the students will be able to:

- apply crystal field theory on different geometries and correlate it with stability.
- elucidate the nomenclature, structures, magnetic properties and reactivity of transition metal complexes.
- apply the concept of L-S coupling for the determination of term symbols of different spectroscopic states and appreciate its utility.
- elaborate the thermodynamic and kinetic stability of metal complexes.
- demonstrate the structure, bonding and reactivity of organometallic compounds.
- discuss a concise treatment of the important inorganic non-aqueous solvents and its application in various known reactions.
- apply HSAB principle on stability of molecules.

Unit 1 Crystal Field Theory:

Introduction, crystal field splitting in octahedral, tetrahedral, square planar, and trigonal bipyramidal complexes, factors affecting the crystal-field parameters, Jahn-Teller distortions, applications and limitations of crystal field theory.

Magnetic Properties of Transition Metal Complexes:

Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of μ_S and μ_{eff} values, orbital contribution to magnetic moments, applications of magnetic data for 3d-metal complexes.

Unit 2 Electronic Spectra of Transition Metal Complexes:

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Thermodynamic and Kinetic Aspects of Metal Complexes:

Lability and inertness of complexes, brief outline of thermodynamic and kinetic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit 3 Chemistry of Lanthanides:

Electronic structure, oxidation states, ionic radii, lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds, spectral and magnetic properties.

Chemistry of Actinides:

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the post actinides and the post lanthanides.

Unit 4 Non-aqueous Solvent:

Classification of solvents, physical properties of solvents, reactions in non-aqueous solvents with reference to liquid NH_3 liquid HF and liquid SO_2 .

Hard and Soft Acid and Base (HSAB):

Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness.

Unit 5 Bio-Inorganic Chemistry:

Essential and trace elements in biological processes, metalloporphyrins: hemoglobin, myoglobin, hemocyanin and hemerythrin; biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} in muscle contraction, nitrogen fixation.

Organometallic Chemistry:

Definition, nomenclature and classification of organometallic compounds, preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylenic complexes, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Recommended Books

Lee, J.D (1998). *Concise Inorganic Chemistry*, (5th ed.). Oxford Publications.

Puri, B.R, Sharma, L.R., Kalia, K.C. (2017). *Principles of Inorganic Chemistry*, (3rd ed.). Vishal Publications.

Cotton, F.A., Wilkinson, G. (1994). *Basic Inorganic Chemistry*, (3rd ed.). John Wiley Publications

Huheey, J.E., Keiter, J.A. & Keiter, R.L. (1997), *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th (ed.) Pearson Publications.

Bhagchandani, P. (2017), *Inorganic Chemistry*, Sahitya Bhawan Publications.

Malik, W.U., Tuli, G.D. & Madan, R.D. (2010), *Selected Topics in Inorganic Chemistry*, Revised Ed., S. Chand Publications.

Suggested e-Sources

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Online Chemistry Courses

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Free Online Education SWAYAM

<https://swayam.gov.in>

Inorganic Chemistry - II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes

On completion of course, the students will be able to:

- perform the proper procedures and have the knowledge of regulations for safe handling and use of chemicals.
- predict chemical bonding or molecular geometry of various complexes based on accepted models.
- synthesize various transition metal complexes.
- Handle instruments like calorimeter and potentiometer.

Analysis of the following by Volumetrically/Gravimetrically:

- Estimation of Barium (as sulphate)
- Estimation of Lead (as sulphate)
- Estimation of Zinc (as ammonium sulphate)
- Estimation of Magnesium (as magnesium hydrogen phosphate)
- Estimation of Copper (as thiocyanate)
- Estimation of Nickel (as nickel dimethyl glyoximate)

Complexometric Titrations using Disodium Salt of EDTA:

- Estimation of Mg^{2+} and Zn^{2+}
- Estimation of Ca^{2+} by substitution method

Preparation and Purification of following Complexes:

- Sodium trioxalatoferrate (III)
- Tetraamminecopper (II) sulphate
- Sodium trioxalatochromate (III)
- cis- and trans-diaquadioxalatochromate (III) ion

Colorimetric Estimation:

- Job's method
- Mole-ratio method

Adulteration Analysis (any one of the following):

- Food stuffs
- Effluents

Solvent Extraction:

- Separation and estimation of Mg (II) and Fe (II)

Recommended Books

- Gurdeep, R. (2016). *Advanced Practical Inorganic Chemistry*, Krishna Prakashan publication.
- Svehla, G. (2010). *Vogel's Qualitative Inorganic Analysis*, (7th ed.). Prentice Hall.
- Gurtu, J. N. and Gurtu, A (2011), *Physical Chemistry Vol – I*, Pragati Prakashan publication.

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Physical Chemistry-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes

On completion of course, the students will be able to:

- explain the basic principles of thermodynamics and thermochemistry.
- describe the states of matter.
- explain the concepts of chemical kinetics and catalysis.
- apply the concept of thermodynamics to determine the heat of neutralization of chemical reaction.
- explain the concept of colloids.

Unit 1 Chemical kinetics and Catalysis:

Introduction, measurement of reaction rate, integration and determination of rate laws, rate constant, unit of rate constant for zero order, first order and second order reactions, order of reaction, molecularity of reaction, difference between order and molecularity of reaction, chemical kinetics and its scope, factors influencing the rate of a reaction-concentration, temperature, pressure, solvent, light, catalyst; concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo order; half-life and mean life; determination of the order of reaction-differential method, graphical method, method of integration, method of half-life period and isolation method, radioactive decay as a first order phenomenon.

Theories of chemical kinetics:

Effect of temperature on rate of reaction, temperature co-efficient, Arrhenius equation, concept of activation energy, transition state theory (equilibrium hypothesis), expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Unit 2 Thermodynamics-I:

Definition, significance and limitations, classical versus statistical thermodynamics, different thermodynamic terms: system, surroundings, types of systems, intensive and extensive properties, state and path functions, and their differentials, Euler reciprocity relation and cyclic rule, thermodynamic process, concept of heat and work.

First law of Thermodynamics: statement, definition of internal energy and enthalpy, heat capacity: heat capacities at constant volume and pressure and their relationship, Joule's law, Joule-Thomson coefficient and inversion temperature, calculation of w , q , dU and ΔH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, application of first law of thermodynamics, zeroth law of thermodynamics and the absolute temperature scale.

Thermo-Chemistry:

Standard state, standard enthalpy of formation: Hess's law of heat summation and its applications, heat of reaction at constant pressure and at constant volume, various types of enthalpies of reaction: enthalpy of formation, enthalpy of combustion, enthalpy of solution, enthalpy of dilution, enthalpy of hydration and enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, calculation of lattice energy from Born-Haber's cycle, temperature dependence of enthalpy, Kirchhoff's equation, adiabatic flame temperature.

Unit 3 Thermodynamics-II:

Second law of thermodynamics: need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem, thermodynamic scale of temperature and its identity with ideal gas temperature scale.

Concept of entropy: entropy as a state function, characteristics of entropy function and Maxwell relations, entropy as a function of V and T , entropy as a function of P and T , entropy change in physical change,

Clausius inequality and its application to an isolated system, entropy as a criteria of spontaneity and equilibrium, entropy change in ideal gases: temperature and volume, temperature and pressure variations, standard entropy and entropy of mixing of ideal gases.

Chemical Equilibrium:

Free energy of spontaneous reactions and the role of temperature, equilibrium constant and free energy, thermodynamic derivation of law of mass action, Van't Hoff reaction isotherm, factors affecting the state of equilibrium, Le-Chatelier's principle and its applications to physical and chemical equilibrium, reaction isotherm and reaction isochore, Clapeyron and Clausius-Clapeyron equations and its applications for liquid-vapor, solid-vapor and solid-liquid equilibrium.

Unit 4 Gaseous State:

Postulates of kinetic theory of gases, deviation from ideal behavior, Van der waals equation of state, critical phenomena, PV isotherms of real gases, continuity of states, the isotherms of Van der waals constants, the law of corresponding states and reduced equation of state.

Molecular velocities: root mean square, average and most probable velocities, qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, liquification of gases (based on Joule-Thomson effect).

Liquid State:

Intermolecular forces, structure of liquids (a qualitative description), structural differences between solids, liquids and gases; liquid crystals: difference between solid crystals and liquid crystals; classification, structure of nematic and cholestric phases, thermography and seven-segment cell.

Unit 5 Colloidal State:

Definition and classification of colloids, solid in liquid (sol): properties-kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number, liquid in liquid (emulsion): types and preparation of emulsions, emulsifier, liquid in solid (gel): classification, preparation and properties, inhibition and general applications of colloids.

Solid State:

Solids-classification, properties:-electrical and magnetic; crystals-external features, symmetry, lattice point, unit cell, classification; ionic crystals - packing of constituents in crystals, relationship between edge length and ionic radii, packing efficiency, co-ordination number, interstitial voids-trigonal voids, tetrahedral voids, octahedral voids and cubic voids, radius ratio of voids.

Defects in Solids:

Definition, classification, stoichiometric and non-stoichiometric defects, consequences of defects.

Recommended Books

Atkins, P., Julio, P. D. (2014). *Physical Chemistry* (10th Ed.), United Kingdom: Oxford University Press.

Castellan, G.W. (1983). *Physical Chemistry* (3rd Ed.), United State of America: Addison-Wesley Publishing Company.

West, A. R. (2014). *Solid State Chemistry and its Applications* (2nd Ed.), John Wiley & Sons Ltd.

Puri, B.R., Sharma, L.R., Pathania, M.S.(2016). *Principle of Physical Chemistry* (47th Ed.), India: Vishal Publishing Company.

Laidler, K.J.(1965). *Chemical Kinetics* (2nd Ed.), New York: McGraw Hill Book Company.

Suggested e-Sources

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Free Online Education SWAYAM

<https://swayam.gov.in>

Physical Chemistry-I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes

On completion of course, the students will be able to:

- determine the percentage composition of unknown mixture by viscosity and surface tension methods.
- measure kinetics parameters of chemical reaction.
- evaluate the enthalpy of neutralization.
- calculate the lattice energy of CaCl_2 and solubility of benzoic acid at different temperatures.

Surface Tension and Viscosity:

- To find the relative and absolute viscosity of the given liquid at room temperature.
- To determine the percentage composition of given mixture (non-interacting systems) by viscosity method.
- To find the surface tension of given liquid by drop number method at room temperature.
- To determine the percentage composition of given binary mixture by surface tension method (acetone and ethyl/methyl ketone).

Chemical Kinetics:

- To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To compare the strengths of HCl and H_2SO_4 by studying the kinetics of ethyl acetate.
- To study the reaction rate of decomposition of iodide by H_2O_2 kinetically.

Colloids:

- To prepare arsenious sulfide sol and compare the precipitating power of mono-, bi- and trivalent anions.

Transition Temperature:

- Determination of the transition temperature of given substance by thermometric method (e.g. $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ / $\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$).

Thermo-Chemistry:

- To determine the solubility and heat of reaction of benzoic acid at different temperatures.
- To determine the enthalpy of neutralization of strong acid and strong base.
- To determine the enthalpy of neutralization of weak acid and strong base.
- To determine the enthalpy of solution of solid calcium chloride and calculate its lattice energy using Born-Haber cycle.
- Determination of heat of reaction and verification of Hess's law.

Partition Coefficient:

- To find the partition coefficient of I_2 between CCl_4 and H_2O .

Recommended Books

- Gurtu, G.N., Gurtu, A. (2014). *Advanced Physical Chemistry*, India: Pragati Prakashan .
- Sindhu, P.S. (2005). *Practicals in Physical Chemistry*, India: Macmillan Publishers.

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Organic Chemistry-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of course, the students will be able to:

- explain the structures and properties of biomolecules: carbohydrates, amino acids, proteins and nucleic acids.
- explain the structures, synthesis and properties of different class of organic compounds: nitro compounds, amines, diazonium salts, enolates, pyrrole, thiophene, furan, pyridine, indole, quinoline and isoquinoline.
- discuss the basic principles of UV-visible, IR and NMR spectroscopy.
- elucidate the structure of organic compounds using UV-visible, IR and NMR spectral data.

Unit 1 Carbohydrates:

Classification and nomenclature, monosaccharides: chain lengthening and chain shortening of aldoses, configuration, mechanism of osazone formation, mechanism of mutarotation, interconversion of glucose and fructose, epimerization (conversion of glucose into mannose), determination of ring size of D (+)-glucose and fructose; disaccharides: -sucrose, lactose and maltose (without involving structure determination); polysaccharides: starch and cellulose (without involving structure determination).

Biomolecules:

- (a) **Amino acids:** Classification, structure, acid-base behaviour, isoelectric point; preparation, physical properties and chemical reactions of α -amino acids.
- Peptides and Proteins:** Classification, structure determination, and end group analysis, selective hydrolysis of peptides, solid-phase peptide synthesis.
- (c) **Nucleic acids:** Introduction, constituents of nucleic acids, ribonucleosides and ribonucleotides, double helical structure of DNA.

Unit 2 UV-visible Spectroscopy:

Introduction to electromagnetic spectrum, basic principle, types of electronic transitions, factors affecting the position of absorption bands: conjugation and solvent; concept of chromophore and auxochrome; bathochromic, hypsochromic, hyperchromic and hypochromic shifts; UV-visible spectra of conjugated enes and enones: Woodward and Fieser rules, calculation of λ_{max} of simple molecules; applications: strength of hydrogen bond, geometrical isomerism, keto-enol tautomerism.

Infrared Spectroscopy:

Basic principle, molecular vibrations, Hooke's law, selection rule, intensity and position of IR bands, factors affecting vibrational frequencies: coupled vibrations, Fermi resonance, electronic effects, hydrogen bonding and angle strain; fingerprint region, characteristic absorptions of various functional groups, interpretation of IR spectra of simple organic compounds, applications of IR spectroscopy.

Unit 3 Organic Compounds of Nitrogen:

Nitro Compounds: Nomenclature, preparation of nitroalkanes and nitroarenes, physical properties, chemical reactions of nitroalkanes: acidic character, mechanism of nucleophilic and electrophilic substitution, reduction; chemical reactions of nitroarenes: mechanism of nucleophilic and electrophilic substitution, reduction in acidic, neutral and alkaline media, picric acid: methods of preparation, physical and chemical properties, halonitroarenes: methods of preparation and reactivity.

Amines: Nomenclature and structure, stereochemistry, separation of mixture of amines, preparation of amines: reduction of nitro compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction, Curtius, Schmidt and Lossen rearrangements, physical properties, chemical reactions: structural features affecting basicity of amines, amine salts as phase-transfer catalysts, electrophilic aromatic substitution, diazotization.

Diazonium Salts: Nomenclature and structure, preparation, physical properties, chemical reactions: replacement of diazo group by H, OH, F, Cl, Br, I, NO₂, CN and aryl group; synthetic applications.

Unit 4 Heterocyclic Compounds:

Introduction, classification, nomenclature of five and six-membered rings, molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine; methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution; mechanism of nucleophilic substitution reactions in pyridine derivatives; comparison of basicity of pyridine, piperidine and pyrrole.

Introduction of condensed five and six membered heterocycles; preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer-indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis; mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit 5 Organic Synthesis via Enolates:

Introduction, acidity of α -hydrogens, reactive methylene group- alkylation of diethyl malonate and ethyl acetoacetate, synthesis and reaction of ethyl acetoacetate, Keto-enol tautomerism of ethyl acetoacetate, alkylation of 1,3-dithianes, alkylation and acylation of enamines.

Nuclear Magnetic Resonance Spectroscopy:

Introduction, basic principle, chemical shift, chemical shift parameters, factors affecting the chemical shift, equivalence and non-equivalence protons, spin-spin coupling, coupling constant, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethene, 1,1,2-tribromoethene, ethyl alcohol, ethyl acetate, acetaldehyde, benzaldehyde, toluene and acetophenone.

Recommended Books

- Clayden, J., Greeves, N., Warren, S., & Wothers, P. (2001). *Organic chemistry*. (2nd ed.). Oxford University Press.
- Sykes, P. (1986). *A guide book to mechanism in organic chemistry* (6th ed.). Pearson.
- Ingold, C. K. (1970). *Structure and mechanism in organic chemistry*. Cornell University Press.
- Morrison, R.T., & Boyd, R.N. (2002). *Organic chemistry* (6th ed.). Prentice Hall.
- Nasipuri, D. (1994). *Stereochemistry of organic compounds*. (2nd ed.). New Age International
- Singh, M.S. (2005). *Advanced organic chemistry-reactions and mechanisms*. Pearson Education, Singapore.
- Wade, L.G., & Singh, M. S. (2008). *Organic chemistry*. Pearson Education.
- Singh, M.S. (2014). *Reactive intermediates in organic chemistry-structure, mechanism and reactions*. Wiley, VCH & Weinheim
- Kemp, W. (1991). *Organic Spectroscopy*. (3rd ed.). Palgrave Houndmills. New York.
- Mohan, J. (2001). *Organic Spectroscopy: Principles and Applications*. Narosa Publication, New Delhi.
- Kalsi, P. S., (2016). *Organic Spectroscopy*. (7th ed.). New Age International Publishers, New Delhi
- Silverstein, R. M., Webster, F. X. & Kiemle, D., (2005). *Spectrometric Identification of Organic Compounds*. (7th ed.). John Wiley & Sons.

Suggested e-Sources

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Organic Chemistry-II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes

On completion of course, the students will be able to:

separate compounds by steam distillation.

understand concept of chromatography (TLC) by separation of green leaf pigment, mixture of dyes and organic compounds.

separate organic mixture containing two solid components and their qualitative analysis.

synthesize organic compounds by synthetic methods: acetylation, benzylation, diazotization or coupling reaction and electrophilic substitution.

Steam Distillation (any one of the following)

Naphthalene from its suspension in water.

Clove oil from clove.

Separation of o and p-nitrophenols.

Thin Layer Chromatography

Determination of R_f values and identification of organic compounds:

Separation of green leaf pigment (spinach leaves may be used).

Preparation and separation of 2,4-dinitrophenyl hydrazones of acetone, 2-butanone, hexan-2 and 3-one using toluene and light petroleum (40:60).

Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, NaHCO_3 , NaOH for separation and preparation of suitable derivatives.

Synthesis of Organic Compounds (any two of the following)

Acetylation

Salicylic acid

Aniline

Glucose

Hydroquinone

Aliphatic Electrophilic Substitution

Preparation of iodoform from ethanol and acetone

Aromatic Electrophilic Substitution

Nitration:

Preparation of m-dinitrobenzene

Preparation of p-nitroacetanilide

Halogenation:

Preparation of p-bromoacetanilide

Preparation of 2, 4, 6-tribromophenol

Diazotization / Coupling

Preparation of methyl orange and methyl red

Oxidation

Preparation of benzoic acid from toluene

Reduction

Preparation of aniline from nitrobenzene

Preparation of m-nitroaniline from m-dinitrobenzene

Recommended Books

Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. (1989). *Practical Organic Chemistry* (5th ed.), John Wiley & Sons, Inc., New York.

Suggested e-Sources:

National Programme on Technology Enhanced Learning

<https://nptel.ac.in>

Online Chemistry Courses

<https://www.edx.org/learn/chemistry>

Free Online Education SWAYAM

<https://swayam.gov.in>

Physical Chemistry-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes

On completion of course, the students will be able to:

- explain the basic principles of nuclear chemistry.
- discuss the surface phenomenon, surface properties of solid and calculate the surface area of the adsorbent.
- discuss conductance, Arrhenius theory, Debye-Huckel-Onseger's equation and Nernst equation.
- explain the concept of corrosion and factors affecting corrosion.
- explain the colligative properties of solution.
- Understand the congruent and non-congruent melting points, and azeotropic mixtures.

Unit 1 Nuclear Chemistry:

Nuclear particles, nuclear size, nuclear spin, nuclear magnetic moment, of a nucleus, discovery of radioactivity, decay processes-average life, half life; Rutherford and Soddy transformation, nuclear forces, packing fraction, binding energy, nuclear shell model, liquid drop model, applications of radioisotopes, hot atom chemistry-Szilard-Chalmers reaction.

Surface Chemistry:

General terms used in adsorption, adsorption of gases by solids, factors effecting adsorption, mono and multi layer adsorption, heat of adsorption Freundlich adsorption isotherm, Langmuirs adsorption isotherm and its limitations, determination of surface area of adsorbents, change in enthalpy, entropy and free energy of adsorption, competitive adsorption, mechanism of surface reaction and activation energy.

Unit 2 Solutions, Dilute Solutions and Colligative Properties:

Ideal and non-ideal solutions, deviation from ideal behaviour, method of expressing concentrations of solutions: - normality, molarity, molality, formality, mole fraction, percentage by mass, parts per million (ppm), activity and activity coefficient, dilute solution, Roul't's law, colligative properties: relative lowering of vapour pressure, measurement of vapour pressure lowering, molecular weight determination, osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, relationship between osmotic pressure and vapor pressure, lowering of an ideal solution, measurement of osmotic pressure (The Morse-Frazer method, the Berkeley-Hartley method), elevation in boiling point, depression in freezing point, thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point, experimental methods for determining various colligative properties, abnormal molar mass and Van't Haff factor, degree of dissociation and association of solutes.

Unit 3 Electrochemistry-I:

Electric transport in electrolytic solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation, its uses and limitations, weak and strong electrolytes, Ostwald's dilution law and its uses and limitations, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), transport number, definition and determination by Hittorf method and moving boundary method, applications of conductivity measurement: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of sparingly soluble salt, conductometric titrations.

Unit 4 Electrochemistry-II:

Types of reversible electrodes:-gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrode reactions, relationship between EMF and equilibrium constant, Nernst equation, effect of electrolytic concentration on electrode potential, standard hydrogen electrode, reference electrode, standard electrode potential, derivation of cell

EMF and single electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic Cells: reversible and irreversible cells, conventional representation of electrochemical cells, EMF of a cell and its measurements, calculation of thermodynamic quantities of cell reactions (ΔG , ΔH and K), irreversible electrode potentials-polarization, over potential and its applications, hydrogen over voltage, concentration cell with and without transport, liquid junction potential, applications of concentration cells, valency of ions in doubtful cases, solubility, solubility product and activity coefficient; potentiometric, acid-base, precipitation and redox titrations; brief introduction of redox indicators, definition of pH and pK_a , determination of pH potentiometric methods.

Corrosion: types, theory, factors affecting corrosion and methods of combating of iron against corrosion.

Unit 5 Phase Equilibrium:

Introduction, terminology: phase, component, degree of freedom or variance, criteria of phase equilibrium, dynamic equilibrium, metastable equilibrium, statement of phase rule; solid solutions: compound formation with congruent melting point (Benzophenone-Diphenylamine) and incongruent melting point (Benzene-Picric acid); liquid-liquid mixtures: ideal liquid mixtures, Raoult's and Henry's laws, non-ideal system; azeotropes: - HCl-H₂O and ethanol-water systems; partially miscible liquids: -phenol-water, trimethylamine-water, nicotine-water systems; lower and upper consolute temperature, effect of impurity on consolute temperature.

Distribution Law: thermodynamic derivation, association, dissociation and chemical combination of solute, applications.

Recommended Books

- Atkins, P., Julio, P. D. (2014). *Physical Chemistry* (10th Ed), United Kingdom: Oxford University Press.
- Castellan, G.W. (1983). *Physical Chemistry* (3rd Ed), United State of America: Addison-Wesley Publishing Company.
- West, A. R. (2014). *Solid State Chemistry and its Applications* (2nd Ed), John Wiley & Sons .Ltd
- Puri, B.R., Sharma, L.R., Pathania, M.S. (2016). *Principle of Physical Chemistry* (47th Ed). India: Vishal Publishing Company.
- Arniker, H. J. (2005). *Essentials of Nuclear Chemistry* (4th Ed), India: New Age International Ltd. Publisher.

Suggested e-Sources:

National Programme on Technology Enhanced Learning

<https://nptel.ac.in>

Online Chemistry Courses

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Free Online Education SWAYAM

<https://swayam.gov.in>

Physical Chemistry-II Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of course, the students will be able to:

handle instruments like calorimeter, conductometer and potentiometer.

perform the proper procedures and have the knowledge of regulations for safe handling and use of chemicals.

evaluate physical properties of analytes viz. the molecular weight, conductivity, optical rotation.

Colorimetry

To verify Beer-Lambert law for $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given solution of the substance.

Conductometry (any two)

To determine the strength of the given acid conductometrically using standard alkali solution.

To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.

To study the saponification of ethyl acetate conductometrically.

To determine the ionization constant of a weak acid conductometrically.

Potentiometry

To titrate potentiometrically the given ferrous ammonium sulphate solution using $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ as titrant and calculate the redox-potential of $\text{Fe}^{2+} / \text{Fe}^{3+}$ on system on the hydrogen scale.

Molecular Weight Determination (one of the following)

Determine of molecular weight of a non-volatile solute by Rast method/Beckmann freezing point method.

Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

Refractometry and Polarimetry (one of the following)

To verify the law of refraction of mixtures (e.g. of glycerol and water) using Abb's refractometer.

To determine the specific rotation of a given optically active compound.

Recommended Books

Gurtu, G.N., Gurtu, A. (2014). *Advanced Physical Chemistry*, India: Pragati Prakashan .

Sindhu, P.S. (2005). *Practicals in Physical Chemistry*, India: Macmillan Publishers.

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Free Online Education SWAYAM

<https://swayam.gov.in>

Analytical Chemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes

On completion of course, the students will be able to:

apply knowledge of basic statistics to validate the results of analysis.

understand various chromatographic techniques and its applications in separation of mixtures, purification of samples, and qualitative and quantitative analysis.

apply the concept of electrophoresis.

explain the principle and applications of thermal methods of analysis and atomic spectroscopy

Section-A

Error: types of errors, measurement, accuracy and precision, significant figure, mean, median and standard deviation, correlation and regression.

General introduction to principles and types of chromatography according to shape of chromatographic bed, physical state of mobile phase, mechanism of separation and techniques involved.

Paper Chromatography: principle, types, choice of paper, visualization, applications.

Thin Layer Chromatography (TLC): principle, advantage over paper chromatography, types, preparation of thin layer, choice of sorbent and solvent, development, detection and applications.

High Performance Thin Layer Chromatography (HPTLC): principle, advantage over TLC, instrumentation, choice of sorbent and solvent, development, detection and applications.

Column Chromatography: principle, column efficiency, factors influencing column efficiency, experimental set up and applications.

Section-B

Gas Chromatography (GC): principle, instrumentation, column efficiency, solvent efficiency, solid supports, liquid phase, liquid phase percentage, column temperature, detectors, chromatographic identification, applications.

High Performance Liquid Chromatography (HPLC): principle, types: partition, adsorption, ion-exchange, size-exclusion or gel; instrumentation,

Ion-Exchange Chromatography: principle, types of ion-exchangers, regeneration, ion-exchange capacity, applications.

Electrophoresis: principle, techniques.

Section-C

Molecular Fluorescence, Phosphorescence and Chemiluminescence:

principles of luminescence

instrumentation for fluorescence and phosphorescence

chemiluminescence

applications of luminescence techniques

Atomic Absorption Spectroscopy

principles

atomization process

flame atomization

electrothermal atomization

atomic line widths and radiation sources for AA

instrumentation

interferences

background correction methods

merits, demerits, and applications

Atomic Emission Spectroscopy

atomic spectra

population distribution with temperature

sources: arc, spark and plasma for atomic emission

spectrometers

merits, demerits, and applications

Recommended Books

Christian, G. D. (2004). *Analytical Chemistry*, 6th Ed., New York: John Wiley.

Skoog, D. A., West, D. M., Hollar, F. J. & Crouch S. R. (2014). *Fundamentals of Analytical Chemistry*, 9th Ed., U.S.: Cengage Limited.

Willard, H. L., Merritt, L., Dean, J.A. & Settle, F.A. (2004). *Instrumental Methods of Analysis*, 7th Ed., India: CBS Publishing.

Ewing, G.W. (1985). *Instrumental Methods of Chemical Analysis*, 5th Ed., U.S.: McGraw-Hill College.

Holler, F.J., Skoog, D. A. & Crouch, S. R. (2007). *Principles of Instrumental Analysis*, 6th Ed., New York: Belmont, CA: Thomson Brooks/Cole.

6. Mendham, J., Denney, R.C., Barnes, J.D. & Thomas, M. (2000). *Text Book of Quantitative Inorganic Analysis*, 6th Ed., U.S.: Prentice Hall

Suggested e-Sources

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Online chemistry courses

<https://www.edx.org/learn/chemistry>

Free online education swayam

<https://swayam.gov.in>

Chemistry Lab-I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

On completion of course, the students will be able to:

develop their skills for qualitative and quantitative research in different fields

perform various analytical operations to qualify and quantify different organic and inorganic samples

present information and write reports in a clear, effective and scientific manner

Inorganic Chemistry

Qualitative and Quantitative Analysis:

Qualitative analysis of mixture of salts (soluble and insoluble) containing six radicals including one less common metal ions-Tl, Mo, W, Se, Ti, Zr, Th, Ce, V and U.

Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Fe etc. involving volumetric and gravimetric methods.

Organic Chemistry

Qualitative Analysis:

Analysis of binary mixture using NaHCO_3 , NaOH , H_2O , HCl and organic solvent and preparation of suitable derivatives.

Separation of following binary organic mixture by column chromatography and preparative TLC:

- (a). *o*-bromo and *p*-bromo aniline
- (b). *o*-bromo and *p*-bromo acetanilide
- (c). *o*-nitro and *p*-nitro aniline
- (d). *o*-nitro and *p*-nitro phenol

One-step Organic Synthesis:

Reduction: Synthesis of benzhydrol from benzophenone.

Oxidation: Synthesis of *p*-chlorobenzoic acid from *p*-chlorotoluene.

Aldol condensation: Synthesis dibenzalacetone from benzaldehyde.

Cannizzaro reaction: 4-chlorobenzaldehyde as substrate.

Physical Chemistry

Error Analysis and Statistical Data Analysis:

Errors, types of errors, minimization of errors, error distribution curves, precision, accuracy and combination; statistical treatment for error analysis, students't test, null hypothesis, rejection, criteria, F & Q test, linear regression analysis, curve fitting.

Partition Coefficient

To find out partition coefficient of iodine between CCl_4 and H_2O .

To find out the partition coefficient of benzoic acid between C_6H_6 and water.

Phase Equilibria

Determination of congruent composition and temperature of a binary system (diphenylamine-benzophenone system).

Determination of glass transition temperature of a given salt (CaCl_2) conductometrically.

To construct the phase diagram for three component system (chloroform-acetic acid-water).

Chemical Kinetics

Determination of the effect of (a) change of temperature (b) change of concentration of reactants and catalysts and (c) ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.

Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micellar media.

Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.

Flowing clock reactions (Ref: experiments in physical chemistry by Showmaker).

Determination of the primary salt effect in the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidized by persulphate ion).

To find out the order of reaction between potassium bromate and potassium iodide.

Recommended Books

Surdeep, R. (2016). *Advanced Practical Inorganic Chemistry*, Revised Ed., India: Krishna Prakashan Publication.

Svehla, G. (2010). *Vogel's Qualitative Inorganic Analysis*, 5th Ed., U.S.: Prentice Hall.

Gurtu, J. N. & Gurtu, A. (2011). *Physical Chemistry Vol. I*, India: Pragati Prakashan Publication.

Leonard, J., Lygo, B. & Procter, G. (2013). *Advanced Practical Organic Chemistry*, 3th Ed., U.K.: CRC Press, Taylor & Francis Group.

Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. (1989). *Practical Organic Chemistry*, 5th Ed., New York: John Wiley & Sons, Inc.

Gurtu, G.N., Gurtu, A. (2014). *Advanced Physical Chemistry*, India: Pragati Prakashan Publication.

Sindhu, P.S. (2005). *Practicals in Physical Chemistry*, India: Macmillan Publishers.

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Free Online Education SWAYAM

<https://swayam.gov.in>

Chemistry Lab-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	12	6

Learning Outcomes:

On completion of course, the students will be able to:

develop their skills for qualitative and quantitative research in different fields.

perform various analytical operations to qualify and quantify different analytes.

outline synthetic strategies for important chemicals.

check the purity of synthesized compounds through TLC, conductance and magnetic susceptibility measurements, and UV, FT-IR spectral data

Inorganic Chemistry

Preparation, purification and structural studies (magnetic, electronic and IR) of inorganic complex compounds:

trans-potassium diaquabis (oxalato) chromate (III), $\text{trans-K}[\text{Cr}(\text{ox})_2(\text{H}_2\text{O})_2]$

vanadyl bis (acetylacetonate) $[\text{VO}(\text{acac})_2]$.

sodiumdiamminetetrathiocyanatochromate(III), $\text{Na}[\text{Cr}(\text{NH}_3)_2(\text{SCN})_4]$

bis(acetate)chromate(II), $[\text{Cr}(\text{OAc})_2] \cdot 2\text{H}_2\text{O}$.

cis-potassium diaquabis(oxalato)chromate(III), $\text{cis-K}[\text{Cr}(\text{ox})_2(\text{H}_2\text{O})_2]$

tris(acetylacetonato)manganese(III), $[\text{Mn}(\text{acac})_3]$

potassium trioxalatoferrate(III) trihydrate, $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$.

Prussian blue, $\text{Fe}_3[\text{Fe}(\text{CN})_6]_3$.

sodium hexanitritocobaltate(III), $\text{Na}_3[\text{Co}(\text{ONO})_6]$.

pentaamminemonochlorocobalt(III) chloride, $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$.

pentaammineaquacobalt(III) chloride, $[\text{Co}(\text{H}_2\text{O})(\text{NH}_3)_5]\text{Cl}_2$ by using $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$ as the starting material.

pentaamminenitritocobalt(III) chloride, $[\text{Co}(\text{ONO})(\text{NH}_3)_5]\text{Cl}_2$ by using $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$ as the starting material.

pentaamminenitrocobalt(III) chloride, $[\text{Co}(\text{NO}_2)(\text{NH}_3)_5]\text{Cl}_3$ by using $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$ as the starting material.

Organic Chemistry

Preparation, purification and structural studies (magnetic, electronic and IR) of inorganic complex compounds:

trans-potassium diaquabis(oxalato)chromate(III), $\text{trans-K}[\text{Cr}(\text{ox})_2(\text{H}_2\text{O})_2]$

vanadyl bis(acetylacetonate) $[\text{VO}(\text{acac})_2]$.

sodiumdiamminetetrathiocyanatochromate(III), $\text{Na}[\text{Cr}(\text{NH}_3)_2(\text{SCN})_4]$

bis(acetate)chromate(II), $[\text{Cr}(\text{OAc})_2] \cdot 2\text{H}_2\text{O}$.

cis-potassium diaquabis(oxalato)chromate(III), $\text{cis-K}[\text{Cr}(\text{ox})_2(\text{H}_2\text{O})_2]$

tris(acetylacetonato)manganese(III), $[\text{Mn}(\text{acac})_3]$

potassium trioxalatoferrate(III) trihydrate, $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$.

Prussian blue, $\text{Fe}_3[\text{Fe}(\text{CN})_6]_3$.

sodium hexanitritocobaltate(III), $\text{Na}_3[\text{Co}(\text{ONO})_6]$.

pentaamminemonochlorocobalt(III) chloride, $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$.

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pentaamminenitrocobalt(III) chloride, $[\text{Co}(\text{ONO})(\text{NH}_3)_5]\text{Cl}_2$ by using $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$ as the starting material.

pentaamminenitrocobalt(III) chloride, $[\text{Co}(\text{NO}_2)(\text{NH}_3)_5]\text{Cl}_3$ by using $[\text{Co}(\text{ONO})(\text{NH}_3)_5]\text{Cl}_2$ as the starting material.

Green Methods of Preparation

bis(acetylacetonato)copper(II)

tris(acetylacetonato)iron(III)

tris(acetylacetonato)manganese(III)

Quantitative Analysis

Determination of the percentage of number of hydroxyl groups in an organic compound by acetylation method

Estimation of amines/phenols using bromate-bromide solution or acetylation method

Determination of iodine and saponification values of an oil sample

Determination of DO, COD and BOD of water sample.

Two-Steps Organic Synthesis

Anthranilic acid from phthalic anhydride (Phthalic anhydride $\rightarrow$ Phthalimide $\rightarrow$ Anthranilic acid).

Hydroquinone to 2,5-dihydroxyacetophenone (Hydroquinone $\rightarrow$ Hydroquinone diacetate $\rightarrow$ 2,5-dihydroxyacetophenone).

2,4-dinitrophenylhydrazine from Chlorobenzene (Chlorobenzene $\rightarrow$ 2,4-dinitrochlorobenzene $\rightarrow$ 2,4-dinitrophenylhydrazine).

Anthroquinone from phthalic anhydride (phthalic anhydride $\rightarrow$ o-benzoyl benzoic acid $\rightarrow$ Anthroquinone).

Acridone from o-chlorobenzoic acid (o-chlorobenzoic acid $\rightarrow$ N-Phenylanthranilic acid $\rightarrow$ Acridone)

Physical Chemistry

Solutions:

Determination of molecular weight of non-volatile and non-electrolyte/ electrolyte by cryoscopic method and to determine the activity coefficient of an electrolyte.

Determination of the degree of dissociation of weak electrolyte and to study the deviation from ideal behavior that occurs with a strong electrolyte.

Electrochemistry

Conductometry:

Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically

Determination of solubility and solubility product of sparingly soluble salts (e.g. PbSO_4 , BaSO_4) conductometrically.

Determination of the strength of strong and weak acids in a given mixture conductometrically.

To study the effect of solvent on the conductance of AgNO_3 /acetic acid and to determine the degree of dissociation and equilibrium constant in different solvents and in their mixtures (DMSO, DMF, dioxane, acetone and water) and to test the validity of Debye-Huckel-Onsager theory.

Determination of the activity coefficient of zinc ions in the solution of 0.002M zinc sulphate using Debye-Huckel's limiting law.

Potentiometry/pH metry:

Determination of strength of halides in a mixture potentiometrically.

Determination of the valency of mercurous ions potentiometrically.

Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter.

Determination of temperature dependence of EMF of a cell.

Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.

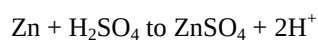
Acid-base titration in a non-aqueous media using a pH meter.

Determination of activity and activity-coefficient of electrolyte.

Determination of the dissociation constant of acetic acid in DMSO, DMF, acetone and dioxane by titrating it with KOH.

Determination of the dissociation constant of monobasic/dibasic acid by Albert-Serjeant method.

Determination of thermodynamic constant ΔG , ΔS and ΔH for the reaction by EMF method.



Polarimetry:

Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.

Enzyme kinetics-inversion of sucrose

Recommended Books:

Gurdeep, R. (2016). *Advanced Practical Inorganic Chemistry*, revised Ed., Krishna Prakashan publication.

Svehla, G. (2010). *Vogel's Qualitative Inorganic Analysis*, 7th Edition, Prentice Hall.

Gurtu, J. N. and Gurtu, A. (2011). *Physical Chemistry Vol – I*, Pragati Prakashan publication.

Leonard, J., Lygo, B., & Procter, G. (2013). *Advanced Practical Organic Chemistry* (3rd ed.). CRC Press, Taylor & Francis Group.

Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. (1989). *Practical Organic Chemistry* (5th ed.). New York, John Wiley & Sons, Inc.

Gurtu, G.N., Gurtu, A. (2014). *Advanced Physical Chemistry*, India: Pragati Prakashan.

Sindhu, P.S. (2005). *Practicals in Physical Chemistry*, India: Macmillan Publishers.

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Cyclic Voltammetry and Spectroscopic Techniques

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The students are required to answer five questions in all selecting not more than two questions from each section.

Section-A

Corrosion:

Scope and economics of corrosion, causes and types of corrosion, electrochemical theories of corrosion, kinetics of corrosion (corrosion current and corrosion potential). Corrosion measurements (weight loss, OCP measurement, and polarization methods), passivity and its breakdown. Corrosion prevention (electrochemical, inhibitor, and coating methods).

Cyclic Voltammetry:

Instrumentation, current-potential relation applicable for Linear Sweep Voltammetry (LSV) and Cyclic Voltammetry (CV), interpretation of cyclic voltammograms and parameters obtainable from voltammograms.

Section-B

Rotational (Microwave) Spectroscopy:

Principal moment of inertia, classification of rotors: rigid rotor and non rigid rotor, selection rule (rigid rotor), effect of isotopic substitution frequencies, linear polyatomic molecules, non-linear polyatomic molecules, asymmetric Top molecules, relative intensities of spectral lines, stark effect, nuclear and electron spin interaction, instrumentation and application.

Raman Spectroscopy:

Raman Effect, theory of Raman Effect (quantum mechanical and classical), rotational Raman spectra, vibrational Raman spectra, rule of mutual exclusion and structure determination, instrumentation, presentation of spectra, determination of depolarization ratio (ρ_n) and application.

Section-C

Photo Electron Spectroscopy (PES):

Principles of photoelectron spectroscopy, PES and Koopman's theorem, types of PES, photo ionization constant, chemical shift in Electron Spectroscopy for Chemical Analysis(ESCA), instrumentation, techniques of PES, atomic and molecular electron spectra, application of ESCA.

Electron Diffraction:

Principle, scattering intensity and scattering angle, Wierl equation, measurement techniques, Elucidation of simple gas phase molecules, low energy electron diffraction(LEED)and structure surfaces, application of electron diffraction.

Neutron Diffraction:

Theory of neutron diffraction, scattering of neutron by solid and liquids, magnetic scattering, measurement techniques, Elucidation of Structure of Magnetically ordered unit cell, application of neutron diffraction.

Books Suggested:

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Fundamental of molecular spectroscopy, Colin N. Banwell and Elaine M. McCash.
3. Spectroscopy, A pragati Edition, H. Kaur.
4. Introduction to Spectroscopy by Donald L. Pavia, Gary M. Lampman & George S. Kriz. 4th Edition, 2009, Thomson Learning.
5. Principles of Physical Chemistry, Puri, Sharma, Pathania.

6. Introduction to Molecular Spectroscopy, G.M. Barrow.
7. Modern Spectroscopy, J.M. Hollas.
8. Rotational Spectroscopy of Diatomic Molecules, John M. Brown

Inorganic Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Structure, Reactivity and Bonding:

(a) Structure and Reactivity of Main Group Elements: VSEPR, Walsh diagrams (AB₂ and AB₃ molecules e.g. H₂O and BH₃), $d\pi-p\pi$ bonds, Bent's and energetics of hybridization, some simple reaction of covalently bonded molecules.

(b) Bonding in Metal Complexes: Molecular orbital theory: octahedral, tetrahedral and square planar complexes, π bonding, η^2 , η^3 , η^5 , η^6 system with reference to molecular orbital theory.

Section-B

Reaction Mechanism of Transition Metal Complexes:

Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic and thermodynamic stability of metal complexes, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal-ligand bond cleavage, substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reactions, redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Section-C

Inorganic Polymers:

Classification, types of inorganic polymerization, comparison with organic polymers, boron-oxygen and boron-nitrogen polymers, silicones, coordination polymers, phosphorus-nitrogen, sulfur-nitrogen, sulfur-nitrogen-fluorine compounds. Chalcogenide clusters – binary and multi-component systems, homolytic inorganic systems

Books Suggested: -

1. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
2. Inorganic Chemistry, J. E. Huheey, Harpes & Row.
3. Chemistry of the Element, N. N. Greenwood and A. Earnshaw, Pergamon.
4. Magnetochemistry, R.L.Carlin, Springer Verlag.
5. Comprehensive Coordination Chemistry, G.Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.

Organic Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The students are required to answer five questions in all selecting not more than two questions from each section.

Section-A

Aromaticity:

Huckel's MO (HMO) theory, PMO theory, aromaticity in benzenoid and non-benzenoid compounds; Huckel's rules, aromatic, anti-aromatic, homo-aromatic compounds; alternate and non-alternate hydrocarbons; fullerenes.

Addition compounds:

Crown ethers, phase transfer catalysis, ionic liquids, inclusion compounds and cyclodextrins.

Reaction Mechanism and its Determination:

Types of mechanism, potential energy diagram, transition states and intermediates, methods of determining mechanisms (product analysis, intermediates analysis, isotope effect, kinetic and stereochemical studies).

Reactive Intermediates:

Generation, structure, stability and reactivity of carbocation, carbanion, free radical, carbene, nitrene and arynes.

Section-B

Stereochemistry:

Conformational analysis of decalins, effects of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding, threo and erythro isomers, enantiotopic and diastereotopic atoms, groups faces, stereospecific and stereoselective synthesis, asymmetric (chiral pool and chiral auxiliaries), optical activity in the absence of chiral carbon (biphenyl, allenes and spirans).

Section-C

Aliphatic Nucleophilic Substitution:

The SN₂, SN₁, mixed SN₁ and SN₂, S_Ni and SET mechanisms; effects of substrate structure, attacking nucleophile, leaving group and reaction medium on the types of mechanism; nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon atom; neighbouring group participation by π - and σ -bonds, classical and non-classical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements: acid catalysed rearrangement of carbonyl compounds, rearrangement of epoxides, transannular rearrangement, rearrangement of camphene hydrochloride to isobornyl chloride; ambident nucleophile, regioselectivity.

Books Suggested:

1. Advanced Organic Chemistry: Reactions, Mechanism and Structure, Jerry March, John Wiley
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
5. Organic Chemistry, R. T. Morrison and R. N. Hall, Prentice-Hall.
6. Modern Organic Reactions, Benjamin H.O. House.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
8. Reaction Mechanism in Organic Chemistry, S. M. Mukherjee and S. P. Singh, Macmillan.
9. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.

Organic Reaction Mechanism

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The students are required to answer five questions in all, selecting not more than two questions from each section.

Section-A

Aromatic Electrophilic Substitution:

The arenium ion mechanism, orientation and reactivity, energy profile diagrams, the ortho/para ratio, ipso attack, diazonium coupling, Vilsmeier Haack reaction, Gattermann-Koch reaction.

Aromatic Nucleophilic Substitution:

The S_NAr, benzyne and S_{RN}1 mechanisms, reactivity effect of substrate structure, leaving group and attacking nucleophile, Von-Richter, Sommelet-Hauser and Smiles rearrangements.

Free Radical Reactions:

Types of free radical reactions, free radical substitution mechanism, allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction, free radical rearrangements, Hunsdiecker reaction.

Section-B

Addition to Carbon-Carbon Multiple Bonds:

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals; regio and chemoselectivity, orientation and reactivity, hydroboration, Michael reaction, Sharpless asymmetric epoxidation.

Addition to Carbon-Hetero atom Multiple Bonds:

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles, addition of Grignard reagents, organozinc and organolithium reagents to saturated and unsaturated carbonyl compounds; Wittig reaction, mechanism of condensation reactions involving enolates - Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

Elimination Reactions:

The E1, E2 and E1CB mechanisms, orientation of the double bond, reactivity effect of substrate structures, attacking base, the leaving group and the medium, mechanism and orientation in pyrolytic elimination.

Section-C

Pericyclic Reactions:

Introduction, classification of pericyclic reactions, frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allylic systems; molecular orbital symmetry: σ -plane and C₂-axis, molecular orbitals of polyene systems, analysis of pericyclic reactions: - correlation diagram, FMO method and PMO approach; electrocyclic reactions: - conrotatory and disrotatory motions, 4n and 4n+2-systems; cycloadditions: - classification, antarafacial and suprafacial additions, 2^o + 2^o and 4^o + 2^o addition, 2^o + 2^o addition of ketenes; sigmatropic rearrangements: - suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3- and 5,5-sigmatropic rearrangements, Claisen and Cope rearrangements.

Books Suggested:

1. Advanced Organic Chemistry: Reactions, Mechanism and Structure, Jerry March, John Wiley
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.

3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Hall, Prentice-Hall.
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
8. Pericyclic Reactions, S.M. Mukherjee, Macmillan, India.
9. Reaction Mechanism in Organic Chemistry, S.M. Mukherjee and S.P. Singh, Macmillan.

Physical Chemistry

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Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The students are required to answer five questions in all selecting not more than two questions from each section.

Section-A

Quantum Chemistry:

- (a) **Introduction quantum mechanics :** The Schrodinger equation and the postulates of quantum mechanics, discussion of solutions of the Schrodinger equation to some model systems viz. particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom.
- (b) **Approximate methods:**
The variation theorem, linear variation principle perturbation Theory (first order and non-degenerate) and applications of Variation method and perturbation theory to the hydrogen atom.

Section-B

Thermodynamics:

Partial molar properties, partial molar free energy, partial molar volume and partial molar heat constant and their significance, determination of these quantities, chemical potential and its variation with temperature and pressure, degree of advancement of reaction, de Donder's treatment of chemical equilibria, variation of equilibrium constant with temperature and pressure, Le Chatelier principle and its thermodynamic derivation, fugacity of gases and mixture of ideal and real gases, determination of fugacity and its variation with temperature and pressure, thermodynamic functions of mixing, ideal solutions and Raoult's laws, Henry's law, solubility behavior of ideal solutions.

Section-C

Chemical Dynamics:

Collision theory of reaction rates, steric factors, activated complex theory, Arrhenius equation and activated complex theory, reactions in solution ion and ion-dipole interactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions (Lindman's theory), homogeneous catalysis and kinetics of enzyme catalysis.

Nuclear and Radiochemistry:

Nuclear structure and nuclear stability, radioactive decay and equilibrium, nuclear reactions, Q-value, cross sections, types of reactions (nuclear fission and fusion), fission products and yields, radioactive techniques, tracer technique, neutron activation analysis, counting techniques: GM, ionization counter.

Books Suggested:

1. Atkin's Physical Chemistry by Peter Atkins & Julio de Paula, 8th Edition, Oxford University Press.
2. Physical Chemistry by Gilbert W. Castellan, 3rd Edition.
3. Introduction to Quantum Chemistry, A. K Chandra, Tata McGraw Hill
4. Quantum Chemistry, Ira N. Levine, Prentice Hall
5. Coulson's Valence, R. Mc Weeny ELBS
6. Chemical Kinetics, K.J. Laider, McGraw Hill
7. Kinetics and Mechanism of Chemical Transformations, J. Rajaraman and J. Kuriacose, McMilan
8. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum

Spectral Techniques in Inorganic Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Electronic Spectroscopy:

Spectroscopic ground states, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d1-d9 states); spectrochemical series, calculations of Dq , B and C parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information, anomalous magnetic moments, magnetic exchange coupling and spin crossover, structural evidence from electronic spectra.

Section-B

Nuclear Magnetic Resonance (NMR) spectroscopy:

Application of chemical shifts, signal intensities and spin-spin coupling to structure determination of inorganic compounds carrying NMR active nuclei like ^1H , ^{11}B , ^{15}N , ^{19}F , ^{29}Si , ^{31}P , effect of fast chemical reactions, coupling to quadrupolar nuclei, NMR of paramagnetic substances in solution, nuclear and electron relaxation time, contact shift, pseudo-contact shift, contact and pseudo-contact shift for transition metal ions, contact shift and π -electron delocalization, application to planar tetrahedral equilibrium, contrast agents.

Mossbauer Spectroscopy:

Doppler shift and recoil energy, isomer shift and its interpretation, quadrupole interactions, effect of magnetic field on Mossbauer spectra, applications to metal complexes, metal carbonyls, Fe-S cluster and tin compounds.

Section-C

Electronic Paramagnetic Resonance (EPR) spectroscopy: Electronic Zeeman effect and EPR transition energy, EPR spectrometers, presentation of spectra. effects of electron Zeeman, Hyperfine splittings in isotropic systems, spin polarization mechanism and McConnell's relations Anisotropy in g -value, EPR of triplet states, zero field splitting, Kramer's rule, survey of EPR spectra of first row transition metal ion complexes.

Nuclear Quadrupolar Resonance (NQR) spectroscopy: Quadrupolar moment, energy levels of a quadrupolar nucleus and effect of asymmetry parameters and energy levels, Effect of an external magnetic field, selected examples for elucidation of structural aspects of inorganic compounds using NQR spectroscopy.

Books Suggested:

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley
2. Inorganic Chemistry, J.E. Huheey, Harper & Row, 1983 Science
3. Chemistry of the Elements, N.N. Greenwood and A. Earnshaw's, Pergamon
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier
5. Comprehensive Coordination Chemistry, G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.
6. Ebsworth, E. A. V. Structural Methods in Inorganic Chemistry Blackwell Scientific Publications (1991).
7. Drago, R. S. Physical Methods in Chemistry W. B. Saunders Co.: U.K. (1977).
8. Carrington, A. & McLachlan, A. D. Introduction to Magnetic Resonance Chapman & Hall: N.Y. (1983).
9. Mabbs, F. E. & Machin, D. J. Magnetism and Transition Metal Complexes Chapman and Hall: U.K. (1973).

Spectroscopy

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The students are required to answer five questions in all selecting not more than two questions from each section.

Section-A

Fundamentals of Spectroscopy:

Electromagnetic radiation, Born-Oppenheimer approximation, types of spectra, intensity of spectral lines, transition probability, natural line width and natural line broadening, selection rules.

UV Spectroscopy:

Principles of absorption spectroscopy, nature of electronic excitations, the origin of UV bands, chromophores, auxochromes, factors affecting the position of UV bands, calculation of λ_{max} qualitative and quantitative applications.

Infrared Spectroscopy:

Modes of vibration, vibrations of polyatomic molecules, theory, the Hook's law and calculation of frequencies for different types of bonds, IR spectrometer, sample handling, anharmonicity, overtones, combination bands, Fermi resonance, group frequencies, factors affecting the band positions and intensities, applications.

Section-B

One-dimensional Nuclear Magnetic Resonance Spectroscopy:

Nuclear spin, nuclear resonance, basic theory, equivalent and non-equivalent protons, shielding and deshielding of nuclei, chemical shift and its measurements, factors influencing chemical shifts, instrumentation of NMR, spin-spin interactions, factors influencing coupling constant 'J', classification of spectra, types of spin systems (AX, ABX, AMX, ABC, A2B2, AA'MM'X etc.), shift reagents, spin decoupling, protons on oxygen, nitrogen and sulphur (proton exchange), nuclear overhauser effect, applications of NMR spectroscopy.

Two-dimensional Nuclear Magnetic Resonance Spectroscopy:

Introduction, pulse sequence, 2D-experiments, data collection, processing and plotting of 2D spectra, general procedure for running 2D spectra, COSY, DQF-COSY, TOCSY, NOESY, ROESY, INADEQUATE, HETCOR, HSQC, HMQC, HMBC.

Section-C

¹³C NMR Spectroscopy:

Carbon-13 nucleus, chemical shifts and their calculation, spin-spin coupling with ¹H, ¹³C, cross-polarization, nuclear overhauser effect, DEPT.

Mass Spectrometry:

Basic principles, production of ions by electron impact, chemical ionization and field desorption techniques, separation and detection of ions, mass spectrum, empirical rules for fragmentation of organic molecules, identification of molecular ion peaks, base peaks, metastable peaks and isotopic peaks, determination of molecular weight and molecular formula of compounds, nitrogen rule, hydrogen deficiency index; introduction to GCMS, LCMS and HRMS.

Structure Elucidation:

Combined structure elucidation problems based on UV, IR, NMR and MS spectral data to find out the structure of simple organic compounds.

Books Suggested:

1. Introduction to Spectroscopy by Donald L. Pavia, Gary M. Lampman & George S. Kriz. 4th Edition, 2009, Thomson Learning.
2. Organic Spectroscopy: Principles and Applications by Jag Mohan, Narosa Publication, New Delhi.
3. Organic Spectroscopy by P.S. Kalsi, New Age International Publishers, New Delhi.
4. Spectrometric Identification of Organic Compounds by Robert M. Silverstein, Francis X. Webster, David Kiemle. 7th Edition, John Wiley & Sons.
5. Mass Spectrometry: Principles and Applications by Edmond de Hoffmann & Vincent Stroobant. 3rd Edition, 2007, John Wiley & Sons.
6. Organic Structure Determination Using 2-D NMR Spectroscopy: A Problem-Based Approach (Advanced Organic Chemistry) by Jeffrey H. Simpson. 2008, Elsevier.

Advanced Inorganic Chemistry

L T P C

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Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Principles and concepts of Green Chemistry:

Introduction, definition, principles, atom economy, atom economic and atom uneconomic reaction, reducing toxicity, waste minimization techniques, on-site waste treatment, design for degradation, polymer recycling.

Catalysis and Green Chemistry:

Introduction to catalysis, heterogeneous catalysis-basics, zeolites, sulfonated resins, clays, oxidation, catalytic converters; homogeneous catalysis-transition metal catalysis, asymmetric catalysis; phase transfer catalysis, bio catalysis, photo catalysis.

Green Solvents:

Organic solvents, solvent-free systems, controlling of solvent-free reactions, supercritical fluids (H₂O and CO₂)-introduction, extraction, advantages and applications; ionic liquids-synthesis.

Section-B

Metal π -Complexes-I:

Metal carbonyls:-preparation, important reactions, structure, bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation.

Metal π -Complexes-II:

Structure and important reaction of transition metal nitrosyl, dinitrogen and dioxygen complexes, tertiary phosphine as a ligand.

Metal Clusters:

Higher boranes, carboranes, metalloboranes and metallocarboranes, compounds with metal-metal multiple bonds, metal carbonyl and halide clusters.

Section-C

Supramolecular Chemistry:

Molecular recognition, molecular receptors for different types of molecules including arisonic substrates, design and synthesis of co-receptor molecules and multiple recognition, supramolecular reactivity and catalysis, transport processes and carrier design, supramolecular devices: - electronic, ionic and switching devices, supramolecular photochemistry, some example of self assembly in supramolecular chemistry.

Books Suggested:

1. Green Chemistry: An Introductory Text, Mike Lancaster, Royal Society of Chemicals, Cambridge,
2. Green Chemistry: Frontiers in Benign Chemical Synthesis and Processes, Edited by Paul T. Anastas & Tracy C. Williamson, Oxford University Press.

3. Green Chemical Syntheses and Processes: Edited by Paul T. Anastas, Lauren G. Heine & Tracy C. Williamson, ACS Symposium Series.
4. Green Chemistry: Environment Friendly Alternatives, Edited by Rashmi Sanghi, M. M. Srivastava, Narosa Publishing House, New Delhi.
5. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley
6. Inorganic Chemistry, J.E. Huhey, Harpes & Row
7. Principle of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
8. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Valentine, University Science Books.
9. Inorganic Biochemistry, Vols I & II. Ed. G.L. Eichhorn, Elsevier.
10. Supramolecular Chemistry, J.M. Lehn, VCH

Advanced Physical Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Oscillatory Reactions:

Autocatalysis and oscillatory reactions, Kinetics and mechanism of Belousov-Zhabotinski (B-z) reactions

Thermodynamics:

Thermodynamics of non-ideal solutions, chemical potential in non-ideal solution, excess functions of non-ideal solutions, experimental determination of excess function, calculation of partial molar quantities from experimental data.

Chemical Kinetics:

Mechanism of Composite Reactions - types of composite mechanisms, rate equations for composite mechanisms, simultaneous and consecutive reactions, steady state treatment, rate-determining steps, microscopic reversibility dynamic chain ($\text{H}_2\text{-Br}_2$ reaction, decomposition of ethane and acetaldehyde).

Section-B

Statistical Thermodynamics:

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition functions. Heat capacity behaviour of solids-chemical equilibria and equilibrium constant in terms of partition functions, Fermi-Dirac Statistics, distribution law, Bose-Einstein statistics distribution Law.

Non-Equilibrium Thermodynamics:

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non-equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

Section-C

Electrochemistry:

Electrochemistry of solutions, activity, activity coefficient, Debye-Huckel theory for activity coefficient of electrolytic solutions, determination of activity and activity coefficient by EMF methods (with and without). Debye-Huckel-Onsager treatment and its extension, ion solvent interactions: thermodynamics of electrified interface equations, Lippmann equations (surface excess), determination of surface excess, structure of electrified interfaces double layer: parallel-plate condenser model (Helmholtz-Perrin theory), Guoy-Chapman model, Stern model, exchange

current density, derivation of Butler-Volmer equation, equation of tunneling, Wentzel, Kramer and Brillouin(WKB) approximation, polarography theory, Ilkovic equation; half wave potential and its significance.

Books Suggested:

1. Bard, A. J. Faulkner, L. R. Electrochemical Methods: Fundamentals and Applications, 2nd Ed., John Wiley & Sons: New York, 2002.
2. Bockris, J. O' M. & Reddy, A. K. N. Modern Electrochemistry 1: Ionics 2nd Ed., Springer (1998).
3. Bockris, J. O' M. & Reddy, A. K. N. Modern Electrochemistry 2B: Electrodics in Chemistry, Engineering, Biology and Environmental Science 2nd Ed., Springer (2001).
4. Bockris, J. O' M., Reddy, A. K. N. & Gamboa-Aldeco, M. E. Modern Electrochemistry 2A: Fundamentals of Electrodics 2nd Ed., Springer (2001).
5. Brett, C. M. A. & Brett, A. M. O. Electrochemistry Oxford University Press (1993).
6. Koryta, J., Dvorak, J. & Kavan, L. Principles of Electrochemistry John Wiley & Sons: NY (1993).
7. Pilling, M. J. & Seakins, P. W. Reaction Kinetics Oxford Press (1997).
8. Laidler, K. J. Chemical Kinetics 3rd Ed., Benjamin Cummings (1997).

Bioinorganic Chemistry

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Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Metal Ions in Biological Systems:

Fundamentals of inorganic biochemistry, essential and non-essential elements in bio-systems, role of alkali/alkaline earth metals in bio-systems, Na⁺ / K⁺ pump, toxic metal ions and their detoxification, chelation therapy/chelating agents in medicine, recent advances in cancer chemotherapy using chelates.

Metalloenzymes:

Zinc enzymes: - caboxyptidase and carbonic anhydrase; copper enzyme:- superoxide dismutase; molybdenum oxatransferase enzymes:- xanthine oxidase, coenzyme vitamin B12.

Section-B

Transport and Storage of Dioxygen:

Heme proteins and oxygen uptake, structure and function of hemoglobin, myoglobin, hemocyanin and hemerythrin, models of synthetic complexes of iron, cobalt and copper. Iron enzymes: - catalase, peroxidase and cytochrome P-450

Electron Transfer in Biological Systems:

Structure and function of metalloproteins in electron transport processes, cytochromes and iron-sulphur proteins, flavoproteins and synthetic models.

Section-C

Metalloproteins in Energy Transmission:

Metal complexes in transmission of energy, structure and reactivity of chlorophylls, photosystem-I and photosystem-II in cleavage of water, model systems, DNA interaction with transition metal complex, DNA-protein interaction with special reference to zinc finger proteins.

Biological Nitrogen Fixation:

Fixation of nitrogen biologically and non-biologically, spectroscopic and other evidences, transition metal sulphide models for nitrogenase sites, Fe-Mo-S cluster models for Fe-Mo-Co.

Books Suggested:

1. Principles of Bioinorganic Chemistry, S.J. Lippard and L.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books
3. Inorganic Biochemistry vols. I and II ed. G.L. Eichhorn, Elsevier
4. Progress in Inorganic Chemistry Vols. 18 and 38 ed. J.J. Lippard, Wiley.

Bioorganic Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Amino acids and Proteins:

Classification, identification, general method of preparation and reactions of amino acids; primary, secondary, tertiary and quaternary structure of protein; analysis of polypeptides and proteins.

Nucleic Acids: Retrosynthetic analysis of Nucleic Acids- Nucleotides, Nucleosides, Nucleobases (A,T,G,C and U), Sugars (Ribose and deoxyribose). Assembly of oligonucleotide chain: Synthesis of polymer support, Nucleosides and Nucleotides, solid phase synthesis of oligonucleotides (DNA/RNA) through phosphoramidite and phosphorothionate approach. Application of protecting groups (-NH₂ and -OH functions, Base and Acid labile) and their deprotection and purification. Concept of depurination.

Lipids:

Classification, nomenclature, physical and chemical properties of fatty acids and triglycerols, analysis of lipids.

Section-B

Enzymes:

Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation, nomenclature and classification, Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis, enzyme kinetics, Michaelis-Menten and Lineweaver-Burk plots, reversible and irreversible inhibition.

Mechanism of Enzyme Action:

Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion, examples of some typical enzyme mechanisms for chymotrypsin, ribonuclease and lysozyme.

Section-C

Co-Enzyme Chemistry:

Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes, structure and biological functions of coenzyme-A, thiamine pyrophosphate, pyridoxal phosphate, NAD⁺, NADP⁺, FMN, FAD, lipoic acid, vitamin B12, mechanisms of reactions catalyzed by the above cofactors.

Applications of Enzymes:

Large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, enzymes and recombinant DNA technology, enzyme catalyzed organic reactions.

Books Suggested:

1. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-Verlag.
2. Enzyme Chemistry: Impact and Application Ed. Collin J. Suckling, Chapman and Hall.
3. Enzyme Mechanisms, Ed. M. I. Page and A. Williams, Royal society of chemistry
4. Fundamentals of Enzymology, N. C. Price and L. Stevens, Oxford University press.
5. Immobilized Enzyme: Introduction and Application in Biotechnology, Michael D. Trevan, John Wiley.
6. Enzymatic Reaction Mechanisms, C. Walsh, W. H. Freeman
7. Enzyme Structure and Mechanism, A Fersht, W. H. Freeman.
8. Principles of Biochemistry, A.L. Lehninger, (1992) CBS Publishers, Delhi.
9. Fundamentals of Biochemistry, D. Voet, J.G. Voet & CW Pratt, (1999) John Wiley & Sons, New York.
10. Biological Chemistry, 2nd Edition, H.R. Mahler and E.H. Cordes, (1971) Harper and Row Pub., New York.
11. Bioorganic Mechanisms, T.C. Bruice and S. Bentkovic, Vol. I & II, (1966) W. A. Benjamin, New York.

Chemistry Lab - III

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Max. Marks : 100
(CA: 40 + ESA: 60)

Inorganic Chemistry

I. Estimation and Separation:

1. Estimation of Nitrogen by Kjeldahl's Method.
2. Estimation of Sulphur / Halogen by Fusion Method.
3. Separation of Cu, Co and Zn on paper strips.
4. Separation of Cu and Ni on cellulose column.
5. Separation and determination of Zn and Cd using Ion Exchanger.
6. Separation and determination of Co and Ni using Ion Exchanger.
7. Separation and determination of chloride and bromide using Ion Exchanger.
8. Evaporation and determination of chloride and iodide using Ion Exchanger.
9. Separation and spectrophotometric determination of Cu, Fe, and Ni using Ion Exchanger.
10. Separation and determination of Cl⁻ and I⁻ (aqueous-acetone medium).

II. Solvent Extraction:

1. Determination of Fe(III) by chloride extraction in ether.
2. Determination of Fe(III) as the 8-hydroxy quinolate (oxinate) by extraction in chloroform.

Organic Chemistry

Qualitative Analysis

Separation, purification and identification of the components of a mixture of three organic compounds (three solids, two liquids and one solid, two solids and one liquid) using the chemical analysis.

Three-steps Organic Synthesis

The exercises should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques:

1. Benzene → Benzophenone → Benzpinacol → Benzpinacolone
2. Benzophenone → Benzophenoneoxim → Benzanilide → Benzoic acid + Aniline
3. Benzaldehyde → Benzoin → Benzil → Benzilic acid
4. Aniline → Acetanilide → p-nitroacetanilide → p-nitroaniline
5. Hydroquinone → Benzoquinone → Adduct → Dihydroxytritycene
6. Benzene → 3-benzoyl propanoic acid → 4-Phenyl butanoic acid → α-Tetralone

Physical Chemistry

Electrochemistry:

1. Titrate a mixture of copper sulphate, acetic acid and sulphuric acid with sodium hydroxide.
2. Titrate phosphoric acid potentiometrically against sodium hydroxide.
3. Determine the dissociation constant (pK_a) of a weak acid using pH meter.
4. Determine the Hammett Constant of a given substituted benzoic acid by pH measurement.
5. Determine the acidic and basic dissociation constant of an amino acid and hence the isoelectric point of the acid.
6. To determine the hydrolysis constant of aniline hydrochloride by pH measurement.

Magneto Chemistry:

1. To determine the magnetic susceptibility of a given compound and hence calculate unpaired electron present in it.
2. To verify the Weidemann's law using Nickel Chloride solution.

Colorometry:

1. To determine equilibrium quotient for the formation of monothiocynato iron III complex by colorometric measurement.
2. Investigate the reaction Kinetics between potassium persulphate and potassium iodide by colorometric measurement.
3. Determine the concentration of Cu^{2+} ions in given solution titrating with EDTA solution by colorometric measurement.

Phase Equilibrium:

1. To draw the mutual solubility curve of two immiscible liquid and to find out the critical solution temperature of Phenol- water-system.
2. To obtain the phase diagram of water – ethanol-benzene system at room temperature.

Potentiometry:

1. To find out the strength of cobalt sulphate solution by titrating it against a standard solution of potassium ferricyanide, potentiometrically.
2. To determine the solubility and solubility product of sparingly soluble salt potentiometrically.

Polarographic:

1. To plot a polarogram for a mixed solution of Cd^{2+} , Zn^{2+} and Mn^{2+} ions in 0.1 M KCl.
2. To determine the half wave potential of Cd^{2+} , Zn^{2+} ion in 0.1 M KCl.

Chemistry Lab - IV

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Max. Marks : 100
(CA: 40 + ESA: 60)

Inorganic Chemistry:

- Quantitative analysis of tri-component mixture of metal ions by gravimetrically, volumetrically and spectrophotometrically.
 - Mixed solution of Cu^{2+} - Ni^{2+} - Zn^{2+}
 - Mixed solution of Cu^{2+} - Ni^{2+} - Fe^{3+}
- Spectrophotometric determination:
 - Manganese / Chromium / Vanadium in steel sample.
 - Iron-phenanthroline complex: Job's method of continuous variation.
 - Zirconium-Alizarin red complex: Slope ratio method.
 - Phosphate, Nitrite, Fluoride and Sulphate
- Analysis of dolomite.
- Analysis of brass.
- Colorimetric determination of chromium (VI) (in ppm) using 1,5 diphenyl carbazide as a reagent for colour development.

Organic Chemistry:

- Column Chromatography
Separation of typical binary solid mixtures of organic compounds by column chromatography.
- Paper Chromatography
Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of R_f values.
- Spectroscopy
Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS)
- Spectrophotometric (UV/VIS) Estimations:
 - Amino acids
 - Proteins
 - Carbohydrates
 - Cholesterol
 - Ascorbic acid

6. Aspirin

7. Caffeine

Physical Chemistry

Chemical Kinetics:

1. To find out the velocity constant of the reaction between potassium per sulphate and potassium iodide also calculate the activation energy and the influence of ions strength on the rate constant
2. To study the reaction between acetone and iodine in the presence of acid

Solution:

1. To study the variation of solubility of Potassium hydrogen tartrate with ionic strength using a salt having common ion and determine the mean ionic activity coefficient.
2. To study the effect of ionic strength on the solubility of calcium sulphate and so determine its thermodynamics solubility product.

Adsorption:

1. Adsorption of acetic acid on charcoal to verify freundlich and lamgmuir's isotherm.
2. To study the adsorption of oxalic acid on charcoal and to prove th validity of freundlich and lamgmuir's isotherm.
3. To study the adsorption of iodine from alcoholic solution on charcoal.

Partition Coefficient and polarimetry:

1. To find out the equilibrium constant of the tri-iodide formation.
2. To find out the dimerisation constant of benzoic acid in benzene medium
3. To determine the relative strength of acid.
4. To find the formula of complex copperammonium ion or study the complex formation between copper sulphate and ammonia solution.
5. To study the complex formation and find the formula of silver amine complex by Partition method.

Group Theory and Photo-Inorganic Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Symmetry and Group Theory in Chemistry:

Symmetry operations, symmetry elements, group, subgroup, relation between order of a finite group and its subgroup, similarity transformations and classes, molecular point groups and their classification, Schonflies symbols, representations of groups by matrices (representation for the C_n , C_{nv} , C_{nh} , D_{nh} only), characters of a representation, properties of character of representation, character tables (C_{2v} & C_{3v} only), relationship between reducible and irreducible representations.

Applications of Group Theory in Chemistry:

Formation of hybrid orbitals: σ -bonding in trigonal planar (BF_3), tetrahedral (CH_4), square pyramid (BrF_5) and square planar (XeF_4).

Ligand Field Theory: Splitting of levels and terms in a chemical environment, energy level diagrams and construction of energy level diagrams.

Section-B

Photochemistry of Carbonyl Complexes:

Introduction, $Cr(CO)_6$, $Fe(CO)_5$ and $Ni(CO)_4$.

Photosubstitution Reactions:

Introduction, photosubstitution of d^3 , low spin d^6 and d^8 complexes, sensitization and quenching of photosubstitution, photosubstitution mechanism, photoisomerisation, photoracemization, photoanation and photosensitive polymers.

Section-C

Redox Reactions by Excited Metal Complexes:

Charge transfer spectra, ligand to metal charge transfer, metal to ligand charge transfer, intraligand and charge transfer to solvent state, metal complexes as redox reactants, reducing and oxidizing properties of $Ru(bipy)_3$, comparison with $Fe(bipy)_3$, role of spin-orbit coupling, applications of redox processes of low energy reactants into high-energy products and chemical energy into light.

Metal Complex Sensitizers:

Metal complex sensitizer, electron relay, metal colloid system, semiconductor supported metal or oxide systems, water photolysis.

Books Suggested:

1. Group Theory and its Chemical Applications, P. Bhattacharya, Himalaya Prakashan
2. Group Theory and its Chemical Applications, F. A. Cotton, Wiley.
3. Concepts of Inorganic Photochemistry, A. W. Adamson and P. D. Fleischauer, Wiley.
4. Inorganic Photochemistry, J. Chem. Edu. vol 60, 10, 1983.
5. Coordination Chem. Revs, 1981, vol.39, 121, 131, 1975, 15, 321; 1990, 97, 313.
6. Photochemistry of Coordination Compounds, V. Balzari and V. Carassiti, Academic Press.
7. Elements of Inorganic Photochemistry, G.J. Ferraudi, Wiley

Organic Chemistry (Chemistry of Natural Products)

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Terpenoids and Carotenoids:

Classification, nomenclature, occurrence, isolation, identification (qualitative idea only), general methods of structure determination, isoprene rule, special isoprene rule, structure determination, stereochemistry and synthesis of the following representative molecules: - citral, α -pinene, α -terpeneol, abietic acid and β -carotene.

Porphyrins:

Structure and synthesis of hemoglobin and chlorophyll (for structure elucidation, emphasis is to be placed on the use of spectral parameters whenever possible).

Section-B

Alkaloids:

Definition, nomenclature and physiological action, occurrence, isolation, identification (qualitative idea only), general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants; structure, stereochemistry and synthesis of the following: coniine, nicotine, atropine, quinine and morphine.

Prostaglandins:

Occurrence, nomenclature, classification, biogenesis and physiological effects and synthesis of PGE₂ and PGF_{2a}.

Section-C

Steroids and Hormones:

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, isolation, identification (qualitative idea only), structure determination and synthesis of cholesterol, androsterone, testosterone, oestrone, progesterone.

Plant Pigments:

Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of apigenin, luteolin, quercetin, quercetin-3-glucoside, cyanidin, cyanidin-7-arabinoside, hirsutidin.

Key Metabolism Pathway:

Acetate pathway, mevalonate pathway and shikimic acid pathway.

Books Suggested:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope and J.B. Harborne, Longman, Essex.
2. Organic Chemistry, Vol 2, I. L. Finar, ELBS.
3. Stereoselective Synthesis: A Practical Approach, M. Nogradi, VCH.
4. Chemistry, Biological & Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston, Harwood Academic Publishers.
5. Introduction to Flavonoids, B.A. Bohm, Harwood Academic Publishers.

Organic Synthesis

L T P C
4 0 0 4
Max. Marks : 100
(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Fundamentals of organic synthesis:

Disconnection approach, one group and two group disconnections, reversal of polarity, one group C-C disconnection, two group C-C disconnections, 1,3-difunctional and 1,5-difunctional compounds, tandem reactions, domino reactions and multi-component reactions.

Microwave Synthesis:

Fundamental theory, mechanism of microwave heating, application of microwave heating, polarization, types of reactions, choice of solvents, reaction vessels, functional group transformation, condensation,, oxidation, reduction. Name reactions:-Friedel-Crafts reaction, Fischer-indole reaction, Reformatsky reaction, Perkin reaction, Cannizzaro reaction, Mannich reaction, Michael addition, Claisen-schmidt condensation, knoevenegel condensation and Gabriel condensation.

Section-B

Oxidation:

Introduction, different oxidative processes, hydrocarbons: -alkenes, saturated C-H groups (activated and inactivated); alcohols and diols; aldehydes and ketones; oxidations with ruthenium tetroxide, iodobenzene diacetate and thallium (III) nitrate.

Reduction:

Introduction, different reductive processes, hydrocarbons: - alkenes, alkynes and aromatic rings; carbonyl compounds: - aldehydes, ketones; acids and their derivatives; epoxides; hydrogenolysis.

Section-C

Rearrangements:

General mechanistic considerations, nature of migration, migratory aptitude, memory effects, a detailed study of the following rearrangements:-pinacol-pinacolone, Wagner-Meerwein, Tiffeneu-Demjanov, Beckmann, Hofman, Curtius, Lossen, Schmidt, Baeyer-Villiger, benzil-benzilic acid, Favorskii, Neber, benzidine and Fries rearrangement.

Name reactions:

Discuss in detail to following name reactions with reference to their application in the synthesis of some medicinal agents, where possible: - Friedel-Crafts reaction, Darzen's condensation, Dieckmann's condensation, Willigordt reaction and Arndt-Eistert synthesis.

Polycyclic Aromatic Compounds:

General considerations, synthesis and reactions of anthracene, phenanthrene.

Books Suggested:

1. Modern Synthesis Reactions, H.O.House, W.A.Benjamin.
2. Some Modern Methods of Organic Synthesis, W.Carruthers, Cambridge Univ. Press.
3. Advanced Organic Chemistry: Reactions, Mechanisms and Structure, J. March, John Wiley.

4. Principles of Organic Synthesis, R.O.C.Norman and J.M.Coxon Blackie, Academic & Professional.
5. Advanced Organic Chemistry Part B, F.A.Carey and R.J.Sundberg, Plenum Press.
6. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey.Elsevier.

Organotransition-Metal Chemistry

L T P C
4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Alkyls and Aryls of Transition Metals:

Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis.

Compounds of Transition Metal-Carbon Multiple Bonds:

Low valent carbenes, alkylidenes, carbynes and alkylidynes:-synthesis, nature of bond, structural characteristics, nucleophilic and electrophilic reactions on the ligand, role in organic syntheses.

Section-B

Transition Metal π -Complexes:

Transition metal π -complexes with unsaturated organic molecules: - alkenes, alkynes, allyl, diene, dienyl, arene and trienyl complexes; preparations, properties, nature of bonding and structural features, important reactions relating to nucleophilic and electrophilic attack on ligands and role in organic syntheses, transition metal compounds with bonds to hydrogen.

Section-C

Homogeneous Catalysis:

Fundamental reaction steps of transition metal catalyzed reactions, stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarbonylation of olefins (oxo reaction), oxopalladation reactions, activation of C-H bond.

Fluxional Organometallic Compounds:

Fluxional and dynamic equilibria in compounds such as η^2 -olefin, η^3 -allyl and dienyl complexes.

Books Suggested:

1. Principle and Application of Organotransition Metal Chemistry, J.P. Collam, L.S. Hegedus, J.R. Norton and R.G. Finke, University Science Books.
2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree, John Wiley.
3. Organometallic Chemistry, R.C. Mehrotra and A. Singh, New Age International.

Photo-Organic and Heterocyclic Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Photochemistry-I:

Photochemical reactions: - interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, photochemistry of alkenes:- intramolecular reactions of the olefinic bond, geometrical isomerism, cyclisation reactions, rearrangements of 1,4- and 1,5-dienes; photochemistry of carbonyl compounds:- saturated, cyclic, acyclic, α,β -unsaturated and β,γ -unsaturated compounds, cyclohexadienones, intramolecular cycloaddition reactions:- dimerisations and oxetane formation.

Section-B

Photochemistry-II:

Photochemistry of aromatic compounds: - isomerisation, additions and substitutions; miscellaneous photochemical reactions: - Photo-Fries reactions of anilides, Photo-Fries rearrangement, Barton reaction, singlet molecular oxygen reactions.

Heterocycle-I:

Small-ring heterocycles: - three-membered and four membered heterocycles- synthesis and reactions of aziridines, oxiranes, azetidines and oxetanes; synthesis, reactions and application of imidazole, isooxazole, indole and benzofuran.

Section-C

Heterocycle-II:

Synthesis, reactions and applications of coumarins, thiocoumarins and chromones.

Synthesis, reactions and applications of pyridazine, pyrazine and pyrimidine;

Synthesis and reactions of 1,4- and 1,5-benzodiazepines.

Books Suggested:

1. Fundamentalas of Photochemistry, K.K. Rohtagi-Mukherji, Wiley-Eastern.
2. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Scientific Publication.
3. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press
4. Heterocyclic Chemistry Vol. 1-3, R.R. Gupta, M. Kumar and V. Gupta, Springer Verlag.
5. Heterocyclic Chemistry, J.A. Joule, K. Mills and G.F. Smith, Chapman and Hall.
6. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical.
7. An Introduction to the Heterocyclic Compounds, R.M. Acheson, John Wiley.
8. Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Rees, Eds. Pergamon Press.

Special Topics in Physical Chemistry

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note: The paper is divided into three sections. The candidates are required to attempt five questions in all selecting not more than two questions from each section.

Section-A

Surface Chemistry:

Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electro-kinetic phenomenon).

Polymer:

Polymer:-definition, types of polymers, kinetics of polymerization, mechanism of polymerization, molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, viscometry and diffusion), sedimentation, chain configuration of macromolecules, calculation of average dimensions of various chain structures.

Micelles:

Surface active agent, classification of surface active agent, micellization, thermodynamics of micellization, electro kinetic effect, quantitative treatment of zeta potential; measurement of zeta potential: streaming potential, electrolysis and electro-osmosis methods.

Section-B

Magneto Chemistry:

Magnetic susceptibility and its determination, susceptibility equivalents, Pascal's law and its applications, diamagnetism of elements, compounds and ions, Langevin's theory of paramagnetism, Curie's law, Weiss molecular field theory of paramagnetism, Curie-Weiss law, determination of Curie point.

Molecular Orbital Theory:

Huckel theory of conjugated systems, bond order and charge density, calculations, applications on ethylene, butadiene, cyclopropenyl radical, cyclobutadiene and benzene; introduction to extended Huckel theory.

Section-C

Introduction of Nanochemistry: Emergence and challenges in nanotechnology, types of nanomaterials: zero dimensional- quantum dots, cluster of spherical noble metal nano-particles and core shell (optical properties), One dimensional- nanowires and nanorods; two dimensional- thin films, advanced nanomaterials-Fullerenes, Carbon nanotubes and Graphene.

Fabrication methods:

Bottom up- molecular self-assembly, reduction method, sol-gel process, chemical vapour deposition and Top down- Ball milling, evaporation, template synthesis + evaporation, sonication, chemical etching and biological methods- microbial and biomolecules.

Stability of Nanomaterials:

Surface energy, electrostatic stabilization with special reference to DLVO theory, steric stabilization: solvent and polymer, interaction between polymer layers, mixed steric and electric interaction.

Books Suggested:

1. Chemical kinetics, Keith J.Laidler, Tata Macgraw Hill Kepmit
2. Physical Chemistry, ALKMs, Oxford University Press.
3. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum

4. Introduction to Polymer Science, V.R. Gowarikar, N. V. Vishwanathan and J. Sridhar, Wiley Eastern.
5. Physical Chemistry, P.W. Atkins, ELBS.
6. Magneto Chemistry, Piece W. Selwood.
7. Research Frontiers in Magneto Chemistry, Charles O. Corn
8. Physical Principles and application of Magneto Chemistry Shanti Swarupa
9. Introduction to Quantum Chemistry, A. K Chandra, Tata McGraw Hil
10. Quantum Chemistry, Ira N. Levine, Prentice Hall
11. Nanostructures and Nanomaterials: Synthesis, properties and application. Guozhong Cao, empirical college press, 2004.
12. Nanochemistry: A chemical approaches to Nanomaterials, Geoffrey A. Ozin, Royal Society of Chemistry, 2005.

Philosophical Foundations of Education

L T P C

6 0 0 6

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives : To enable students

- To develop an understanding that education has at its base philosophic understanding.
- To understand the nature of philosophic inquiry and its application in education.
- To critically analyze the bearing of philosophical issue on education, viz. epistemological and Axiological and develop an appreciation for the philosophic bases of education.
- To critically examine the Indian policy on education, at least the current one for its Philosophical, logical basis.

Section -A

- **Education and Indian Philosophical thoughts as a bases of Education**
 - Contextual nature of education.
 - Meaning of Philosophy of Education
 - Relation between Education and Philosophy
 - Need for a Philosophy of Education
- **Goals, substance, organization and method of the Education system with Reference to:**
 - Sankhaya darshan
 - Vedanta darshan

Section -B

- **Modern Indian Thinkers and Western Philosophical thoughts as a Basis of Education**

Goals, substance, organization and method of the Education system with Reference to:

 - Mahatma Gandhi
 - R. N. Tagore
 - Vivekananda
 - Idealism
 - Naturalism
 - Pragmatism
 - Existentialism

Section -C

- **Philosophical Issues and Inquiry in Education**
 - Nature of knowledge in education
 - Values reflected in educational substance
 - Conflict, contradiction, compromise reflected among values in education
 - Nature and Scope of Philosophical Inquiry in Education
 - Steps
 - Philosophical inquiry of current educational issues.

Practicum:

1. Critical Analysis of any one of the following with reference to their Philosophical, Logical basis.
 - a. Indian Education System: its goals and substance

- b. Current policy on education.
2. Study any one of the philosophical schools of thought.
 - a. Critically examine the selected philosophy.
 - b. Nature of educational system according to selected philosophy.
 - c. Report writing

References:

- 1 Broudy, Harry S., 1965, Building a Philosophy of Education. Prentice Hall of India Pvt. Ltd., New Delhi.
- 2 Butler, Donald, 1968, Four philosophies and their practice in Education, 2nd ed. Harper and Row Publishers, New York.
- 3 Dupuis, Adrain M., 1966, Philosophy of Education in Historical Perspective, Thomson Press India., New Delhi.
- 4 Ellis, Arthur K. John. J. Cogan, Kenneth R. Howey, 1981, Introduction to Foundations of Education, 2nd ed. Prentice Hall, New Jersey.
- 5 Henderson, 1947, Introduction to Philosophy of Education. The University of Chicago Press, Chicago.
- 6 Morrish, Ivor, 1961, Disciplines of Education, George Allen and Unwin Ltd., London.
- 7 Sharma S.R. ed., 1996, Philosophy of Education, vols, I to X, Mohit Publications, New Delhi.
- 8 Taneja V.R., 1977, Socio Philosophical Approach to Education, Atlantic Publishers and Distributors, New Delhi.
- 9 Aggarwal, J.C., Theory and Principles of Education, Vikas publishing House Pvt. Ltd., Noida, 2007.
- 10 Brubacher, John. S., Modern philosophies of Education, 3rd edition, Mc Graw hill book Company, Inc, New York, 1962.
- 11 Ellis, A.K., John Tcofan & Kenneth R. Howey Introduction to the Foundations of education, Prentice Hall Englewood Cliffs, New Jersey, 1986.
- 12 Gupta, R and M.M. Bajaj, Principles of Education, Sahib Publishers and distributors, New Delhi, 2008.
- 13 Mishra, P.K. and P.C. dash, An Introduction to Philosophical and Sociological foundations of education, Manglam Publication, New Delhi, 2010.
- 14 Saxena, N.R.S., Philosophical and Sociological Foundation, R.Lall book depot, Meerut, 2011.
- 15 Chandra S.S. & R.K.Sharma, Philosophy of Education, Atlantic publishers & distributors pvt. Ltd. New Delhi, 2007.
- 16 Ghanta, R. & B.N.Dash, Foundations of Education, Neelkant publishers' pvt. Ltd., N.Delhi, 2006.
- 17 पाण्डेय. रामशकल. उदीयमान भारतीय समाज में शिक्षक. विनोद पस्तक मंदिर. आगरा. 2003.
- 18 सक्सेना. एन०आर० स्वरूप एवं शिक्षा चतर्वेदी. उदीयमान भारतीय समाज में शिक्षक. आर०लाल० बक डिपो. मेरठ. 2006.
- 19 लाल. रमन बिहारी. शिक्षा के दार्शनिक एवं समाजशास्त्रीय सिद्धांत. रस्तौगी पब्लिकेशन्स. मेरठ. 1995.
- 20 चौबे. सरयप्रसाद. शिक्षा के दार्शनिक. ऐतिहासिक एवं समाजशास्त्रीय आधार. आर० लाल० बक डिपो. मेरठ. 1993.
- 21 ओड. एल०के०. शिक्षा की दार्शनिक पष्ठभूमि. राजस्थान हिन्दी ग्रन्थ अकादमी. जयपर. 2004.
- 22 गप्त. रामबाब. महान पाश्चात्य शिक्षा शास्त्री. सामाजिक विज्ञान प्रकाशन. कानपर. 1983.
- 23 पाण्डेय. रामशकल. भारतीय शिक्षा दर्शन. विनोद पस्तक मन्दिर. आगरा. 1994.
- 24 पचौरी. गिरीश. शिक्षा के दार्शनिक आधार. आर०लाल० बक डिपो. मेरठ.
- 25 तिवारी. के.एन.. तत्वमीमांसा एवं ज्ञान मीमांसा. मोतीलाल बनारसीदास. नई दिल्ली. 2002.
- 26 शर्मा, सपना एवं राजेश शर्मा. 'दार्शनिक परिदृच्छा - एक विवेचन'. भारतीय आधुनिक शिक्षा अप्रैल 2000. एन०सी०ई०आर०टी०. नई दिल्ली.

- 27 श्रीवास्तव, मदनमोहन, शिक्षा के दार्शनिक परिप्रेक्ष्य, विजय प्रकाशन मन्दिर, वाराणसी, 2007.
- 28 माथर, एस0 एस0, 'शिक्षा सिद्धांत' विनोद पस्तक मन्दिर, आगरा.
- 29 सैयदेन, के०जी०, भारतीय शैक्षणिक विचारधारा, मीनाक्षी प्रकाशन, मेरठ 1969.

Sociological Foundations of Education

L T P C
6 0 0 6
Max. Marks : 100
(CA: 40 + ESA: 60)

Objectives: Student teacher will be able to understand

- The Sociological basis of Education.
- The role of Education in Social Structure and Social Stratification
- The role of Education in Social Control and Social Mobility.
- The role of Education in Social Change.
- Certain important issues in Education.

Section - A

- **Sociological Basis of Education**
 - Sociological Foundation of Education.
 - Education as process of Socialization.
- **Social -Structure, Social Stratification and Education.**
 - Education and Social-Structure.
 - Concept of Social-Structure.
 - Characteristics of Social-Structure.
 - Role of Education in Social-Structure.
- **Education and Social-Stratification.**
 - Concept of Social-Stratification.
 - Basis of Social-Stratification,
 - Forms of Social-Stratification in Indian Society.
 - Role of Education in Social-Stratification.

Section - B

- **Social Control, Social Mobility and Education.**
 - Education and Social control.
 - Concept of Social Control.
 - Types of Social Control.
 - Agencies of Social Control.
 - Role of Education in social control.
 - Education and Social Mobility.
 - Concept of Social-Mobility.
 - Types of Social-Mobility.
 - Factors affecting Social-Mobility.
 - Role of Education in social mobility.
 - Social Change and Education
 - Concept of Social-Change.
 - Factors affecting Social-Change.
 - Constraints of Social-Change.
 - Role of Education in Social Change

Section - C

- **Certain Issues in Education**

- Relevance of Education.
- Accountability in Education.
- Alternatives in Education.
- Westernization and Education.

Practicum: Any two of the following:

- 1 One thematic Term paper and its presentation in classroom.
- 2 Two abstracts of recent articles in journals on topics related to course content.
- 3 Critical appraisal of Role of Education in Social stratification and Social change.

References:

1. Brembeck Cole, 1971, "Social Foundations of Education". New York (Sec.Ed.) John Wiley and sons.
2. Cook L.A. and E.F. 1960, "A Sociological Approach to Education" New York, McGraw Hill Book Co. (3rd Ed.)
3. Corwin Ronald, G 1965, "A Sociology of Education", New York Appleton Century Croft.
4. Dinkar, Ram Dhari Singh, 1970 "Sanakriti ke Char Adhyay" Patna, Udayanchal Prakashan.
5. Dube, S.C. 1967, "Modernisation and its Adaptive Demands on Indian Sopciety", NCERT, New Delhi.
6. Havinghurst, Robert andNewgarten L., 1957 Society and Education" Boston Allyn & Becon.
7. Kneller, George, F.1963 "Foundations of Education" New York, John Wiley and Sons.
8. Madhok Balraj, 1972 "Bhartiyakaran" Lajpat Rai & Sons, New Delhi.
9. Morsis Ben, 1972: Objectives and Perspectives in Education", Boston, Routledge Rogen Paul.
10. Morsis Ivor, 1976: Aspects of Educational Change, London.
11. Musgrave, P.W. 1972, "The Sociology of Education", London Methen & Co. Ltd.
12. Gupta, S.P., Gupta, Alka, "History, Development and Problem of Indian Education," Sharda Pustak Bhawan, 2010.
13. Lavania, M.M., Jain, Shashi K., "Sociology of Education," Research Publications, 2010.
14. Mayhew, Arther and James, H.R., "Development of Education system in India," Reprint Publication, Dehradun.
15. Mishra, S.K. and Puri,V.K., "Development and Planning: Theory and Practices," Himalaya Publishing House, Delhi, 1988.
16. Mohanty, Jagannath, "Indian Education the Emerging Society," Sterling Publishers Pvt. Ltd., New Delhi, 1986.
17. Mohanty Jagannath, Current Trends in Higher Education, Deep & Deep Publication Pvt. Ltd. New Delhi, 2000.
18. Prasad, Janardan, "Education and Society," Ist ed., Kanishka Publishers, 2004.
19. Ruhela, Satyapal, "Social Foundation of Education," Maya Prakashan Mandir, 2010.
20. Saxena, N.R. Swarup, "Principles of Education", R.Lall Book Depot, Meerut, 1995.
21. Sharma, Yogendra K, "Sociological Philosophy of Education", Kanishka Publishers, New Delhi, 2003.
22. Sindhu, I.S., "Sociological Basis of Education," International Publishing House, 2005.
23. Srinvas, M.N., "India: Social Structure Delhi, Hindustan Publishing Co-operation,1986.
24. Van Scotter, Richard D, "Foundations of Education, Social Perspectives," Prentice Hall, Inc., 1979.

- 25 दबे, श्यामाचरण शिक्षा समाज और भविष्य, राधाकृष्ण प्रकाशन, 1994.
- 26 गप्त, रामबाबू, “भारतीय शिक्षा का विकास एवं सामयिक समस्याएँ” रतन प्रकाशन मंदिर, आगरा, 1996.
- 27 जैन, शशी के, “भारतीय शिक्षा का अध्ययन” रिसर्च पब्लिकेशन्स, नई दिल्ली, 1987.
- 28 जौहरी, बी० पी० एवं पाठक, पी० डी०, “भारतीय शिक्षा का इतिहास,” विनोद पस्तक मंदिर, आगरा, 2005.
- 29 हैलन, जी० सी०, “सामाजिक संरचना एवं सामाजिक संस्तरण,” रस्तोगी पब्लिकेशन, मेरठ, 1976.
- 30
रूहेला, सत्यपाल एवं शर्मा राजेन्द्र कुमार, “शिक्षा का समाजशास्त्र,” मूल सम्प्रत्यय और सिंता, “उत्तरप्रदेश हिन्दी ग्रन्थ अकादमी
लखनऊ, 2007.
- 31 शर्मा योगेन्द्र कुमार, मधलिका शर्मा “शिक्षा के समाजशास्त्रीय आधार”, कनिष्क पब्लिशर्स, 2008.
- 32 शर्मा, गणपतिराय, “शिक्षा एवं भारतीय समाज,” राजस्थान हिन्दी ग्रन्थ अकादमी, जयपुर, 1993.

Conceptual Perspectives of Teacher Education

L T P C
6 0 0 6
Max. Marks : 100
(CA: 40 + ESA: 60)

Objectives: To enable the students

- i. To understand the concept and objectives of teacher education.
- ii. To understand the development of teacher education
- iii. To acquaint with the diversification in teacher education.
- iv. To acquaint with the concept, inputs and evaluation in pre-service teacher education.
- v. To acquaint with in-service teacher education and various agencies involved in- service teacher education.

Section- A

Development and Diversification in Teacher Education .

- Pre independence
 - Ancient
 - Medieval Period
- British period.
- Post independence : in following Commission and Polices
 - Mudaliar Commission (1952)
 - Kothari Commission (1964-66)
 - NPE - 1986 and its reviews.

Diversification in Teacher Education

- Objectives and organization of Curriculum across the level.
 - Pre primary
 - Primary
 - Secondary

Section- B

Pre-service and Distance Mode of Teacher Education in India.

- Meaning and Purpose of Pre-Service Teacher Education.
- Expectations of teacher education programme with reference to Teacher, Learner, Institution and Society.
- Input in Pre-Service Teacher Education Programme i.e. Theoretical and Practical, effectiveness with respect to field requirement.
- Evaluation procedure in Pre-service Teacher education programme i.e. Theoretical and Practical.
- Nature, forms and Feasibility of distance mode of teacher education.
- Major dimensions needed in distance education.

Section- C

In-Service Teacher Education in India.

- Meaning and purpose of In-Service teacher education.
- Agencies involved- DIETs, CTEs, IASEs, ASCs, CCRT, NCERT and OUs. (with references to their purpose and programme).
- Critical Appraisal of above agencies in respect of their functions.
- Main criticism and achievement of distance mode of Teacher Education.

Practicum:

- 1 Preparation of a Term paper on any one topic related to course content.
- 2 Abstract of two articles published in recent Educational Journals.

References:

1. Aggarwal J.C.: Teacher role, Status, Service Condition in India, Dooba House, New Delhi, 1988.
2. Gupta, Arun K. Teacher Education Current and Prospects Sterling Publishers Pvt. Ltd. Delhi, 1984.
3. Mangla Sheela:. Teacher Education: Trends and Strategies, Radha Publications, New Delhi, 2001.
4. Mohanty, Jagannath,Teacher Education, Deep & Deep publications Pvt. Ltd., New Delhi, 2003.
5. Mohanty, Jagannath,Teacher Education, Deep & Deep publications Pvt. Ltd., New Delhi, 2007.
6. Mohan, Radha,Teacher Education, PHI Learning Pvt. Ltd., New Delhi, 2011.
7. National policy on Education, 1986, MHRD, GOI, New Delhi, 1986.
8. NCTE, Policy perspective in Teacher Education, Critique & Documentation, National Council for Teacher Education, New Delhi, 1998
9. Policy perspectives in Teacher Education -Critique and Documentation 1998.
10. Programme of Action (POA), NPE-1986, MHRD, GOI, New Delhi, 1992.
11. Rao, Digumati Bhaskara: Teacher Education in India, Discovery Publishing House, New Delhi,1998.
12. Report of the Committee for Review of National Policy of Education 1986.
13. Report of the Secondary Education Commission (1952-53), Govt. of India, 1962.
14. Report of the Education Commission (1964-66), Summary and Recommendations, Ministry of Education, Govt. of India, New Delhi1966.
15. Saxena, N.R. and Others, Teacher Education,R. Lal Book Depot, Meerut, 2011.
16. Sharma, Shashi Prabha, Teacher Education. Principles, Theories and practices, Kanishka Publishers & Distributors, New Delhi, 2003.
17. Singh L.C. and Sharma P.C.: Teacher Education and the Teachers, Vikas Publications New Delhi, 1995.
18. Varma, Neeru,Teacher Education, Ayush publisher's and distributor's, New Delhi, 2008.
- 20 जोशी. दिनेश चन्द्र एवं चतरसिंह मेहता. शिक्षक प्रशिक्षण के सिांत और समस्यायें. राजस्थान हिन्दी ग्रन्थ अकादमी. जयपर. 1995.
- 21 एन0सी0टी0ई0.अध्यापक शिक्षा में नीतिगत परिदृश्य. विवेचन एवं प्रलेखन. राष्ट्रीय अध्यापक शिक्षा परिषद. नई दिल्ली. 2001.
- 22 सकसैना.एन0आर0 एवं अन्य. अध्यापक शिक्षा. आर0 लाल बक डिपो. मेरठ. 2007.
- 23 शर्मा. आर0 ए0. अध्यापक शिक्षा एवं प्रशिक्षण तकनीकी. आर0 लाल बक डिपो. मेरठ. 2010.
- 24 शर्मा. आर0 ए0. भारतीय शिक्षा प्रणाली का विकास. आर0 लाल बक डिपो. मेरठ. 2007.
- 25 गप्ता. एस0 पी0 एवं अलका गप्ता. मक्त एवं दरस्थ शिक्षा. शारदा पस्तक भवन. इलाहाबाद 2007
- 26 राज, अंजली एवं महेश कुमार गंगल, “ भारतीय अध्यापक शिक्षा का सम्प्रत्ययात्मक परिप्रेक्ष्य. विद्या शोध. ए बाईलिंगल व बाई एनअल जर्नल ऑफ एज्युकेशन एण्ड एलाइड हयमिनिटीज. वाल्यम-2. अंक-1. जलाई 2014. ISSN:2347

Communication Skills, Self Development and Yoga

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
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Course Outcomes:

Student- teacher will be able to-

- express their ideas in small and large group.
- reflect through reading of some inspirational books.
- communicate through Creative Writings.
- discuss the importance to Yoga for their well-being.
- perform Asnaas and Pranayam.

Course Outline:

SECTION - A

Communication Skills, Self Development and Yoga includes-

Reflection of communication skills on social and educational issues in small and large group.

Inspiring Self through any one of the following selected Readings-

- 'My experiments with Truth' by Mahatma Gandhi.
- 'Diwaswapn' by Giju Bhai Badheka
- 'Geeta ka Nitishastra' by Prof. Diwaker Shastri
- 'Pralay Pratiksha' By Hiralal Shastri
- "Wings of Fire-An Autobiography", Kalam, A.P.J.
- 'Leader in you' Dale Carnegie

SECTION - B

Self Expression through any one of the following creative writings-

- Story
- Article
- Event Description/Summary
- Life experience
- Poem
- Drawing

SECTION - C

Yoga and Self Development

- Concept of yoga
- Importance of yoga and its importance for self development
- Pranayam- types and Importance
- Three milestones of women's life and yoga .
- Do's and Dont's of Asanas.

Yoga for healthy mind and body.

- Practice of various asanas.
- Practice of various skills of pranayam.

Note: It is Self Practice based ISB Course. Each student has to show reflection of communication skills, yoga skills and Self Development in her presentation(s) and given assigned task(s)/ demonstration.

Mode of Transaction:

1. Orientation/Lecture
2. Presentation
3. Demonstration
4. Drill
5. Self-Practice

References:

Dale, Carnegie. (1993). *Leader in you; you to win friends, influence people and succeed in a changing world*,.

Gupta, D. & S. (1987). *Yoga: its Philosophy & Religion*.

Sinha, P. (2003). *Yogic Cure for Common Diseases*. Allied Publishers Pvt. Ltd.

Joshi, K.S. (2003). *Yogic Pranayam*. Allied Publishers Pvt. Ltd.

Ananda, Sri, (1999). *The Complete Book of Yoga Harmony of Body and Mind*. Delhi : Orient paperbacks, Madarasa Road, Kashmere Gate.

Niranjanananda, Paramahansa. (1993). *Yoga Darshan, Vision on Yoga Upnishads*. Bihar : Sri Panchadashnam. Paranaahamsa Alakh Bara, Deoghar.

Sharma, P. D. (1984). *Yoga Yogasana and Pranayama for Health*. Ahmedabad: Navneet Publications Limited.

Kalam, A.P.J. (1999). *Wings of Fire-An Autobiography*. Hyderabad: Universities Press.

अग्रवाल, विजय (2015), *स्टूडेंट और पर्सनैलिटी डेवलपमेंट*, Bhopal: Benten Books.

अग्रवाल, विजय (2015), *स्टूडेंट और मन की शक्ति*, Bhopal: Benten Books.

कलाम, ए.पी.जे. (1999), *अग्नि की उड़ान—अत्मकथा*, हैदराबाद: यूनिवर्सिटीज प्रैस।

गिजुभाई, बंधेका (1991), *दिवास्वप्न*, नई दिल्ली : नेशनल बुक इण्डिया।

दिवाकर, शास्त्री (2008), *गीता का नीतिशास्त्र*, नई दिल्ली: रास्ता साहित्य मण्डल।

मोहनदास, करमचन्द गाँधी (1970), *सत्य के प्रयोग: गांधीजी की संक्षिप्त आत्म-कथा*, दिल्ली : राजपाल।

योगेश कुमार शर्मा एवं प्रज्ञा शर्मा (2003), *नोबेल पुरस्कार से सम्मानित विश्व की महिलाएँ*, जयपुर: पोइण्टर पब्लिशस।

Web Resources:

My experiments with Truth:

<https://books.google.co.in/books?id=MUEDDAAAQBAJ&printsec=frontcover&da=mv+experiment+with+truth&hl=en&sa=X&ved=OahUKEwiUolWY-9HhAhWh6XMBHZPOCrAQ6AEIIVIDAB#v=onepage&g=mv20experiment2Qwith20truth&f=false>

Wings of Fire-An autobiography:

<https://books.google.co.in/books?id=c3gmlZtWUiAC&printsec=frontcover&dg=Wings+of+fire-An+autobiography&hl=en&sa=X&ved=OahLIKEwi9HhAhWOheYKHQpOAOcQ6AEIKiAA#v=onepage&q=Wings20of20fire-20An20autobiography&f=false>

Yoga and Self development:

<https://books.google.co.in/books?id=h8UJCAAAQBAJ&printsec=frontcover&dg=yoga+and+self+development&hl=en&sa=X&ved=OahUKEwics70tNHhAhUh7nMBHeeOD18Q6AEIMDAB#v=onepage&g=yoga20and20self20development&f=false>

Yoga and Self development:

<https://books.google.co.in/books?id=tFsoDwAAQBAJ&printsec=frontcover&dg=voga+and+self+development&hl=en&sa=X&ved=OahUKEwics70tNHhAhUh7nMBHeeOD18Q6AEIOzAD#v=onepage&g=yoga20and20self20development&f=false>

Yoga and Self development:

<https://books.google.co.in/books?id=wVTWiAKxOsgC&pnntsec=frontcover&dq=Pranavam+types+and+importance&hl=en&sa=X&ved=OahUKEwiLzl2BdHhAhVVXnwKHU-BCxwQ6AEIODAC#v=onepage&q&f=false>

Pranayama:

<https://books.google.co.in/books?id=NagKQNRaLtAC&pg=PA40&dq=Pranavam+types+and+importance&hl=en&sa=X&ved=OahUKEwiLzl2BdHhAhVVXnwKHU-BCxwQ6AEIVzAI#v=onepage&q=Pranavam20types20and20importance&f=false>

Psychological Foundations of Education

L T P C

6 0 0 6

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives: Students will be able to-

- 1 Understand the Psychological Foundation of Education.
- 2 Understand the meaning, nature and kinds of learning.
- 3 Acquaint the basic ideas, components of major schools of learning and their contribution to Education.
- 4 Acquaint the concept of motivation and its implication in Educational process.
- 5 Understand the Learner as an individual and help them develop in the development of their attributes.
- 6 Understand learner as group member and psychological process of group.

Section - A

- **Education: Changing view**
 - Education as Psycho-Sociological process
 - Change in views of Educational components i.e. Teacher, Learner, Curriculum and Learning Experiences in respect of Psychology
- **Learning : As a Continuous Process**
 - Concepts, Features of Learning process
 - Various forms of Learning-
 - Cognitive, Affective Psychomotor.
 - Conceptual & Skill Learning
 - Intended & Unintended
- **Learning Process: Behaviouristic view**
 - Classical Conditioning Theory of Pavlov.
 - Operant Conditioning Theory of Skinner.
 - S-R Bond Theory of Thorndike.

(Basic ideas, Technical Component, providing bases to Education)

Section - B

- **Learning Process: Cognitive view**
 - Insight Theory- Kohler
 - Social Cognitive Theory-Bandura
 - Cognitive Theory: Piaget
 - Cognitive Stage Theory - Bruner
 - (Basic ideas, Technical Component, providing bases to Education)
- **Learning Process: Humanistic view**

Humanistic Theory -Roger's

 - (Basic ideas, Technical Component, providing bases to Education).
- **Learner: As a Group member**
 - Class group and features
 - Group process-Interaction, Structure, Cohesiveness, Norms, Conformity of Behaviour.
 - Ways of generating a positive class-room climate.

Section - C

- **Motivation and Learning**
 - Motivation: concept and its role in Learning
 - Maslow's Need Hierarchy Theory of Motivation.
 - McClelland's n-ach Theory of Motivation.
(Concept, Features and their bases for Learning)
- **Learner: As an Individual**
 - Individual difference among Learner's: Concept and Types
 - Intelligence, Aptitude, Creativity
 - Attitude, Self-Concept, Personality
 - (Concept, Features and development of above traits)

Practicum: Any two

1. Administration and interpretation of a Psychological Test on a small sample :
 - i. Intelligence Test
 - ii. Aptitude Test
 - iii. Attitude Test
 - iv. Self Concept Test
 - v. Creativity Test
 - vi. Personality Test
2. A Study of group dynamics of a class.
3. Critical appraisal of one theoretical view of learning process.
4. One thematic paper on psychology as a foundation of Education.

References:

- 1 Lindgran, Herry Clay (1980) Educational Psychology in the classroom (VI edi), Oxford University Press, New York.
- 2 Lefrancois, Guy R. (1982) Psychology for teaching, (II Edi), Wadsworth publishing company, California.
- 3 Felker, Donall W. (1974) Building positive self concept, B Vurgess puglishing company, U.S.A.
- 4 Behr, A.L. (1983), Psychology and the School, Butterworths, Durban.
- 5 Mangal, S.K. (2008), Advanced Educational Psychology, (II Edi), Prentice Hall of India Pvt. Ltd., New Delhi.
- 6 Nambiar, K.K. Vijyan (2007), Psychology of Learning and instruction, Neelkamal publications Pvt. Ltd. New Delhi.
- 7 Morris Charles, G. (1976), Psychology: An Introduction, Prentice Hall, New Jersey.
- 8 Child Dennis (2010), Psychology and the teacher, continuum international publishing group, New York.
- 9 Woolfolk, Anita (2005), Educational Psychology, Pearson Educational Pvt. Ltd., New Delhi.
- 10 Bhargava, Mahesh (1997), Modern Psychological Testing and Measurement, Bhargav House, Agra.
- 11 Yadav, M.S. and T.K.S. Laxmi (2003), conceptual inputs for secondary school teachers, NCTE, New Delhi.
- 12 DuBais NelsonF, George F.A.Lverson and Richard K Staley (1979), Educational Psychology and Instructional Decisions, The Dorcy Press, Geogdown antario.
- 13 Chauhan, S.S (1998), Advanced Educational Psychology, .Vikas Publishers, New Delhi.

Education as an Area of Study Lab

L T P C

0 0 12 6

Max. Marks : 100

(CA : 40+ESA:60)

Objectives:

On completion of this course the students will be able to:

- Understand the nature of education as a discipline/an area of study.
- Examine issues related to education as interdisciplinary knowledge.
- Understand the basic concepts/issues of education with reference to kind of concerns the NCF (2005) has raised.
- Examine critically the theories and basic concepts of education drawn from various disciplines cognate to education in such a way that their linkages with methods, pedagogy and practices in the classroom could be established.
- Examine critically the concerns arises from vision of school education and teacher education.
- Reflect on the multiple contexts in which the school are working.

Section-A

• Conceptual Basis of Education

- Education as a socially contrived system influenced by social, cultural, political, economic, and technological factors.
- Education as a discipline or area of study.
- Aims of Indian Education in the context of a democratic, secular, socialist, egalitarian and a humane society.
- Concept of knowledge and knowledge construction between:
 - Content knowledge and Pedagogy knowledge
 - Theoretical knowledge and practical knowledge
 - Universal knowledge and contextual knowledge.
- Need for a vision of school education:
 - Flow of national goals to instructional objectives.
 - Child's rights.
- Concepts of quality and excellence in education- it's relation to quality of life.

Activity: Assignment based on any relevant theme under conceptual basis of education.

Section-B

• Education as Interdisciplinary Knowledge

- Interdisciplinary nature of education; relationships with disciplines/subjects such as philosophy, psychology, sociology, management, economics and anthropology
- Contribution of science and technology to education and challenges ahead.
- Axiological issues in education: role of peace, values and aesthetics in education.

Activity : Preparation and presentation of a paper based on critical analysis of education as an inter-disciplinary knowledge.

Section-C

• Socio-cultural Context of Education

- Social purposiveness of education.

- Multilingual and multicultural Indian Society and other diversity, appropriate approaches for teaching in the context of diversity.
- Equality in educational opportunity-critical analysis of the ways in which schooling, teaching-learning and curriculum contribute to social inequality.
- Education of socio-economically deprived groups based on gender, local (rural/urban), income differential and disabilities.

Activity : Presentation based on theme related to this unit followed by group discussion.

Section-D

- **School Context**

- Learner friendly school environment.
- Role of personals in school management: teachers, headmasters, and administrators.
- Nurturing School as subsystem of society
- Role of school management committee in school management
- Teacher's autonomy and accountability.

Activity : Observation of real classroom situations, various activities in the school and its discussions with peers.

Section-E

- **Supportive Mechanism of Education**

- Teacher Education as reflects in NCF (2005).
- Functions of Academic and Administrative Governmental/autonomous Agencies for School Education.
- Complementarity's in participation of different stakeholders in school education-role of media, use of technology, NGOs, Civil society groups, Teacher organisations, family and local community.
- Monitoring and evaluation of schools.
- Organization of learning resources-textbooks, supplementary books, workbooks, multimedia and ICT and School library.

Activity : Based on library reading and study of documents and references, interaction with field staff and relative interaction with peer group and its responsibility.

Sessional Work: The students may undertake any two of the following activities:

- Assignments based on self-study and its presentation in a seminar on identified themes such as
 - 1 Policy perspectives and status of education of socio-economically disadvantaged children of India/of a particular State;
 - 2 Vision of school education in India;
 - 3 Process of socialisation of the child and role of Education.
 - 4 Critical analysis of the ways in which schooling; Teaching-learning and curriculum contribute to social inequality.
 - and its presentation in a seminar.
- Visit to a rural/tribal school, observation of activities and preparation of a reflective diary and interaction in a group.

Essential Readings :

- Bruner, J.S. (1996), *The Culture of education*. Cambridge, M.A.: Harward University Press.
- Broudy, H.S. (1977) *Types of knowledge and purposes of education*. In R.C. Anderson, R.J., Spiro and W.E. Montanaque (eds) *Schooling and the acquisition of knowledge* (PP. Hillsdale, NJ: Erlbaum.
- Dearden R. F. (1984). *Theory and practice in Education*. Routledge K Kegan & Paul.
- Dewey, J. (1916/1977): *Democracy and Education: An introduction to the philosophy of education*, New York: Macmillan.
- Palmer, Joy A, (2001). *Fifty Modern thinkers on education: From Piaget to the present Day*. Routledge Flamer. London. USA. Canada.

- NCERT (2005). *National curriculum framework*, New Delhi.
- MHRD, Gov. of India (1992), *National policy on education* (revised) New Delhi.
- MHRD, (1992), *Programme of action*. Govt. of India, New Delhi.
- Naik, J.P. (1975) *Equality, quality and quantity: The elusive triangle of Indian education*, Allied Publications, Bombay.
- Peters, R.S. (ed), (1975). *The Philosophy of education*. Oxford University Press, London.
- Peters, R.S. (1967), *The Concept of education*, Routledge, United Kingdom.

References :

- Beyer, L.E. (Ed.) (1996) *Creating democratic classrooms: The struggle to integrate theory and Practice*. New York: Teachers College Press.
- Banrs, J.A. (1996), *Cultural diversity and education: Foundations curriculum and teaching* (4th ed.) Boston: Allynand, Becon.
- Bruubacher, John S.; (1969) *Modern Philosophies of education*, Tata McGraw-Hill, Publishing Company Pvt LTD, New Delhi.
- Butchvarov, P. (1970) *The Concept of knowledge*. Evanston, Illinois, North Western University Press.
- Debra Heyes, Martin Hills, Pam Chistie and Bob Lingard (2007) *Teachers and schooling: Making a Difference*, Allen and Unwin, Australia.
- Delors, Jacques, et al; (1996). *Learning: The Treasure within report of the international commission on education for 21st century*, UNESCO.
- Freire, Paulo (1970). *Pedagogy of the oppressed*. New York: Continuum.
- Freire, P. and Shor, I. (1987). *A Pedagogy of liberation*. London, Macmillan Education.
- *International Encyclopedia of Education*. (1994) 2nd edition. Vol.10. Perganon Press.
- Matheson, David (2004). *An Introduction to the study of education* (2nd edition). David Fulton Publish.
- Slatterry, Patrick and Dana Rapp. (2002). *Ethics and the foundations of education- Teaching Convictions in a postmodern world*. Allyn & Bacon.
- Wall, Edmund (2001). *Educational theory: philosophical and political Perspectives*. Prometheus Books.
- Winch, C. (1st edition). (1996). *Key Concepts in the philosophy of education*. Routledge.
- Inch, C. (1986). *Philosophy of human learning*, Routledge, London.

Educational Research - I : Theoretical Perspective

L T P C
6 0 0 6
Max. Marks : 100
(CA: 40 + ESA: 60)

Objectives:

- i To acquaint students with the concepts of research and educational research.
- ii To develop an understanding of the nature and scope of educational research.
- iii To develop an understanding and appreciation for various kinds of research as well their aspects.
- iv To develop insights into the methodological issues involved in educational research.
- v To acquaint students with the process of research proposal writing.
- vi. To develop ability to design a research proposal.

Section-A

- **Research as a Scientific Inquiry and Research Problem**
 - Research: Concept & Objectives
 - Educational Research: Meaning, Need & Importance, Characteristics & Limitations.
 - Various types of Research:
 - Basic Research,
 - Applied Research
 - Action Research.
 - Identification of Research Problem: Role of experience, common sense, discussion, literature
 - Variables: Concept and Kinds.
 - Research problem formulation
 - Identification of specific research questions
 - Defining the problem
- **Evolving a conceptual framework**
 - Understanding and organizing concepts/constructs in a defined purview.
 - Meaning and relevance of conceptual framework.
 - Reviewing the related literature for formulating conceptual framework - Meaning, Sources and Importance.

Section-B

- **Research Hypothesis**
 - Hypothesis: Meaning, Sources, Criteria's of a good Hypothesis
 - Various forms of Hypothesis- Alternative, Directive, Null
- **Sampling design**
 - Sources of data: Primary and Secondary
 - Nature of data: Primary and Secondary
 - Sampling design: Meaning, Steps and features.
 - Types of sampling: Random, Stratified, Cluster, Purposive and Incidental.
- **Educational Research and designs**
 - Concept, basic features and limitations of following -
 - Survey Research
 - Experimental Research-
 - Post Test design

- Pre-Post Test design
- Randomized block design

Section-C

- **Qualitative Research-**
 - Philosophical
 - Phenomenological
 - Case Study
- **Various Research Tools and Techniques**
 - Concept of research tools and their need
 - Characteristics and limitations of following tools-
 - Observation
 - Interview
 - Sociometry
 - Questionnaire
 - Checklist
 - Standardized Psychological Test
 - Rating Scales
- **Research Proposal Writing**

Practicum: Any two

1. Designing a research proposal for any one research study.
2. Appraisal of research design.
3. Presentation of a term paper .
4. Collection of information from any primary/secondary sources.

References:

1. Best, John W, Research in Education, IV edition, Prentice Hall Inc., New York.
2. Borg, Walter R. & Meredith Damein Gall, 1983.Educational Research-an introduction IV edition, Longman Inc., New York.
3. Borg, Walter R, 1981. Applying Educational Research, A Practical Guide to Teacher, Longman Inc., New York.
4. Fox, David, J. 1969. The Research Process in Education, Holt, Rinehart & Winston Inc., New York.
5. Kerlinger, Fred N., 1973. Foundations of Behavioural Research, II edition, Hold Rinehart & Winston IUC, New York.
6. Pal S.K. & P.C. Saxena (eds) 1989. Quality control in Educational Research, Metropolitan Book Company, New Delhi.
7. Rummel, Francis, J. 1984. An Introduction to Research Procedure in Education, II edition, Harper & Row Publishers, New Jersey.
8. Sharma BAB, Ravindra Prasad D. Sathyanarayanan P., 1984. Research Methods in Social Science Sterling Publishers Pvt. Ltd., New Delhi.
9. I Subby Reddy T.P. Bappa Rao, 1995. Research Methodology & Statistical Measures, Reliance Publishing House, New Delhi.
10. Travers, Robert HMW, 1964, An Introduction to Educational Research Macmillan Co., New York.
11. Yadav M.S. & Shib K. Mitra (eds.) 1989, Educational Research - Methodological Perspectives, Centre of Advanced Study in Education, M.S. University of Baroda, Baroda.
12. Khanzode V.V. 1995, Research Methodology - Techniques & Trends, P.P. H. Publishing Corporation, New Delhi.

13. कपिल. एच. के. (2006). अनसंधान विधियाँ. आगरा. : भार्गव बक हाउस
14. Pandey, K.P. (2010), Fundamentals of Educational Research, Varanasi: Vishwavidyalya Prakashan.
15. जैन बी. एम. (2010). शोध प्रविधि एवं क्षेत्रीय तकनीक. जयपर : रिसर्च पब्लिकेशन्स.
16. रायजादा. बी. एस. (2010). शिक्षा में अनसंधान के मूल आधार जयपर : राजस्थान हिन्दी ग्रन्थ अकादमी.

Educational Research-II: Data Analysis and Interpretation

L T P C

6 0 0 6

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives:

- (i) To develop understanding and skill in using quantitative and qualitative techniques of data analysis.
- (ii) To develop skill to interpret a given set of data after analysis.
- (iii) To enable the student to write a research report.

Course Outline:

Section-A

- **Data and Descriptive Statistics for Educational Research:**
 - Concept and difference of data and Variables (continuous and discrete)
 - Scales of measurement (nominal, ordinal, internal and ratio)
- **Uses, meaning of results and computation with help of calculator of the following statistical tools -**
 - Tabulation and graphical representation of data: histogram, frequency polygon, ogive.
 - Measures of central tendency (mean, median, mode)
 - Measures of variability (SD)
 - Percentile and Percentile Rank
- **Measures of Relationship Concept of correlation, correlation coefficient Rank Difference, Product-Moment, Partial correlation**

Section-B

- **Normal distribution and Concept of Inferential Statistics**
 - Normal distribution-Concept of probability, NPC and its properties, use of Normal Table and applications of NPC.
 - Nature of inferential statistics, distribution of statistics and standard error, reliability of statistics.
- **Applications of Inferential Statistics**
 - Uses, meaning of the results of the following -
 - Testing the significance of difference between the following statistics for independent and correlated samples: Mean, SD. Analysis of variance (one way).

Section-C

- **Non-Parametric Statistics-**
 - Chi-square Test
- **Qualitative Data Analysis and Report writing**
 - Qualitative data - Concept
 - Content analysis - Concept and Steps
 - Trend analysis - Concept
 - Mixed Method Research - Concept and Importance
 - Interpretation of results in terms of objectives, hypothesis, earlier findings, limitation of tools, etc.
 - Preparation of Research report - format, language, style, bibliography, appendix.

Practicum :

1. Students will critically examine the analysis procedure adopted in a research study with respect to its design and objectives.
2. Student will analyse the data and prepare report.

References:

1. Ferguson, G.A., 1976, Statistical Analysis in Psychology and Education, Tokyo; Mc.Graw Hill Book Co.
2. Garrett, H.E., 1969, Statistics in Psychology and Education, Bombay : Vakils Feffer and Simons Pvt. Ltd.
3. Guilford, J.P. 1956 Fundamental Statistics in Psychology and Education, Mc. Graw Hill Bookd Co., New York.
4. Kerlinger, F.N. 1983, Foundations of Behavioural Research, Surjeet Publication, Delhi.
5. Khanzode V. V., 1995, Research Methodology: Techniques and Trends, A.P.H. Publishing Corporation, New Delhi.
6. Lal, J.N. 1996, Manovigyan Aur Shiksha Main Shankhyiki, Radha Publications, New Delhi.
7. Mendenhall, William & Madelaine Ramey 1973, Statistics for Psychology, Duxbury Press, Cal.
8. Mc. Millan, H.J.& Schumacher, Sall, 1989, Research in Education, U.S.A. : Harper Colling Publishers.
9. Subbi Reddy T. & P. Bappa Rao, 1995, Research Methodology and Statistical Measures, Reliance Publishing House, New Delhi.
10. Selltitz, Charie and others, 1969, Research Methods in Social Relations, U. K. Methuen & Co.

Principles and Procedures of Guidance & Counselling

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Course Outcomes:

Student Teacher Educators will be able to:

explain the concepts of guidance and counselling, their need and application to the process of education.

discuss the basic principles of guidance and counselling

analyze the theoretical background of vocational development and guidance activities.

describe the organizational frame work of various guidance services in schools.

Course Outline:

Section - A

Guidance & Counselling – Nature and Areas

Meaning, Nature and Principles of Guidance and Counselling.

Need for Guidance and Counselling in Education.

Areas of Guidance –Educational, Vocational and Personal.

Vocational development and Guidance.

Concept and significance.

Theories of Vocational development (D.E. super and J. Holland)

Job analysis and Job description

Section – B

Guidance Services (Concept, Types, Purpose and Organisation)

Individual Inventory Service

Information Service

Counselling Service

Placement Service

Follow-up Service

Section – C

Essential Features and Organizational requirements of Guidance Programme.

Essentials of good guidance programme.

Organization of guidance service at secondary level.

Organization of guidance service at college level.

Role of the teacher and other personnel in guidance programme.

Guidance activities-possibilities and problems:

Guidance activities as career days, career conferences, field trips, group discussion.

Problems of guidance in India.

Guidance related Research in India

Practicum: Any two of the following

- One term paper related to guidance and counselling.

- b. Visiting and reporting guidance work being done at University employment information and guidance bureau or employment exchange or in a school.
- c. Guidance programme planning Trainees should submit proposed plan for a guidance programme for a senior secondary institution.
- d. Identification of Guidance needs of the school students and give them proper guidance.
- e. Organising an activity for Guidance & Counselling of school students.

References:

- Chouhan. S.S. (1982). *Principles and Techniques of Guidance*. New Delhi: Vikas Publication House Pvt. Ltd.
- Crow & Crow. (1964). *Introduction to Guidance*. New Delhi: Vikas Publication House Pvt. Ltd.
- Donald, S. (1965). *Counselling in the Secondary School*. New Delhi: Harper and Row.
- Dosiagh, N. L. (1969). *Guidance Services in India*. New Delhi: Arya Book Depot.
- Jones, A.J. (1951). *Principles of Guidance and Pupil Personal Work*. Tokyo: Mc Graw Hill. Book Co.
- Kochhar, S.K. (1984). *Educational and Vocational Guidance in Secondary School*. Sterling Publishers Pvt. Ltd.
- Mathuson, R.S. (1962). *Guidance Policy & Practice*. New York: Harper and Bros.
- Smith, Robert. & Erickson. (1953). *Organization and Administration of Guidance Service*. London: Mc Graw Hill Book Co.
- Stoops. (1959). *Principles and Practices in Guidance, Guidance service*. London: Mc. Graw Hill Book Co.
- दवे एवं पाठक अरविन्द. (1973). *निर्देशन के मूल तत्त्व*. जयपुर: (राज.) हिन्दी ग्रंथ आकदमी.
- जायसवाल एस. आर. (1987). *निर्देशन एवं परामर्शन*. आगरा: विनोद पुस्तक मंदिर.
- वर्मा एवं उपाध्याय. (1967). *शैक्षिक एवं व्यावसायिक निर्देशन*. आगरा: विनोद पुस्तक मंदिर.

Web Resources:

- Concept of Guidance and counselling- <http://ncert.nic.in/textbook/pdf/lehe108.pdf>
- Organization of guidance services in schools- <http://www.yourarticlelibrary.com/education/guidance-in-schools/guidance-services-in-schools-introduction-committees-and-scope/63674>
- Need of Guidance and Counselling- <https://www.nalandaschool.org/importance-of-guidance-and-counselling>
- Follow up services- <http://www.yourarticlelibrary.com/education/guidance-in-schools/follow-up-service-in-schools-meaning-functions-and-ways-to-conduct-it/63682>
- Vocational development Theory of Super- <https://www.careers.govt.nz/assets/pages/docs/career-theory-model-super.pdf>
- Role of Personnel in Guidance Program- https://www.edb.gov.hk/attachment/en/teacher/student-guidance-discipline-services/projects-services/sgs/guidance-in-secondary-schools/roles4_e.pdf

Educational Administration and Planning

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

Students will be able to:

- analyze fundamental of Educational Management.
- describe the development of Educational Administration.
- visualize Educational Administration as a process.
- Critically evaluate status of Educational Administration in India.
- critically analyze Educational planning in India.

Course Outlines:

SECTION - A

Fundamentals and Development of Educational Administration

- Concept and Nature of Educational Administration
- Scope of Educational Administration.
- Relationship among Management, Administration, Supervision and Planning.
- Development of Modern Concept of Educational Administration from 1900 to present day.
 - Taylorism
 - Administration as a process.
 - Human relation approach to Administration

SECTION - B

Educational Administration as a process and level.

- Process of Educational Administration.
- Concept, Importance and Process of Communication in Educational Administration.
- Concept, Importance and Process of Decision Making in Educational Administration.
- Structure of Educational Administration at various levels.
 - National Level
 - State Level
 - District Level
 - Institutional Level

SECTION - C

Educational Planning

- Meaning, Nature and need of Educational Planning.
- Basic Principles of Educational Planning.
- Approaches of Educational Planning-
 - Social demand approach
 - Man-power approach
 - Return of investment approach
- Institutional Planning-Concept, need, principles and procedure.

Practicum: Any two of the following:

1. Thematic Term Paper and its presentation in classroom.
2. Presentation of Process of Educational Administration with suitable examples.
3. Critical Appraisal of Approaches to Educational Planning.

4 Identification of Research Areas in Educational Administration & Planning.

Reference:

- Beaby, C.E. (1967). *Planning and Educational Administration*. Paris: UNESCO.
- Bhatnagar and Verma. *Educational Supervision*. Meerut : International Pub. House.
- Dessler, G. (2005). *Human Resource Management*. New Delhi : Pearson Prentice Hall.
- Edwin, F. (1984). *Personnel Management*. New Delhi: Mac Graw Hill.
- Fletcher, B.A.(1963). *Planning of Education*. New York: Institute of Education.
- Griffiths, V.L.(1962). *Educational Planning*. London:Oxford University Press.
- Harpinson, F. (1964). *Education Manpower and Economic Growth*. New York: McGraw Hill.
- Harry, J. H. (1973). *Educational Planning, Programming, Budgeting : A System Approach*. New Jersey: Prentice Hall Inc.
- John, R.L. and Morphot. (1964). *Financing the public school*. New Jersey: Englewood Cliffs.
- Kimbrough, S.Ralph, Michall & Nunnery. *Educational Administration*. New York: Mc Millan
- Lyons, R.F. (1967). *The Fundamentals of Educational Planning*, (No.21 and 22). International Institute of Educational Planning. UNESCO.
- Mckerinan, K.R. (1973). *Realistic Educational Planning*. Paris: UNESCO.
- Mishra, A. (1967). *The Financing of India*. Bombay: Asia Publishing House.
- Mukerji, S.N.. *Administration of Educational Planning and Finance*. Baroda : Acharya Book Depot.
- Musgrave, R.A.(1959). *Theory of Public Finance, A Study of Public Economy*. New York: McGraw Hill.
- Naik, J.P.(1965). *Educational Planning in India*. Bombay: Allied Publishers.
- Newman and Summer. *The process of Management : Concept, Behaviour and Practice*. New Delhi.
- Pattnayak, B. (2005). *Human Resource Management*. New Delhi: Prentice Hall of India (Pvt.) Ltd.
- Platt,W. J.(1960). *Research for Educational Planning*. UNESCO. (Practice). Baroda: Acharya Book Depot. Prentice Hall of India Pvt. Ltd.
- Rao, T.V. (1999). *Appraising and Developing Managerial Performance*. New Delhi: Excel Books.
- Rao, V.K.(1961). *Education and Human Resource Development*. Bombay: Allied Publishers.
- Robin Stepher P. *Organizational Behaviour*. Prentice Hall Pub. Pvt. Ltd.
- Saiyadain, M. (2003) *Human Resource Management*. New Delhi: Tata Mac. Graw Hill Publishing Co. Ltd.
- Simon, Herbart A. *Administrative Behaviour*. New York : McMillan Company.
- Singh, B. (1967). *Education as Investment*. Delhi: Meenakshi Prakashan.UNESCO (1963). *Economic and Social Aspects of Planning*. Paris.
- Singh, N.K. (1999). *Human Resource Management*. New Delhi: Excel Books.
- Waber, Clarence A. *Fundamentals of Educational Leadership*. New York : Exposition Press.

Web Resources:

- Educational Administration- http://ddceutkal.ac.in/Syllabus/MA_Education/Paper_8.pdf
- Leading People Resource Management- http://www.csu.edu.au/_data/assets/pdf_file/0007/51946/Resource-Management.pdf
- Educational leadership and management: theory, policy, and practice- <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.729.7350&rep=rep1&type=pdf>

Handbook of Educational Leadership and Management-

http://www.edindustrygroup.com/uploads/2/9/2/8/2928545/handbook_of_educational_leadership_and_management-2003.pdf

Management and Leadership Issues for School Building Leaders- <https://files.eric.ed.gov/fulltext/EJ1024110.pdf>

Primary and Secondary Education Management Issues-

https://poledakar.iiep.unesco.org/sites/default/files/fields/publication_files/chapter7.pdf

Fundamentals of Educational Assessment and Evaluation

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

Students will be able to:

explain the Concept and Need of Educational Measurement and Evaluation.

discuss the relationship of Instructional Process and Educational Evaluation.

discuss selection and use the various items used in Educational Evaluation.

selection and use of the Characteristics of Evaluation Tools.

analyze the Trends in Educational Evaluation.

reflect the skills necessary for determining the degree of reliability and validity of a test.

Course Outline:

Section - A

Concept Need and Instructional process of Educational Assessment and Evaluation.

Concept of Educational Assessment and Evaluation.

Meaning and Difference between Physical and Psychological Measurement.

Need of Educational Assessment and Evaluation.

Relationship of Educational Evaluation with Instructional objectives, Teaching Learning process.

Formative and Summative Evaluation

Concept and Types of Reliability and Validity (Validity Content, Construct, Predictive, Face validity and External Validity)

Section - B

Estimation of Reliability and Validity of Tools and Assessment

Estimation of Reliability

- Test-Re-Test Method
- Split half method
- Parallel form method
- Kuder-Richerdson

Factors of influencing Reliability

Estimation of Validity (Co relational and factor analysis)

Factors of influencing validity

Interrelationship of Reliability and Validity

Section - C

Unit-V: Recent Trends in Educational Evaluation

Meaning, Advantages and limitations of

Semester system

Open Book exam

Grading and its determination

Continuous Comprehensive Evaluation

Functions

Action Plan

Critical Appraisal

Meta-evaluation: Concept need and Guide line to conduct Transparency in Educational Evaluation.

Practicum: Any two of the following-

- i. Determining the reliability of an Educational Test.
- ii. Determining the validity of an Educational Test.
- iii. Reporting the result of any achievement test in terms of grading.
- iv. Analysis and Presentation of a report on CCE action plan.
- v. Preparation of a term paper on any one topic related to course content.

References:

- Anastasi, A.(1976). *Psychological Testing (Fourth Edition)*. New York : Macmillian Publishing Co. Inc.
- Bhargava, Mahesh.(2003). *Adhunik Mano Vaigyanik Prikshan Evam Mapan*. Agra : H.P. Bhargava Book House.
- Ebel, Robert L. & David, A. Frisbie. (1986). *Essentials of Educational Measurement (Fourth Edition)*. New Jersey USA: Prentice-Hall, INC, Englewood Chaffs,
- Ferguson, G.A. (1976). *Statistical analysis in Psychology and Education*. Tokyo: McGraw Hill Book Co. New York
- Fredrick, B. Devis. (1964). *Educational Measurement and their Interpretation*. Belmont California : Wadsworth Publishing Company. INC. USA.
- Garrett, H.E. (1969). *Statistics in Psychology and Education*. Bombay: Vakips Fetter and Simouis Pvt. Ltd.
- George, David. (2005). *Trends in Measurement and Evaluation Techniques*. New Delhi : Commonwealth Publishers.
- Guilford, J.P. (1956). *Fundamental Statistics in Psychology and Education*. New York: Mac. GrewHill Book.
- Gupta, S.P. (2001). *Adunik Mapan Evam Mulyankan*. Allahabad : Sharda Pustak Bhawan.
- John, A. Green. (1963). *Teacher made tests*. New York Vanstone: Harper and Row Publishing.
- Kennethl, Bean. (1953). *Construction of Educational and Personnel Tests*, New York. U.S.A. : McGraw Hill Book Company. INC.
- Payne, D. A. (2002). *Applied Educational Assessment*. CA. USA: Wards worth Thompson Learning.
- Sharma, R.A. (1999). *Essential of Educational Measurement and Evaluation*. Meerut: R. Lal Book Depot.

Web Resources:

- Meaning and Difference between Physical and Psychological Measurement- <http://www.yourarticlelibrary.Com/statistics-2/measurement-of-data-meaning-types-and-characteristics-statistics/92436>
- Relationship of Educational Evaluation with Instructional objectives- <https://www.nap.edu/read/5287/chapter/6>
- Formative and Summative Evaluation- <https://cft.vanderbilt.edu/student-assessment-in-teaching-and-learning/>
- Concept and Types of Reliability and Validity- <https://chfasoa.uni.edu/reliabilityandvalidity.htm> ,
<https://opentextbc.ca/researchmethods/chapter/reliability-and-validity-of-measurement/>,
<https://www.cpp.edu/~smemerson/nbu-programeval/trochimppp/Part%203/Types%20of%20Reliability.ppt> ,
<https://socialresearchmethods.net/kb/relytypes.php>

Communication Skill with ICT Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	6	3

Course Outcomes:

Student- teacher will be able to:

explain the concept and potential of ICT for Communication.

critically analyze and utilize the ICT for teacher-educator related work.

design appropriate ICT for Communication.

apply appropriate ICT for Communication.

Course Outline:

SECTION - A

Communication Skill with ICT includes

Using Gadgets for Communication (Public Address System and LCD Projector)

Inquiry for communication

(Offline and Online inquiry using digital library and ICT)

SECTION - B

Document Processing (Formatting and Printing of Documents)

Data Processing (Using Spreadsheet Formula and Functions)

Graphical Presentation (Preparation, formatting and editing the graph)

SECTION - C

Multimedia Presentation (slide design, animation and presentation)

Ethical issues of Using ICT (Using Plagiarism Software and IPR).

Note - It is a self practice based Inter- Semester Break (ISB) course and each student has to demonstrate communication skills in her presentation (s) using ICT.

Mode of Transaction: Orientation and Demonstration, Self Practice and Presentation.

Reference:

CD ROM. (2005). Intel Teach to the Future programme (I. T.F.P.).

Sinha, P. K. and P. S. (2005). Computer Fundamentals - Concept; System and Applications. New Delhi: BPB Publication.

शास्त्री, ए. एवं ए. (2005). *कम्प्यूटर अनुप्रयोग एवं प्रोग्रामिंग*, जयपुर: जयपुर पब्लिशिंग हाऊस।

सिंह, एन. एवं ए. उ. (2001). *कम्प्यूटर अनुप्रयोग*. जयपुर: मंगलदीप पब्लिकेशन.

गुप्ता, एम. कु. (2005). *संगणक एवं सूचना प्रौद्योगिकी*. जयपुर: आविष्कार पब्लिकेशन.

चौबे, एस. एस. (2005). *कम्प्यूटर एक परिचय मध्यप्रदेश*. भोपाल: हिन्दी ग्रन्थ अकादमी.

Web Resources:

Ethics and Copyright Issues in Using ICT

<https://sites.google.com/site/ignouhelpbooks95/Block-420Support20 Svstems 2C20Legal20and20Ethical201issues.zip?attredirects=0&d=l>

Ehics and Copyright Issues in Using ICT

<https://sites.google.com/site/ignouhelpbooks96/BESE-13520Block-04.zip?attredirects=0&d=l>

ICT for Administrative Support

<https://books.google.co.in/books?id=16-Fgie2Cg8C&printsec=front cover& dq= books+for+microsoft+word&hl=en&sa=X&ved=OahUKE wi5p eHmM gAhUEEnlKHQafBCsQ6AEIKDAA#v=onepage&q= books20for20microsoft20word&f=false>

Document and Data Processing, Graphical & Multimedia Presentation

<https://www.gfmer.ch/Informatics/Presentations/postgrad2005/presentation.pdf>

Document and Data Processing, Graphical & Multimedia Presentation

<http://bcihmct.ac.in/download/Unit20420-Intemet20Basics20and20 HTML.pdf>

Document and Data Processing, Graphical & Multimedia Presentation

<https://books.google.co.in/books?id=qKVCAwAAQBAJ&pg:=PA665&dq:=word+powerpoint+excel>

Childhood and Growing Up

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

Student Teacher will be able to:

clarify development as a continuous process.

explain childhood development in various aspects.

describe the adolescent stage in reference to characteristics & problems.

describe the causes of the problems in adolescent learner and imply the suitable solutions.

recognize and appreciate adolescent learner's uniqueness and enshape them.

illustrate the impact of social context upon growing child

Course Outline:

Unit-I Learner's Development: A Continuous Process

Concepts of Growth, Development and Maturity

Difference between Growth and Development

Different Stages of Development

Genetic and Non-Genetic factors affecting Learner's Development

Activity: Identification of cases in which Development is affected by Genetic/Non Genetic Factors

Unit-II Childhood: As a Foundation Stage

Late Childhood: An Elementary School age with its unique name

Major Developmental Characteristics in different aspects: Physical, Cognitive, Emotional, Social and Moral.

Interest and Hazards

Dealing of late Childhood in reference to Characteristics and Hazards.

Activity: School Visit to observe developmental features and hazards among Children.

Unit-III Adolescent Stage: Transition to Maturity

A Period of Secondary Schooling

Development of Adolescent: Physical, Cognitive, Emotional, Social and Moral

Problems Facing by Adolescents- (concept, features and providing help for solutions)

- Identity Crisis
- Physical Abuse (Bullies and Violence)
- Depression

Activity: Presentation and Discussion on Adolescent's Problems

Unit-IV: Adolescents: A Unique Learner

Adolescent as Unique Learner: Inter and Intra individual Differences

Differences in Intelligence, Aptitude, Interest and Personality. (Concept, Features, Identification and dealing of above traits among Adolescents)

Activity: Observation of Adolescent in reference to Uniqueness

Unit –V Growing Child in Social Context

Child in the Family:

- Child-Family Relationship
- Blended Family
- Expectation of Parents

Child in the School:

- Influence of Peer Relationship and Peer Culture
- Relationship with Teachers

Child in the Society:

- Impact of Rural/Urban Community
- Influence of Media

Activity: Study of an Adolescent in relation to Family/School /Society.

Practicum: Any Two of the following

1. To observe a class and describe the developmental characteristics of student in various aspects.
2. Identification of Adolescent's traits through a Psychological test.
3. Presentation of a problem-facing by Adolescent with supports of data and provide helping suggestions.
4. To prepare a term paper on the role of social context and growing child.
5. On the classroom teaching experiences present children problems.

References:

- Barnard, H. W. (1965). *Psychology of Learning Teaching*. New York : Mc.Graw Hill.
- Borich, G. D., & Tombari, M. L. (1997). *Educational Psychology A Contemporary Approach*. New York: Longman.
- Chauhan, S.S. (1998). *Advance Educational Psychology*. New Delhi: Vikas Publication.
- Cronbach, L.J. (1963). *Educational Psychology*. London: Staples Press.
- Crow, L.D., & Crow, A.D. (1964). *Educational Psychology*. Delhi: Eurasia Publishing House.
- Hurlock, E.(1959). *Developmental Psychology*. New York,: Tata Mc Graw Hill Publication Company.
- Kolesnic, W. B. (1953). *Educational Psychology*. New York: Mc. Graw Hill.
- Lindgren, H. C. (1962). *Educational Psychology*. New York:: John Wiley.
- Mangal, S.K.(2009). *Advance Educational Psycholog*. New Delhi: PHI Learning Private Limited..
- Morris, C. G. (1979). *Psychology: An Introduction..* New Jersey: Prentice Hall.
- Woolfolk, A. E. (1995.) *Educational Psychology*. Bostan, USA: Allyn & Bacon.

Web Resources:

- Stages of Development- <http://www.psychology discussion.net/psychology/stages-of-development-of-psychology-of-people-at-different-ages-from-infancy-to-old-age/732>
- Individual differences- <http://www.psychology discussion.net/psychology/individual-differences-psychology/individual-differences-types-causes-and-role-psychology/2557>
- Depression- <https://www.healthline.com/health/adolescent-depression> Differences between growth and development- <http://www.preservearticles.com/201102244162/differences-between-growth-and-development.html>

Language across the Curriculum

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student teacher will be able to -

employ language according to its nature and function to acquaint with language diversity in classroom.

carry out classroom interaction in reference to first, second and third language,

appreciate multilingualism and culture in their class

resolve Communication Problem of school Students.

appreciate challenges of language across the curriculum (LAC).

analyze barriers of Listening, Speaking, Reading and Writing (LSRW) skills

Course Outline:

Unit-I: Nature and Functions of Language

- Language – Concept
- Functions of Language
- Language used in classroom by teacher and students: Barriers & Strategies to overcome them

Activity: Group discussion on language used in classroom discourse

Unit-II: Language Diversity in Classrooms

- Concept and importance of First Language Acquisition and Second Language Learning
- Use of First and Second Language in the Classroom
- Multilingualism- Concept, Concern and Challenges

Activity: Presentation (Thematic paper/posters/multimedia/Role play) on relationship between language and culture

Unit-III: Communication and Language Across Curriculum

- Communication – Meaning and Importance
- Types of Communication (Means, Direction and Network)
- Communication flow in schools
- Language Across the Curriculum: Concept, importance and Challenges

Activity: School visit to find out communication problem/apprehension in school Students

Unit- IV: Developing Receptive Skills

- Barriers to Listening Skills
- Activities for Developing Listening Skills
- Barriers to Reading Skills
- Activities for Developing Reading Skills

Activity: Identification of barriers of receptive skills.

Unit – V: Developing Productive Skills

- Barriers to Writing Skills
- Activities for Developing Writing Skills
- Barriers to Speaking Skills
- Activities for Developing Speaking Skills

Activity: Identification of barriers of productive skills.

Mode of transaction: Lecture, discussion, exercises, assignments, language games, seminar and dialogue.

Practical Work: Any two of the following:

1. Designing Games and Exercises for Developing Listening, Speaking, Writing and Reading Skills.
2. Organisation and participation in activities for Writing Skills- Summary, Letter, Paragraph, Essays, Speech.
3. Organisation and participation in activities for Speaking Skills – Oral Presentations, Debate, Elocution, Discussion, Brain-storming.
4. Assignments on Developing Listening Skills – Listening to speech, directions.
5. The thematic term paper.

References:

Akmajian, A. et al. (2010). *Linguistics: Introduction to Language and Communication*.

(6thed.). Cambridge: MIT Press.

Fasold, R. & Connor-Linton, J. (2013). *An Introduction to Language and Linguistics*.

(6thed.). Cambridge: Cambridge University Press.

Floyd, K. (2009). *Interpersonal Communication*. New York: McGraw Hill Companies Inc.

Fromkin, V, Rodman, R & Hymes, N. (2011). *Introduction to Language*. (9thed.). Canada: Cengage Learning.

Pearson, J.C. et al. (2011). *Human Communication*. (4th ed.). New York: McGraw Hill Companies Inc.

लाल, आर. बी. (1965). *हिन्दी शिक्षण*. मेरठ: रस्तोगी एण्ड कम्पनी.

मत्तल, एस. (2005). *शैक्षिक तकनीकी*. जयपुर: राजस्थान हिन्दी ग्रन्थ अकादमी.

Web Resources:

First and Second Language Acquisition- a Brief Comparison. Retrieved from

https://www.uni-due.de/ELE/FLA_SLA_brief_comparison.pdf

Similarities and Differences between First and Second Language Acquisition Retrieved from

<http://multilingualism.pbworks.com/w/page/21913433/Similarities%20and%20Differences%20between%20First%20and%20Second%20Language%20Acquisition>

Activities for Developing Speaking Skill Retrieved from

<http://faculty.weber.edu/ppitts/ed4320/Handouts/speakingskills.htm>

<http://www.educ.ualberta.ca/staff/olenka.Bilash/best%20of%20bilash/speaking.html>

Activities for Developing Listening Skill Retrieved from

<http://www.educ.ualberta.ca/staff/olenka.bilash/best%20of%20bilash>

<https://blog.udemy.com/listening-skills-exercises/>

[/listening.html](#)

Educational Technology

L T P C
4 0 0 4
Max. Marks :100
(CA:40+ESA:60)

Objectives :

1. To develop in students the basic concepts related to Educational Technology.
2. To familiarize the students with Communication & its relation to Instruction.
3. To enable the students to understand the role of Instructional Material, & its development.

Course Outline :

Unit-I : Nature of ET

- (a) Meaning & Nature of ET
- (b) Concept of ET
- (c) System Approach in ET

Unit-II : Communicative Process

- (a) Communicative Process (educational) within & outside school.
- (b) Role of Instructional Material & its development based on
 - Target audience
 - Instructional Objective
 - Available Resources

Practicum :

Skill based activities:

1. Preparing any two of the following material for Teaching-Learning purpose
 - Chart
 - Map
 - Model
 - Transparency
 - Photographic Slide
2. Preparing a print-media based thematic instructional programme.
3. Operating Hardware Technology (Any two)
OHP, Slide Projector, Tape Recorder, Epidiascope, VCR

References :

1. Levine, J.M., Secondary instruction: A manual for classroom Teaching, Boston: Allyn & Becon, 1989.
2. Percival, F. and Ellington, H., A Handbook of Educational Technology, London: Kogen Page, 1984.
3. Rao, Usha, Educational Technology, Bombay : Himalaya Publishing House, 1991.
4. Sampath, K. Panneerselvam, A. And santhanam S., 1984, Introduction to Educational Technology, New Delhi : Sterling Publishers.
5. Sharma, Mittal, System Approach : Its Application in Education, Bombay, Himalaya Publishing House, 1985.
6. Sharma, R.A., Shiksha Takniki, Meerut : Loyal book Depot., 1987.
7. Woolfolk, A.E., Educational Psychology, New Jersey: Prentice Hall, 1990.

Women Education

L T P C
4 0 0 4
Max. Marks :100
(CA:40+ESA:60)

Objectives:

To enable students:

- 1 To develop an understanding of Concept and meaning of Women Education.
- 2 To critically analyse the issues related to women education.
- 3 To understand the status of women in Indian Society.
- 4 To analyse the problem of working women.

Course Outline :

Unit-I : Women and Education

- Meaning and Concept of Women Education.
- Concept, Issues and Problem of Girls education.
 - at primary level
 - at secondary and senior secondary level
 - at Higher level of education.
- Status of Women in Indian Society.

Activity : Group Discussion on Status of women in present Indian society

Unit-II : Women at work

- Job stress and working women
- Problems of working women at work place.
- Role of NGO's in upliftment of rural women.

Activity : Identification and reporting of issues and problems of Girl education across of various levels of education

Unit-III : Practical Activity (any one)

- Identify and Report the issues and problems of Girl Child education across the various levels of education.
- Prepare a scrap book on contribution of Great Indian Womens.
- Critical analysis of status of women in Indian Society.

Activity : Group discussion on problems of working women's and prepares a report.

Unit-IV: Practical Activity (any one)

- Prepare a profile of any 10 Renound Womens of India.
- Radio-talk on topic concern with women education.
- Survey report on role and support of any NGO in upliftment women.

Activity : Group discussion on ways and means of Women Empowerment

Unit-V : Practical Activity (any one)

- Action research on any topic related to women education.
- Report the functions of women study centres.
- Survey report on problems of womens as professionals.

Activity : Poster presentation on domestic violence

Practicum: Any two of following

1. Prepare a scrap book on great Indian Women's.
2. Action research on attitude of society towards girl's education.
3. Report on Uniform Civil Code as Women's right.
4. Project on Women empowerment present through Power Point presentation.
5. Observation and reporting on issues on problems of Girls education at school level.
6. Report on major Constitutional provisions for Women's.

References:

- <http://www.educationforallinindia.com>
- <http://www.collegeeducation.rajasthan.gov.in>
- M.H.R.D. (2008): "Elementary Education in India-Analysis Report 2006-07", NEUPA and Department of School education and Literacy, Ministry of Human Resource Development, Government of India, New Delhi.
- Satya, B.R. (2003): "Trends in Education", Anmol Publication, New Delhi.
- Sharma, Usha, B.M. Sharma (1995): "Girl's Education", Women and Educational Development Series-6", Common Wealth Publishers, New Delhi.
- Verma, G.C. (1984): "Modern Education, Growth and Development in Rajasthan", Publication Scheme, Jaipur.
- www.education.nic.in
- शिक्षा विभाग (2008), वार्षिक प्रतिवेदन एवं अंकेक्षित लेखा, सर्व शिक्षा अभियान, शिक्षा विभाग, राजस्थान सरकार, जयपुर।
- पारीक, मथुरेश्वर, सम्पादक (2002): "राजस्थान में शिक्षा", राजस्थान हिन्दी ग्रन्थ अकादमी, जयपुर।
- वर्मा, सांवलिया बिहारी, एम0 एल0 सोनी एवं संजीव गुप्ता, (2005): "महिला जाग्रति और सशक्तिकरण", आविष्कार पब्लिशर्स, जयपुर।
- Goel Aruna (2004): "Education and Socio-Economic Perspectives of Women Development and Empowerment, Government of India, New Delhi.
- Panigrahi, L.K. (2003): "Women and child Education", Abhishek Publication, Chandigarh.

Environmental Education

L T P C
4 0 0 4
Max. Marks :100
(CA:40+ESA:60)

Objectives: Pupil Teachers will be able to-

- Understand the Concept, Aim, Objectives and Need of Environment Education.
- Understand the Importance of environment education in School Curriculum.
- Appreciate the Role of Various media in environment education.
- Understand Environment crisis.
- Develop ISM for teaching environment education.
- Organize different Activities related to Environment Education
- Perform activities for awareness of Environment Education.

Course Outline :

Unit-I : Environment Education-An Introduction

- Meaning and need of environment education.
- Importance of environment education for teachers and students.
- Purpose of environment education.

Unit-II : Issues and Efforts in Environment Education

- Role of Individual and media in environment education.
- Environmental related issues:
 - Acid rain
 - Global warming
 - Ozone depletion
 - Tower Radiation
- Efforts for preservation of environment

Unit-III : Practical Activity (Any two)

- Preparation of any one ISM based on theme "environment conservation"
- Project on environment conservation programme
- Preparation of one ISM based on theme "Natural Resource Conservation".

Unit-IV: Practical Activity (Any two)

- Organization of activities related to save our environment
- Debate
- Quiz
- Essay Writing
- Poster Presentation

Unit-V : Practical Activity (Any two)

- Drama performance for awareness of environment
- Plantation programme
- Organization of exhibition based on environment efforts

References:

1. Gupta, K. R.(2010). "Environmental education in India", Atlantic Publishers and Distributors, New Delhi.
2. Bhalla, G. S. and Heema Khanna (2007), "Environmental Education", Regal Publishers, New Delhi.
3. Srivastava, Pankaj and S. P. Singh (2002). "Environmental Education", Anmol Publication, New Delhi.

4. Vashist Himanshu (2002), "Environmental Education: Problems and Solutions", Book Enclave, Jaipur.
5. Pandey, V. C. (2006), "Environmental Education", Isha Books, New Delhi.
6. पाठक, चन्द्रभूषण, (2008), "पर्यावरणीय शिक्षा एवं प्रबन्धन, अनुभव पब्लिशिंग हाउस, इलाहाबाद।
7. गोयल, एम. के., (2006), "पर्यावरण शिक्षा, विनोद पुस्तक मंदिर, आगरा।

Disaster Management Education

L T P C
4 0 0 4
Max. Marks :100
(CA:40+ESA:60)

Objectives:

Student teacher will be able to-

- Understand the meaning of Disaster relative terms
- Understand the need of Disaster Management
- Analyse the Governmental and Non-Governmental efforts of Disaster Management
- Understand man made and natural disasters and their effects.
- Acquaint skills of First-Aid and Disaster Management.

Course Outline :

Unit-I : Disaster Management: An Overview

- Meaning of Disaster, Hazard and Risk
- Concept of Disaster Management
- Need of Disaster Management
- Efforts for Disaster Management by government authorities

Unit-II : Natural and Man-Made Disaster

(Cause, Effect, Prevention and Individual responsibilities)

- Natural Disaster
 - Earth Quake
 - Flood
 - Famine
 - Volcano
 - Thunder
 - Tsunami
- Man Made Disaster
 - Terrorist Activity
 - Fire
 - Gas Leakage
 - Stampede
 - Electrical Fault
 - Blast
 - Radiation

Unit-III : Practical Activity (Any One)

- Short Term Training in Disaster Management
- Training of First Aid
- Display on a Disaster and its effect.

Unit-IV: Practical Activity (Any One)

- Presentation and Discussion on any Natural Disaster
- Poster Presentation on Natural Disaster

Unit- V : Practical Activity (Any One)

- Presentation and Discussion on any Man Made Disaster
- Poster Presentation on Disaster Management

References:

1. Ariyabandu, Madhavi Malagoda, Gender Dimensions in disaster management: a guide for South Asia,Zubaan, New Delhi.2005.
2. Asthana, N.C.(and) Priyanka Asthana, Disaster Management,Aavishkar Pub., Jaipur. 2014.

3. Coppola P. Damon, Introduction to international disaster management, Elsevier, Amsterdam. 2011.
4. Dhunna, Mukesh Disaster Management, Vayu Education of India, New Delhi. 2009.
5. Ghosh G.K., Disaster Management, APH Pub., New Delhi.2015
6. Gupta, Harsh K., Disaster Management, University Press, Hyderabad. 2003.
7. Sundar and T. Sezhiyan, Disaster Management, Sarup & Sons, New Delhi.2007.
8. Rajib. Shaw (and) Krishnamurthy, Disaster Management: Global challenges and local Solutions, University Press, Hyderabad. 2009.
9. Taori, Kamal, Disaster Management through Panchayati Raj, Concept Publishing company, New Delhi. 2005.
10. जाट, बी०सी० आपदा प्रबन्धन, मंथन पब्लिकेशन्स, जयपुर। 2013.
11. शील कुमार, पर्यावरणीय आपदा प्रबन्धन ज्योति इण्टरप्राइजेज, दिल्ली। 2007.
12. प्रिय रंजन त्रिवेदी एवं उत्तम कुमार सिंह, आपदा प्रबंधन परिचय, नई दिल्ली.

Learning and Teaching

L T P C
5 0 0 5
Max. Marks :100
(CA:40+ESA:60)

Objectives: Pupil teacher will be able to:

1. Understand the concept of Learner and Learning.
2. Understand the concept of Teaching and its factors.
3. Acquaint with different type of methods and media.
4. Acquaint with essentials of Teaching.
5. Acquaint with teachers attribute.

Course Outline :

Unit-I : Learner and Learning

- Learning-a natural tendency
- Learning-connotation in education
- Learning inside and outside the school
- Socio-cultural background of Learner

Activity : Report on learning inside or outside schools.

Unit-II : Teaching process-basic understanding

- Concept of Teaching, Instruction and Training
- Complex nature of Teaching
- Factors influencing Teaching Learning process

Activity : Discussion on factors influencing Teaching Learning Process.

Unit-III : Modes of Transaction

- Methods in teaching (Concept, Procedure, Advantages and Limitations)
 - Team Teaching, Debate, Workshop, Seminar.
- Instructional Media
 - Type of Media
 - Criteria of Selection

Activity : Term paper on media inclusion in class.

Unit-IV: Essentials of Teaching

- Phases of Teaching- Pre-active, Inter-active, Post-active
- Levels of Teaching- Memory level, Understanding level, Reflective level.
- Maxims of Teaching

Activity : Group Discussion on importance of maxims in preparing lesson plan.

Unit-V : Teaching as a Profession

(a)Teacher Attributes

- Regularity, Punctuality, Teaching Attitude and Professional Ethics
- Content Mastery and Its Maintenance

(b) Role of Teacher in Classroom Management.

Activity : Sharing Experiences as teacher in managing class.

Practicum: Any two of the following.

1. Report on Learners Behaviour in Classroom Setting.
2. Analysis of Instructional Process.
3. Collection and Presentation of Photographs related to learning inside and outside the classroom.
4. Making a model on one topic of your teaching subject.

References:

1. Hough, John B. & James K. Duncan (1970); 'Teaching: Description and Analysis', Addison-Wesley Publishing Company, Massachusetts, U.S.A.
2. Cruickshank, Donald R., Deborah B. Jenkins & Kim K. Metcalf (2009); 'The Act of Teaching', McGraw-Hill Company, New York, U.S.A.
3. Weimer, Maryelen (1996), Improving your classroom Teaching, SAGE Publications, Inc., California, USA.
4. Pierce Walter D., Micheal A. Lorber (1977); 'Objectives and Methods for Secondary Teaching', Prentice-Hall, Inc., New Jersey, U.S.A.
5. Yadav, Neelam (2003); 'A Handbook of Education Technology', Anmol Publications Pvt. Ltd., New Delhi, India.
6. Mangal, S.K. & Uma Mangal (2009); 'Essentials of Education Technology', PHI Learning Private Ltd., New Delhi.
7. Capel, Susan, Marilyn Leask & Tony Turner (1995); 'Learning to teach in Secondary Schools', Routledge, London, England.
8. Rao, D.B. (2001); 'Science & Technology Education', Discovery House, New Delhi.
9. Sampath, K.A.Panneevselvan & S. Santhanam (1994); 'Introduction to Education Technology', Sterling Publication pvt., Ltd.
10. Sharma, R.A. (2000), 'Technological Foundation of Education Technology, International Publications, Meerut, India.
11. Sood, J.K. (1989); 'New Direction in Science Teaching,' Kohli Publishers, Chandigarh.
12. Washton, N.S. (1967); 'Teaching Science Creativity', W.B.Saunders Company, London.
13. Sharma R.A. (1987) 'Shiksha Takniki', Loyal Book Depot, Meerut.
14. Sharma Y.K. (2002) 'Fundamentals of Educational Technology' Kaniska Publishers, New Delhi.
15. Saxena, N.R.S & S.C. Oberoi (1996), 'Technology of Teaching; R.L. Book, Meerut.
16. Wragg E.C. (1996); Classroom Teaching Skills' Routledge, London.
17. Kumari, Sarita (2004) 'Increasing Role of Technology in Education, Chawla Offset Press, Delhi.

Knowledge and Curriculum

L T P C
5 0 0 5
Max. Marks :100
(CA:40+ESA:60)

Objectives :

Student Teacher will be able to-

1. Understand conceptual basis of Knowledge and as a Process.
2. Familiarize Various approaches of Knowledge structuring.
3. Acquaint the form of knowledge.
4. Develop understanding in epistemological bases of education and implementing the different learner driven pedagogies.
5. Acquaint learner driven pedagogies.
6. Understand the different phases of Curriculum.
7. Critically analyze the curriculum framework as a policy decisions.

Course Outline :

Unit-I : Conceptual Basis of Knowledge

- Meaning of Concept, Principle, Theories and Experience.
- Differentiation between Data, Information, Knowledge and Wisdom.
- Ways of Knowledge Acquisition : Observation, Experience, Reasoning and Inference.
- Knowledge and Skills needed in Democratic Citizenship.

Activity : Exposing Learners to Diverse situations for exploring (Discussion, Research and Documentation.)

Unit-II : Epistemological Bases of Education

- Meaning of Education : Etymological, Analytical, Narrow and Broader.
- Diverse Philosophies and Perspectives in Education of Swami Vivekananda, Mahatma Gandhi, Plato and Dewey (In reference to their Epistemological perspectives).
- Learner driven pedagogies : Activity and Discovery.

Unit-III : Approaches and form of Knowledge Structuring

- Domain wise : Cognitive, Affective and Psycho-Motor
- Multidisciplinary and Interdisciplinary (Concept and Features)
- Interrelationship of the following with Education and their reflection in Curriculum
 - Nationalism
 - Universalism
 - Secularism

Activity : Preparation of Group Project Based on any of Social Concerns

Unit-IV: Curriculum : Concept and Kinds

- Concept of Curriculum, Syllabus and Text Book.
- Kinds of Curriculum :
 - Recommended Curriculum
 - Taught Curriculum
 - Learnt Curriculum
 - Hidden Curriculum
- National Curriculum Framework and its association with national mission and vision

Activity : Writing and Presentation of a Paper based on any kind of Curriculum

Unit-V : Curriculum Development

- Need of Curriculum Development
- Principles of Curriculum Development
- Phases of Curriculum
 - Curriculum Development
 - Curriculum Transaction
 - Curriculum Evaluation (with respect to aims of education)

Activity : Evaluation of secondary level school subject curriculum.

Practicum : Any two of the Following :

- Identify and presentation of Epistemological ideas of Vivekananda Gandhi, Plato and Dewey.
- Writing a thematic term paper and its presentation in classroom.
- Presentation on social concerns through exhibition.
- Critical analysis of latest NCF in the Specific Context of Constitutional Values.

References:

1. Butler, Donald I. (1968). *Four Philosophies and their practice in Education*. II Ed. harper and Row Publishers. New York.
2. Dupuis, Adrain M. (1966). *Philosophy of Education in Historical Perspective*. Thomson Press india Ltd., New Delhi.
3. Gupta, R nad M.M. Bajaj (2008). *Principles of Education*, Sahib Publishers and Distributors, New Delhi.
4. Saxena, N.R.S. (2011), *Philosophical and Sociological Foundation*, R. Lall book Depot, Meerut.
5. Chandra S.S. & R.K. Sharma (2007). *Philosophy of Education*, Atlantic Publishers & Distrivutors Pvt. Ltd. New Delhi.
6. Yadav, M.S. and lakhmi, T.K.S. (2003). *Conceptual Inputs for Secondary Teacher Education*, NCTE, New Delhi.
7. Aggrawal, J.C., & Gupta, S. (2005). *Curriculum Development*. New Delhi : Shipra Publisher.
8. Alaxander, W. M., & Saylor, J. G. (1966). *Curriculum Planning for Modern Schools*. New York: Holt, Rinhart and Winston Inc.
9. Balrara, M. (1999). *Principles of Curriculum Renewal*. New Delhi : Kanishka Publishers.
10. Candra, A. (1977). *Curriculum Developmetn and Evaluation in education*. New Delhi : Sterling Publishers.
11. Darji, D. R., & Lulla, B.P. (1967). *Curriculum Development in Secondary Schools of Baroda*. Baroda: Sadhana Press.
12. Erickson, H.L. (2007). *Concept Based Curriculum and instruction for the thinking cassroom*, California; Corwin Press.
13. Hassrin, M. (2004). *Curriculum Planning for elementary education*. New Delhi : Anmol Publisher.
14. Herbert, J.W. & Geneva, D. H. (1990). *International Encyclopedia of Education Evaluation*, new York : Pergamon Press Oxford House.
15. Jenkins, D. & Shifsnan, D.M. (1976). *Curriculum an introduction*. London: Pitman Publishing House.
16. Jhompson, K., and White, J.C. (1975). *Curriculum development*. London : Pitman Publishing.
17. Khan. M.I. and Nigam, B.K. (2007). *Curriculum reform change and Continuity*, New Delhi; Kanishka Publication.
18. Kumari, S., and Srivastava, D.S. (2005). *Curriculum and Instruction*. New Delhi : Shipra Publishers.
19. Macdonald, B., & Walker, R. (1976). *Changing the Curriculum*. Britain : Pitman Press.

20. Musgrave, P.W. (1974). *Contemporary studies in the Curriculum*. Australia : Angus and Roberston Publishers.
21. Nigam, B.K., & Khan, I. M. (1993). *Evaluation and research in Curriculum Construction*. New Delhi : Kaniska Publishers.
22. Ornstein, A.C. & Hunkins, F.P. (1988). *Curriculum Foundations, Principles and Issues*, New Jersey Prentice Hall.
23. Panday, M. (2007). *Principles of Curriculum Development*. New Delhi; rajat Publications
24. Rajput, J.S. (2004). *Encyclopedia of Indian Education*. New Delhi : NCERT.
25. Satyanarayan, P.V. (2004). *Curriculum Development and management*. new Delhi: DPH.
26. Sharma. R. (2002). *Modern Methods of Curriculum organisation*. Jaipur : Book Enclave.
27. Sharma, S.R. (1999). *Issues in Curriculum Administration*. New Delhi : Pearl Publihsing House.
28. Srivastava, H.S. (2006). *Curriculum and Methods of Teaching*. New Delhi : Shipra Publishers.
29. Taba, h. (1962). *Curriculum Development theory & Practice*. New York : Harcourt, Brace & World Inc.
30. Yadav, Y.P. (2006). *Fundamentals fo Curriculum design*. New Delhi, shri Sai Printographers.
31. पाण्डेय, रामशकल (2003), उदीयमान भारतीय समाज ने शिक्षक, विनोद पुस्तक मंदिर, आगरा,
32. सक्सेना, एन. आर. स्वरूप एवं शिक्षा चतुर्वेदी (2006), उदीयमान भारतीय समाज में शिक्षक, आर, लाल बुक डिपो, मेरठ ।
33. लाल, रमन बिहारी (1995), शिक्षा के दार्शनिक एवं समाजशास्त्रीय सिद्धांत, रस्तौगी पब्लिकेशन्स, मेरठ ।
34. चौबे, सरयुप्रसाद (2004), शिक्षा के दार्शनिक, ऐतिहासिक एवं समाज शास्त्रीय आधार, आर. लाल बुक डिपो, मेरठ ।
35. ओड एल. के. शिक्षा की दार्शनिक पृष्ठभूमि, राजस्थान हिन्दी ग्रन्थ अकादमी, जयपुर, 2004
36. गुप्त, रामबाबू (1983), महान पायचात्य शिक्षा शास्त्री सामाजिक विज्ञान प्रकाशन, कानपुर,
37. पाण्डेय, रामशकल (1994), भारतीय शिक्षा दर्शन, विनोद पुस्तक मन्दिर, आगरा ।
38. पचौरी, गिरीश, शिक्षा के दार्शनिक आधार, आर. लाल बुक डिपो, मेरठ
39. तिवारी, के.एन. (2002), तत्वमीमांसा एवं ज्ञान मीमांसा, मोतीलाल बनारसीदास, नई दिल्ली ।
40. श्रीवास्त, मदनमोहन (2007), शिक्षा के दार्शनिक परिप्रेक्ष्य, विजय प्रकाशन मन्दिर, वाराणसी ।

Creating an Inclusive School

L T P C
4 0 0 4
Max. Marks :100
(CA:40+ESA:60)

Objectives : Student teacher will be able to understand and reflect upon-

- The diversity in Indian classroom, School and Society.
- The concept of special education, integrated education and inclusive education.
- National initiatives and provisions for inclusive education.
- The teacher's role in an inclusive school.
- The learning environment of an inclusive classroom.
- The public private participation in inclusive education.

Course Outline :

Unit-I : Classroom as Reflection of Society

- Diversities in Society and Classroom
 - Meaning of Diversity
 - Diversities in Society and Classroom
- CWSN (Children with Special Need) in classrooms.
 - Concept & Categories

Activity : Discussion on the type of diversity which exist in Indian Classroom.

Unit-II : Inclusive Education : An Overview

- Concept of Inclusion
- Different relative concepts - Special Education, Integrated Education, Inclusive Education.
- National Initiatives for Inclusive Education
 - Constitutional Provisions in RCI Act 1992, PWD Act 1995
 - Sarva Shiksha Abhiyaan (SSA)
 - NCF 2005

Activity : Presentation on any initiative programme for Inclusive Education.

Unit-III : Inclusive Schools - Vision and Provision

- Provision in Inclusive Schools
 - Physical Facilities
 - Aids & Equipments
 - Guidance and Counseling
- Role of a Teacher in inclusive school.

Activity : Discussion on teacher's role in inclusive school.

Unit-IV: Generating Learning Environment in Inclusive Classroom

- Curricular Adaption for CWSN.
- Pedagogical strategies to support learners' need- Cooperative Learning, Participative Learning, Peer Tutoring, IEP, Multisensory Teaching.
- Evaluation process in inclusive classroom (with reference to CBSE & RBSE's Provisions).

Unit-V : Public Private Participation (PPP) in Inclusive Schools

- Role of Supportive Services for Inclusive Schools
 - Pre Service and In-service Teacher Education Institutions

- Professionals
- Parents
- Community

Activity : Group discussion on supportive services for inclusive schools.

Practicums: (Any two of the following)

- 1 Visit and observation of Inclusive school and preparation of a report about provisions in inclusive school.
- 2 Exhibition on Inclusive Education
- 3 Thematic Term paper.

References:

- 1 Dash Neha. (2006), Inclusive Education for CWSN, Atlantic Publisher and Distributers, New Delhi.
- 2 Loreman Tim, Jaonne Deppour and Davice Harvey (2005)- Inclusive Education-A Practical guide to Supporting Diversity in classroom, Roudledge falmer, London.
- 3 Prui Madhumita and George Abraham (2009), Handbook of Inclusive Education for Educators, Administrators and Planners, Sage Publications, New Delhi.
- 4 Balsara Maitreya (2011), Inclusive Education for Special Children, Kanishk Publishers, New Delhi.
- 5 Dash Nibeta (2003), Integrated Education for Children, with special need, Dominant Publishers, New Delhi.
- 6 Sharma, Bharti (2011), Inclusive Education-Needs Practices and Prospects, Kanishk Publishers, New Delhi.
- 7 Gargiulo, Richare M. and Debbie Metcalf, (2008), Teaching in Today's Inclusive Classroom, WADSWORTH, USA.
- 8 Alur Mithu and Timmous (2009), Inclusive Education across Cultures, Sage Publication, New Delhi.

Reading and Reflecting on Texts Lab

L T P C
0 0 4 2
Max. Marks :100
(CA:40+ESA:60)

Objectives :

This course will serve as a foundation to enable student-teachers-

- To read and respond to a variety of texts in different ways and also learn to think together, depending on the text and the purposes of reading.
- To enhance their capacities as readers and writers by becoming participants in the process of reading.
- To develop the skill of critical thinking by offering opportunities to read a wide variety of texts,
- To write with a sense of purpose and audience, through tasks such as, responding to a text with one's own opinions or writing within the context of other's ideas.

Course Outline :

Unit-I : Skills for Reflection: Reading & Writing

- Reading-Meaning and Importance
- Types of Reading-
 - Loud Reading (Individual & Group)
 - Silent Reading (Intensive & Extensive)
- Development of Reading
- Writing-Meaning and Importance
- Types of writing
 - Narrative
 - Descriptive
 - Expository
 - Persuasive
- Development of writing (Observe and write, listen and write, see and write, writing with proper speed and comprehensive and spontaneous writing).

Unit-II : Reflection on Texts

- Reflection-Meaning, elements and Importance
- Stages of reflection
- Reading for Comprehension and Reflection
- Reflection through Writing

Unit-III : Practice Components

1. Engaging with Narrative and Descriptive Accounts

Suggested Activities (any two)

- Reading for comprehending and visualizing the account (individual plus group reading and discussion/explanation)
- Re-telling the account-in one's own words/from different points of view (taking turns in a smaller group)
- Narrating/describing a related account from one's life experience (in front of a smaller group)
- Discussion of characters and situations-sharing interpretations and points of view (in a smaller group)
- Writing based on the text, e.g. summary of a scene, extrapolation of story, converting a situation into a dialogue, etc. (individual task).

2. Engaging with Popular Subject Based Expository Writing (any two)

- Identifying major concepts and ideas involved and making notes on these in some schematic form-flow diagram, tree diagram, mind map, etc. (guided working in pairs).
- Explaining the gist of the text/topic to others (in the larger subject group)
- Attending the writing style, subject-specific vocabulary and 'perspective' or 'reference frame' in which different topics are presented-this will vary across subjects and texts, and requires some interpretative skills for 'placing' the context of each text (group discussion and sharing).
- Writing a review or a summary of the text, with comments and opinions (individual task)

3. Engaging with Educational Writing and its presentation

- Reading for discerning the theme(s) and argument of the essay (guided reading-individually or in pairs)
- Analyzing the structure of the argument: Identifying main ideas, understanding topic, sentences of paragraphs, supporting ideas and examples, terms used as connectors and transitions (small group discussion).
- Discussion of the theme, sharing responses and point (s) of view (small group discussion)
- Writing a response paper (individually or in pairs)
- Presentations of selected paper, questions and answers (large group).

References:

- Brookfield, S. (1995), *Becoming a critically reflective teacher*. San Francisco: Jossey-Bass Inc.
- Dewey, J. (1933). *How we think. A restatement of the relations of reflective thinking to the educative process*. Boston: D.C.Heath.
- Goodlad J.I .(1990). The occupation of teaching in school. In J.I. Goodlad, R.Soder & K.A.Sirotnik (Eds.) *The moral dimensions of teaching* (pp3-34 San Francisco: Jossey-Bass.
- Hole, S.& McEntee, G. (1999). *Reflection is at the heart of practice*. Educational Leadership. 56 (8) May, p34-37.
- Kottamp, R. (1990), Means of facilitation reflection. *Education and Urban Society*, 22.2pp. 182-203.
- Lasley, T.(1990). Editorial. *Journal of Teacher Education* 40, (2), March-April 1998.
- Osterman, K.F. (1990). Reflective Practice: A new agenda for education. *Education and Urban Society*, 22(2); February 1990,p 133-152.
- Schon, D. (1983). *Educating the reflective practitioner*. New York:Basic Books.
- Schon, D. (1987). *Educating the reflective practitioner*. San Francisco: Jossey-Bass.
- Clark, Don. "Critical Reflection".
- Kain, Patricia, "How to do a close reading".
- Lye. John. "Critical reading: a guide".
- New College Composition-Punjab University-1965.
- Geoffrey Leech, Margaret Deuchatr and Robert Hoongenraad (2005). *English Grammer for Today: A New Introduction*.

Critical Understanding of ICT Lab

L T P C
0 0 4 2
Max. Marks :100
(CA:40+ESA:60)

Course Objectives:

1. To enable the student-teachers to understand the meaning and potential of ICT.
2. To enable the student-teachers to critically utilise the ICT for teaching-learning and other teacher related work.
3. To develop the skills in student teacher to plan and apply appropriate ICT.

Course Outline:

Note-The Unit I and II are for theoretical orientation and Unit III, IV and V are Practice oriented.

Unit-I : The ICT: Meaning and Potential

- a) Computer system, Hardware, Software
- b) The meaning of IT and ICT
- c) Potential and need of ICT for Teacher

Unit-II : Integrating The ICT

- a) ICT for Formal Teaching
- b) ICT for Collaborative Learning
- c) ICT for constructivist Classrooms
- d) Ethics and copyright issues in using ICT

Unit-III : ICT for administrative support

- a) Formatting of Documents- Notices/ Brochure / Letters / Address label
- b) Formatting of table - School time - table, Exam Time table
- c) Maintaining - Fee record, Attendance record, formative evaluation record

Unit-IV: ICTs for Teaching-Learning

- a) Developing multimedia presentation
- b) Image Processing
- c) Using Video and Hyperlink with presentation
- d) Creating Animation for teaching

Unit-V : ICT for Evaluation

- a) Formating a Question Paper
- b) Preparing result sheet: Class wise, student wise
- c) Graphical representation of Results

Practicum:

Developing a Plan and sample digital content to teach a Unit in pedagogy subject for secondary classes with the support of ICT.

Reference:

1. शास्त्री. आदित्य एवं अन्य (2006) “कम्प्यूटर अनुप्रयोग एवं प्रोग्रामिंग”. जयपुर पब्लिशिंग हाऊस. जयपुर।
2. सिंह. नीरल एवं आलोक उपाध्याय (2001) “कम्प्यूटर शिक्षा”. विनोद पुस्तक मंदिर. आगरा।
3. गुप्ता. मनेश कुमार (2005) “कम्प्यूटर अनुप्रयोग”. मंगलदीप पब्लिकेशन. जयपुर।
4. कुमार वी. एवं ए० ए० अंजली (2005) “संगणक एवं सूचना प्रौद्योगिकी”. आखिष्कार पब्लिशर्स।
5. चौध. संतोष. ‘संपादक’ (2005) “कम्प्यूटर एक परिचय”. मध्यप्रदेश हिन्दी ग्रन्थ अकादमी. भोपाल।
6. CD ROM (2005): Intel Teach to the Future' programme (I.T.F.P.).

7. Sinha, P.K. and Priti Sinha (2005): "Computer Fundamentals- Concept, System and Applications", BPB Publication, New Delhi.
8. Intel Innovations in Education (2002) : "Pre-Service Curriculum" Intel Teach to the Future' , Intel Corporation, CA. (English Binder)
9. Intel Innovations in Education (2004) : "Pre-Service Curriculum" Intel Teach to the Future' , Intel Corporation, CA. (Edition 2.0 Hindi Binder)

Contemporary Indian Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

The student teacher will be able to

reflect upon diversity in Indian Society.

express the constitutional values (Secularism, Socialism, Democracy) as reflected in Education.

analyze the roles of commissions and policies in Secondary Education.

deal with inequality and marginalization related issues in India.

analyze and appraise the policy framework for Public Education in India.

Course Outline:

Unit-I: Diversity in Indian Society

- Basic features of Indian Society
- Relationship between Education and Society.

Activity: Discussion on Society and role of Education

Unit-II: Constitutional Values and Education

Realisation of following Values through Education

- Secularism
- Socialism
- Democracy

Activity: Thematic presentation on attainment of Constitutional Values through Education.

Unit-III: Commission and Policies for Secondary Education in India.

- Secondary Education Commission (1952-53).
- Education Commission (1964-66)
- NPE-1986.

Objectives and Structure of Education, Curriculum, Methods of Teaching, Women Education, Status of Teachers).

Activity: Critical analysis of recommendations of Commissions and Policy provisions for Secondary Education in India.

Unit-IV: Inequality and Marginalization in Indian Society

Status, problems and role of different agencies (Educational institution and Government) regarding-

- Education for Women
- Education for Physically disadvantaged.
- Education for Socially disadvantaged.

Activity: Presentation and discussion on status of problems related to inequality and marginalization.

Unit-V: Policy and programmes for Promoting Public Education in India

Critical Appraisal of Implementation of following-

- Sarva Shiksha Abhiyan (SSA)

- Rashtriya Madhyamik Shiksha Abhiyan (RMSA)
- Mid Day Meal (MDM)

Activity: Critical analysis on status of SSA, RMSA and MDM programmes.

Practicum: Any two of the following:

- One thematic term paper and its presentation in classroom.
- Organisation of a thematic exhibition
- Group Discussion on
 - Fundamental Rights and Duties of citizens in India.
 - Directive Principles of state policies.

References:

- अग्निहोत्री, आर. (2008). *आधुनिक भारतीय शिक्षा: समस्याएँ और समाधान*. जयपुर: राजस्थान हिन्दी ग्रन्थ अकादमी.
- भारत सरकार (1986). *नेशनल पॉलिसी ऑन एज्युकेशन*. मानव संसाधन विकास मंत्रालय. नई दिल्ली: शिक्षा विभाग,
- भारत सरकार 1985., *शिक्षा नीति की चुनौती*. नई दिल्ली: शिक्षा मंत्रालय.
- Bhattacharya, S. (2003). *Foundations of Education*. Delhi: Atlantic Publishers and Distributors.
- Dhiman, O.P. (2007). *Principles and Techniques of Education*. Delhi: Kalpaz publications.
- Jayapalan, N. (2005). *Problems of Indian Education*. Delhi: Atlantic Publishers and Distributors.
- मदन, जी. आर. (1988). *समाजशास्त्र के सिद्धांत*. दिल्ली: आत्माराम एण्ड सन्स.
- Mangla, S. (2012). *Teacher Education, Trends and Strategies*. New Delhi: Radha Publications.
- माथुर, एस. एस. (1978). *शिक्षा सिद्धांत*. आगरा: विनोद पुस्तक मंदिर.
- ओड, एल. के. (1978). *शिक्षा के नूतन आयाम*. जयपुर: राजस्थान हिन्दी ग्रन्थ अकादमी.
- पाण्डेय, आर. (2005). *शिक्षा की दार्शनिक एवं समाजशास्त्रीय पृष्ठभूमि*. आगरा: विनोद पुस्तक मंदिर.
- पाण्डेय, आर. (1986). *शिक्षा के मूल सिद्धांत*. आगरा: विनोद पुस्तक मंदिर.
- पारीक, एम. एवं शर्मा, आर. (2004-05). *उदीयमान भारतीय समाज और शिक्षा*. जयपुर: शिक्षा प्रकाशन.
- Pathak, R.P. (2009). *Philosophical and Sociological Foundations of Education*. Kanishka Publications distributors.
- रावत, पी. (1992). *भारतीय शिक्षा का इतिहास*. आगरा: रामप्रसाद एण्ड सन्स.
- Reddy, V., Daya K. and Rao, D. B. (2006). *Value Oriented Education*. New Delhi: Discovery Publishing House.
- Report of Education Commission (1964-66). *Ministry of Education & Culture*. New Delhi: Govt. of India,
- Report of Secondary Education Commission (1952-53). *Ministry of Education & Culture*. New Delhi: Govt. of India
- Saini, S.K. (1980). *Development of Education in India: Socio economic and political perspective*. New Delhi: COSMO publications.
- सक्सैना, आर., शर्मा, जी. एवं शास्त्री, आई. (2000). *उभरते हुए भारतीय समाज में शिक्षा एवं शिक्षक*. जयपुर: क्लासिक पब्लिकेशन्स.
- शर्मा, डी. एल. (1994). *शिक्षा तथा भारतीय समाज*. मेरठ: आर लाल बुक डिपो.
- शर्मा, आर. ए. (1998). *शिक्षा तकनीकी*. मेरठ: आर. लाल बुक डिपो.
- Sharma, B.L. and Maheshwari, B.K (2010). *Education for Values, Environment Human Rights*. Meerut: R. Lall Book Depot.
- Sharma, B. (2004). *History of Indian Education*. New Delhi: Vohara Publishers and Distributors.
- Sharma, R. A. (2008). *Metaphysics, Epistemology, Axiology and Education*. Meerut: R. Lall Book Depot,

सिंह, आर. पी. एवं उपाध्याय, आर. *शिक्षा के दार्शनिक एवं सामाजिक सिद्धांत*. आगरा: विनोद पुस्तक मंदिर.

Singh, L.C. Sharma, P.C. (1995). *Teacher Education and Teacher*. New Delhi: Vikas Publication House.

Srivastava, K.K. (2003). *Philosophical Foundations of Education*. New Delhi: Kanishka Publishers distributors.

Taneja, V. R (2005). *Philosophical Approach to Education*. Delhi: Atlantic Publishers Distributors.

Taneja, V. R. (2002). *Foundation of Education (Philosophical and Sociological)*. Chandigarh: Abhishek Publications.

Web Resources:

Mid Day Meal:

<http://mdm.nic.in/VDO.html>

Mid Day Meal (Capacity Building):

http://mdm.nic.in/Capacity_building.html

Mid Day Meal (School Health Program):

<http://mdm.nic.in/School%20Health%20Program.html>

Mid Day Meal (Community Participation):

<http://mdm.nic.in/Community%20Participation.html>

Right to Education:

<http://rte.raj.nic.in/View/ViewDocuments.aspx?id=167&type=1>

Rashtriya Madhyamik Shiksha Abhiyan

<http://rajrnsa.nic.in/Public/DOCView.aspx?Title=Documents&Id=1>

Secondary Education Commission (1952-53):

<http://dspace.gipe.ac.in/xmlui/bitstream/handle/10973/33772/GIPE-111964.pdf?sequence=2&isAllowed=y>

Education Commission (1963-64): http://www.kkhsou.in/main/education/edu_commission.html

National Policy on Education 1986:

www.ncert.nic.in/oth_anoun/npe86.pdf

Review of National Policy on Education 1986:

http://www.kkhsou.in/main/education/national_policy1992.html

<http://www.right-to-education.org/girlswomen>

Position Paper National Focus Group on Education of Children with Special Needs: http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/special_ed_final1.pdf

Policies, Programmes and Schemes for Educational Development of Children from Scheduled Castes: www.ncert.nic.in/departments/nie/degsn/pdf_files/degsnmodule6.pdf

Assessment for Learning

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

Student Teacher will be able to
interpret concept of assessment in education, evaluation and its related term.
differentiate between kinds of evaluation.
apply appropriate tools of evaluation in field.
elucidate different forms and characteristics of achievement test.
organize an effective evaluation program.
apply ICT skills during evaluation program.
conduct an action research related to problems at school level.

Course Outline:

Unit –I: Assessment in Education

- Concept of Assessment in Education, Test, Measurement, Evaluation.
- Relationship of Educational Evaluation with IO's (Instructional Objectives) and Learning Experience
- Kinds of Assessment
 - Internal and External
 - Formative and Summative
 - Continuous Comprehensive Evaluation (CCE)

Activity: Presentation of Critical Analysis of any one kind of Assessment

Unit–II: Various Evaluation Tools: Concept and Characteristics

- Following evaluation tools related testing, self reporting and observation Technique: (concept only)
 - Achievement Test, Diagnostic Test and Performance Test, Check List, Interview, Observation, ARC (Anecdotal Record Cards) and CRC (Cumulative Record Cards)
- Characteristics of Good Assessment tool
 - Objectivity, Reliability, Validity and Usability

Activity: Practice to Prepare a Performa/format of Observation based Tool

Unit – III: Assessment of Learner's Achievement

- Kinds of Achievement Test
 - Teacher Made and Standardized Test
 - Oral, Written, Practical
 - NRT and CRT

Designing Evaluation Programme (Scholastic & Non-scholastic): Time, duration, Mode.

Assessment as Providing Feedback: Student, Teachers, Administrators, Parents

Activity: Practice to construct different types of Test items in their respective Subject.

Unit – IV: Reforms in Educational Assessment

Reforms in Examination -

Grading System: Concept, Determination and use

Question Bank

Open Book Exam, Online Examination

- Importance of ICT in Assessment

Use of ICT: Question Paper Making, Administration, Scoring, Preparing Results and Showcasing

Activity: Discussion on use of ICT/anyone reforms in examination

Unit – V: Action Research in Educational Assessment

Meaning and difference of research and action research

Purpose of action research

Importance of action research

Steps of action research

Action research and different problems

Proposal and Reporting format of action research

Activity: Practice to prepare a reporting of action research for any school problem

Practicum: (any two of the following)-

- (1) Reporting the Result of any Achievement Test in Terms of Grading.
- (2) A Report Presentation on Organization of Assessment Activities in School during Internship.
- (3) Administration and Interpretation of one Standardized Psychological Test.
- (4) Prepare a proposal for action research.

References:

- Best, J. W., & James V. K. (1992). *Research in Education*. IV edition, New York: Prentice Hall Inc.
- Borg, W., R. (1981). *Applying Educational Research, A Practical Guide to Teacher*. New York: Longman Inc.
- Ebel, R. L., & David A. F. (1986). *Essentials of Educational Measurements*. New Jersey Prentice Hall, Inc, E. Clifs.
- Gronlund, N. E. (1976). *Measurement of Evaluation in Teaching*. New York: MacMillan Publishing Co.
- Pandey, K. P. (2010). *Fundamentals of Educational Research*. Varanasi: Vishwavidyalya Prakashan.
- Pathak, R.P. (2012). *Measurement & Evaluation in Education*. New Delhi: Dorling Kindessely (India) Pvt. Ltd., Pearson, South Education.
- Rao, V.K. & Reddy, R.S.(1992). *Perspective in Educational & Evaluation* (World Education Development-Series-8) New Delhi: Commonwealth Publishers.
- Rummel, F., J. (1984). *An Introduction to Research Procedure in Education*. II edition. New Jersey: Harper & Row Publishers.
- Vashist, S.R. (1994). *Perspectives in Measurement & Evaluation in Education Series*. New Delhi: Anmol Publications.
- Worthen, B. R., & Sanders, J. R. (1987). *Educational Evaluation*. New Delhi: Longman INC.
- अस्थाना, वि. एवं अस्थाना, एस. (2009). *मनोविज्ञान और शिक्षा में मापन तथा मूल्यांकन*. सोलहवें संस्करण. आगरा: अग्रवाल पब्लिकेशन्स.
 - बालिया, एस., अरोड़ा, आर., शर्मा, ओ. पी. (2013). *शिक्षा में मापन एवं मूल्यांकन*. तृतीय संस्करण. जयपुर: राजस्थान हिन्दी ग्रन्थ अकादमी
 - भार्गव, एम. (2010). *आधुनिक मनोवैज्ञानिक परीक्षण एवं मापन*. 19वें संस्करण. आगरा: राखी प्रकाशन.
 - भटनागर, ए . बी. भटनागर, एम. (1999). *मापन एवं मूल्यांकन*. तृतीय संस्करण. मेरठ: आर. लाल बुक डिपो.
 - पाण्डे, के. पी. (2011). *शैक्षिक मापन एवं मूल्यांकन*. वाराणसी : विश्वविद्यालय पब्लिकेशन्स.
 - गुप्ता, एस. पी. एवं. गुप्ता ए., (2000). *आधुनिक मापन एवं मूल्यांकन*. इलाहाबाद: शारदा पुस्तक मन्दिर.
 - कपिल, एच. के. (2006). *अनुसंधान विधियाँ*. आगरा : भार्गव बुक हाउस.
 - रायजादा, बी. एस. (2010). *शिक्षा में अनुसंधान के मूल आधार*. जयपुर : राजस्थान हिन्दी ग्रन्थ अकादमी.

Web Resources:

Concept of Measurement - <https://www.yourarticlelibrary.Com/statistics-2/measurement-of-data-meaning-types-and-characteristics-statistics/92436>

Relation of Educational Evaluation with Instructional objectives- <https://www.nap.edu/read/5287/chapter/6>

Formative and Summative Evaluation -

<http://cft.vanderbilt.edu/student-assessment-in-teaching-and-learning/>

Continuous Comprehensive Evaluation-

https://www.ncert.nic.in/oth_anoun/CCE_Guidelines.pdf

Concept of Reliability and Validity- <https://chfasoa.uni.edu/reliabilityandvalidity.htm>,

<https://opentextbc.ca/researchmethods/chapter/reliability-and-validity-of-measurement/>,

<https://www.cpp.edu/~smemerson/nbu-programeval/trochimppp/Part%203/Types%20of%20Reliability.ppt>,

<https://socialresearchmethods.net/kb/reotypes.php>

Teacher made and Standardized Test-<https://www.theclassroom.com/similarities-difference-classroom-test-standardized-achievement-test-152626.html>

NRT and CRT-https://www.researchgate.net/figure/Differences-between-Noun-Referenced-Tests-NRT-and-Criterion-Referenced-Test-CRT_tbl_295530493

Open Book exam-<http://www.studygs.net/tsttak7.htm>

Online Examination <https://www.onlineexambuilder.com/knowledge-centre/exam-knowledge-center/advantages-and-disadvantages-of-online-examination-system/item10240>

Use of ICT in assessment <https://epi.ioe.ac.uk/cms/Default.aspx?tabid=462>

Grading System <https://content.wisestep.com/advantages-disadvantages-grading-system-education/>

Grading and its determination-<https://www.ierf.org/wp-content/uploads/2016/01/IERFGrading2011.pdf>

Action Research- http://www.ncert.nic.in/departments/nie/der/publication/modules_material.html

Gender, School and Society

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to

approve and appreciate gender equality .

elucidate the constitutional and legal provisions related to women.

disapprove the gender bias in family, workplace and educational institution.

appreciate the role of education in eradicating gender bias.

reflect roles and responsibilities of various agencies in promoting gender equalities.

Unit-I: Basic Concepts related to Gender

- Concept of Sex, Gender, Patriarchy, Matriarchy
- Concept of Gender Bias and Gender Stereotype

Activity - Discussion on key concepts related to Gender Issues and relating them with the Social Context of student teacher.

Unit- II: Constitutional and Legal Provisions

- Constitutional Provisions related to women
- Legal Provisions
 - Dowry Prohibition Act, 1961
 - The Medical Termination of Pregnancy Act, 1971
 - The Protection of Women from Domestic Violence Act, 2005

Activity - Presentation and Discussion on Constitutional Provisions and Legal Polices for Capacity Building.

Unit- III: Gender Bias in Society

- Gender bias in family
- Gender bias in workplace
- Role of Education in eradicating gender bias in family, workplace and society

Activity - Debate/Discussion on Gender Bias in Family and Workplace.

Unit -IV: Gender Bias in Formal Education

- Gender Bias in Educational Institutions
 - School Setting
 - Curriculum
 - Text Book
 - Teaching Method
 - Co-Curricular Activities

Activity - Discussion on Gender Bias in Educational Institution

Unit -V: Role and Responsibilities in Promoting Gender Equalities

- Parents
- Community
- Mass Media

Activity - Display roles of Mass Media towards gender equality through poster/charts.

Practicum- Any two of the following:

- School Visits/Observe the Schooling Processes from a Gender Perspectives and Submission of its Report.
- Thematic term paper
- Exhibition on gender related issues
- Survey based activity on gender issues

References:

- Bagchi, Jasodhara, Guha, Jaba and Sengupta, Piyali (eds). (1997). *Loved and Unloved: the Girl Child in West Bengal*. Kolkata: Stree Publishers.
- Bank, B.J. (2007). *Gender and Education: An Encyclopedia*. London: Praeger, Westport.
- Batliwala, Srilatha. (1993). *Empowerment of Women in South Asia: Concepts and Practices*. New Delhi : Asian-South Pacific Bureau of Adult Education.
- Bhasin, Kamla.(2000). *Understanding Gender*. New Delhi: Kali for Women.
- Bhasin, Kamla. (2004). *Exploring Masculinity*. New Delhi: Women Unlimited.
- Bhatt, B.D. & Sharma, S.R. (1992). *Women's' education and social Development*. Delhi: Kanishka.
- Chanana, Karuna(ed.). (1988). *Socialisation, Education and Women: Explorations in Gender Identity*. New Delhi: Orient Longman.
- Gould, S. J. (1981). *The Mismeasure of Man*. London: Penguin Books.
- Govinda, R. (ed.). (2002). *India Education Report: A Profile of Basic Education*. New Delhi: Oxford University Press.
- Kathleen, W. (1988). *Women Teaching for Change: Gender, Class, and Power*. New York: Bergin Garvey.
- Mehrotra, S. (2006). *Child Malnutrition and Gender Discrimination in South Asia*. Economics and Political Weekly, Vol. 41, No. 10 (Mar. 11-17, 2006), pp. 912-918.
- Ramachandran, V. (2004). *Gender and Social Equity in Education: Hierarchies of Access*. New Delhi: Sage.
- Ramchandran, V. (1998). *Girls and women Education: Policies and implementation Mechanism*. Case study: India, Bangkok, UNESCO.
- Sharma, M.C. & Sharma, A.K. (2003). *Discrimination based on Sex, caste, religion and disability: Addressing through educational interventions; A handbook for Sensitizing Teacher and Teacher educators*. NCTE & NHRC.
- Subramanyam, R. (2003). *Gender Equality in Education: Definitions and Measurements*. International Journal of Educational Development, July 2005. Vol.25 No.4: p.p. 395-407.

Web Resources:

- Gender School and Society, <http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/II/GENDER,%20SCHOOL,%20SOCIETY%20AND%20INCLUSIVE%20SCHOOL.pdf>
- Gender Bias in Education, <http://uou.ac.in/sites/default/files/bed17/PE-5.pdf>

Dowry prohibition Act, 1961. <http://wcd.nic.in/act/dowry-prohibition-act-1961>

The Medical termination of Pregnancy Act, 1971. <http://tcw.nic.in/Acts/MTP-Act-1971.pdf>

Domestic Violence Act, 2005. <http://wcd.nic.in/sites/default/files/wdvact.pdf>

Understanding Discipline and Subjects

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student teacher will be able to:

- utilize the nature and importance of Disciplinary Knowledge in class
- differentiate present content of teaching subject in school with its history
- appreciate the paradigm shift in disciplines
- critically appraise the Disciplinary and Interdisciplinary Subjects
- appraise the phenomenon of Interdisciplinary approach to Subjects

Course Outline:

Unit I: Disciplinary Knowledge

Nature of Disciplinary Knowledge

Importance of understanding disciplinary knowledge for teachers

Activity: Presentation of disciplinary knowledge from socio-Cultural, Political and Intellectual Context

Unit-II: Disciplinary areas in School

Disciplinary areas in School Education– Language, Mathematics, Social Science, Science

- Paradigm shifts in nature of discipline
- History of teaching subject areas in school at a glance.

Activity: Poster presentation on History of Teaching subject in school.

Unit-III: Understanding School Subject (Content)

- School Subject-Meaning and Importance
- Nature of content in school subject (Theory of Content-)
 - content selection,
 - framing in syllabus
 - transformation of content

Activity: Discussion on identification of organization of knowledge in any one school subject.

Unit IV: Disciplinary Subject in School

Role of disciplinary Knowledge in School Curriculum

Critical Appraisal of disciplinary subject in school

Activity: Discussion on knowledge of disciplinary subject

Unit V: Interdisciplinary Approach and Subject

Objectives of Interdisciplinary subjects

Critical Appraisal of Interdisciplinary subject in school

Activity: Presentation and discussion on phenomenon of Interdisciplinary approach

Reference:

Maisnan Premlata, Lenka, S.K., Gandhi A.K., (2016), *Understanding Discipline and Subject*, Meerut, Surya R. Lall Publisher.

- Makel, Rajesh, MakalLalita, (2016), *Understanding Discipline and Subject*, Delhi.
- Pandey, Ranjana, 2016, *Understating Discipline and subject*, Meerut, Surya R. LallPubl.
- TallaMrunalini, 2012, *Curriculum Development - Perspectives, Principles and Issues*, Noida, Pearson India education Service Pvt. Ltd.
- Yadav, GhawriSapna, 2016, *Knowledge and Curriculum*, New Delhi, Paragon International Publ.
- Yadav, M.S. and Lakhmi, T.K.S. (2003) *Conceptual Inputs for Secondary Teacher Education*, NCTE, New Delhi.
- Alaxander, W. M., & Saylor, J. G. (1966). *Curriculum Planning for modern schools*. New York: Holt, Rinhart and Winston Inc.
- Balrara, M. (1999). *Principles of Curriculum Renewal*. New Delhi: Kanishka Publishers.
- Candra, A. (1977). *Curriculum Development and Evaluation in education*. New Delhi: Sterling Publishers.
- Darji, D. R., & Lulla, B. P. (1967). *Curriculum development in secondary schools of Baroda*. Baroda: Sadhana Press.
- Erickson, H.L. (2007) *Concept based curriculum and instruction for the thinking classroom* California; corwin press.
- Hassrin, M. (2004). *Curriculum Planning for elementary education*. New Delhi: Anmol Publishers.
- Satyanarayan, P.V. (2004). *Curriculum development and management*. New Delhi: DPH.
- Taba, H. (1962). *Curriculum development theory & practice*. New York: Harcourt, Brace & World Inc.
- Yadav, Y.P. (2006). *Fundamentals of Curriculum design*. New Delhi; Shri Sai Printographers.
- NCERT (2000) *National curriculum framework (NCF 2000)*, New Delhi.
- NCERT (2005) *National Curriculum framework (NCF 2005)*, New Delhi
- Arulsamy, S., (2011). *Curriculum Development*, Hyderabad, Neelkamal Publication Pvt. Ltd.
- Kalaiyaran, G., (2017). *Curriculum Development*, New Delhi, APH Publishing Corporation.
- सिन्धु, पू., यादव सं. (2014). *पाठ्यक्रम विकास और अनुदेशन*. नई दिल्ली: अर्जुन पब्लिशिंग हाउस.
- भाटिया, एस., के., जिन्दल, स. (2017). *पाठ्यचर्या, शिक्षण-शास्त्र एवं मूल्यांकन*. नई दिल्ली: पैरागॉन इंटरनेशनल पब्लिशर्स.
- लाल, ब., र., पलोड़, स. (2016). *ज्ञान और पाठ्यचर्या*. मेरठ: आर. लाल बुक डिपो.
- सक्सैना, स्व., एन. आर. गुप्ता, महिमा, कुमार, सं., कु. ध. (2016). *ज्ञान और पाठ्यक्रम*. मेरठ: आर. लाल बुक डिपो.
- तावडे, र., तिवारी, कु. म. (2015). *शिक्षा के उद्देश्य, ज्ञान एवं पाठ्यचर्या*. जयपुर: अनु प्रकाशन.
- पालीवाल, प्र., तिवारी, क. (2016). *ज्ञान एवं पाठ्यक्रम, भाग-2*. आगरा: राखी प्रकाशन प्रा. लि.
- परवीन, अ., गुप्ता, अं, शर्मा, स., गुप्ता, र. (2016). *ज्ञान और पाठ्यक्रम*. जयपुर: आस्था प्रकाश.

Web Resources:

Understanding Disciplines and Subjects, retrieved from

www.tnteu.in/pdf/c5.pdf

The Paradigm Shift in Education In India, retrieved from

shodhganga.inflibnet.ac.in/bitstream/10603/29463/9/09_chapters%201-6.pdf

Formation of school subjects as curriculum content, retrieved from oru.diva-portal.org/smash/get/diva2:303864/FULLTEXT01.pdf

School subjects and academic disciplines: the differences, retrieved from

https://www.researchgate.net/.../284157807_School_subjects_and_academic_disciplines..

Inter Disciplinary Subjects , retrieved from

shodhganga.inflibnet.ac.in/bitstream/10603/96850/11/11_chapter%203.pdf

Disciplinary, Multidisciplinary, Interdisciplinary -Concepts and Indicators

https://www.researchgate.net/.../267939164_Disciplinary_Multidisciplinary_Interdiscipli.

HM Kliebard (1985) Structure of the Disciplines as an Educational Slogan

www1.udel.edu/educ/whitson/897s05/files/KliebardStructDiscs-.pdf

Slattery, J.M.; Carlson, J.F. (2005). "Preparing an effective syllabus: current best practices". College Teaching.54 (4): 159–164. doi:10.3200/CTCH. 53.4.159-164

Habanek, D.V. (2005). "An examination of the integrity of the syllabus". College Teaching.53 (2): 62–64. doi:10.3200/ctch.53.2.62-6

Aesthetic Appreciation through Art and Drama

L T P C

1 0 0 1

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives : Pupil Teachers will be able to:

1. Understand the concepts of Art and Type of Arts
2. Understand Fundamentals of Visual Art
3. Understand Drama, Its Elements and Types of Drama
4. Appreciate different type of Arts
5. Create Various Products by Using Art
6. Perform Various Type of Drama by Organizing the Stage

Course Outline :

Unit I : Visual Art and Craft

- Concept of Art
- Types of Art - (a) Visual Art (b) Performing Art
- Fundamentals of Visual Art
- Classification of Art Style
- An introduction of Medium (Material) and Methods of Art
- Importance of Visual Art Education

Unit II : Performing Art : Drama

- Meaning of Dramatic Art
- Importance of Drama in Education
- Elements of Drama
- Types of Drama
 - Individual
 - Group
- Importance of stage-Setting in Drama

Aesthetic Appreciation through Art and Drama Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Unit III : Visual Art and Craft (Practical)

- Creating new, product through manipulating different Material of Visual Art and Craft : (Any one)
- Paper, Sand, Color, Pan-Ink, Clay, Paper Mashie, Waste Material
- Creation by the use of Different Methods of Art : (Any Two)
 - Preparation of Composition (for Teaching) with the Application of Fundamentals of Art
 - Painting, Printing, Collage, Clay Modeling, Paper Mushy, Paper Cutting and Failing
 - Preparation of Composition (For Teaching) with the appreciation of fundamental of Art.

Unit IV : Improvised Material (Practical)

- Making Puppet through Improvised Materials

Or

- Making a Improvised Instructional Aid

Unit V : Drama and Theatre (Practical)

- Listening, Viewing and Disrning Different Kinds of Drama and Present Report
- Perform any one of the form of Drama with planning, organizing and of setting the stage (Rang Manch).

References :

1. शर्मा, प्रभा (2007), कला विज्ञान शिक्षण, श्रुति पब्लिकेशन, जयपुर।
2. कासलीवाल, मीनाक्षी, (2003), ललितकला के आधारभूत सिद्धान्त, राजस्थान ग्रन्थ अकादमी, जयपुर।
3. वैश्य, आर.पी. (1969) चित्रकला शिक्षण, विनोद पुस्तक मन्दिर, आगरा।
4. गोदीका, साधना एवं सावित्री माथुर (2008), कला शिक्षा शिक्षण, आस्था प्रकाशन, जयपुर।
5. शर्मा, माता प्रसाद (2008), कला शिक्षा शिक्षण, अपोलो प्रकाशन, जयपुर।
6. Husain Ashfaque (1956), Seminar on Art Education, Lalit Kala Academy, New Delhi.
7. Ganga Darshan Munger, Bihar, India, 1995.

Understanding the Self and Yoga

L T P C

1 0 0 1

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives :

1. To facilitate student to understand the self.
2. To develop capacity to identify the values for a good teacher.
3. To facilitate student to perform self reflected activities.
4. To acquaint students with the meaning and importance of yoga.
5. To develop essential skills to perform various asana.

Course Outline :

Unit I : Understanding the self

- a. Self and self development - Concept and Importance
- b. Concept and types of values
 - Individual
 - Social
- c. Importance of Values

Unit II : Yoga and self development

- a. Concept of yoga
- b. Importance of yoga for self development
- c. Pranayam-types and importance
- d. Three milestones of woman's life and yoga
- e. Do's and Don'ts of Asanas

Understanding the Self and Yoga Lab

L T P C

0 0 4 2

Max. Marks : 100

(CA: 40 + ESA: 60)

Practical Units : (Activities based) :

Unit III : Self reflection and personal integration

- a. Expression of Aspiration & Expectations.
- b. Self observation exercise to understand one's own strength and weakness.
- c. Self expression through creative activities.

Unit IV : Enhancing self development

- a. Community participation through Radio Banasthali or Group work.
- b. Self reflecting report, based on one's own experience or reading great authors.
- c. Identification of the values for a good teacher

Unit V : Yoga for healthy mind and body

- a. Practice of various asanas.
- b. Practice of various skills of Pranayam.

References :

1. Dale Carnegie, Leader in you; you to win friends, influence people and succeed in a changing world.
2. Das Gupta & Surendranath : "Yoga : its philosophy & Religion", 1987
3. Sinha, Phulgenda, : "Yogic Cure for Common Diseases", Allied Publishers Pvt. Ltd., 2003.
4. Joshi, K.S. "Yogic Pranayam", Allied Publishers Pvt. Ltd., 2003.
5. Ananda, Sri, "The Complete Book of Yoga Harmony of Body and Mind", Orient Paperbacks, Madarasa Road, Kashmere Gate, Delhi, 1999.
6. Niranjanananda, Paramahansa, "Yoga Darshan, Vision on Yoga upnishads", Sri Pachadashnam ParanaHamsa Alakh Bara, Deoghar, Bihar, India, 1993.
7. Sharma, P.D., "Yoga Yogasana and Pranayama for Health", Navneet Publications (I) Limited Ahmedabad, 1984.
8. Saraswati, Swami Satyanada, "Asana and Pyanayama Mudra, Bnadha", bihar School of Ygoa.
9. M. Vanaja, M. and Charathi Vijaya, Value Oriented Education Neelkamal Publication Pvt. Ltd. New Delhi.
10. Kumar Praveen, Value Education, KSK Publishers, New Delhi.
11. अग्रवाल विजय, स्टूडेंट और पर्सनैलिटी डेवलपमेंट, Benten Books, Bhopal.
12. अग्रवाल विजय, स्टूडेंट और मन की शक्ति, Benten Books, Bhopal.
13. बंधेका गिजुभाई, दिवास्वप्न, नेशनल बुक इंडिया, नई दिल्ली।
14. शास्त्री दिवाकर, गीता का नीतिशास्त्र, सस्ता साहित्य मण्डल, नई दिल्ली।
15. गांधी मोहनदास करमचन्द, सत्य के प्रयोग, गांधीजी की संक्षिप्त आत्म-कथा, राजपाल दिल्ली।
16. शर्मा योगेश कुमार (एवं) प्रज्ञा शर्मा, 'नोबेल पुरस्कार से सम्मानित विश्व की महिलाएँ, पोइण्टर पब्लिशर्स, जयपुर।
17. पटेल ले.जे.आई., आधुनिक भारत के निर्माता : सरदार वल्लभभाई पटेल, प्रकाशन विभाग सूचना भवन, सी कॉम्प्लेक्स, ओ. जी. लोधी रोड़, नई दिल्ली।

18. खेड़ा शिव, जीत आपकी : कामयाबी की ओर ले जाने वाली सीढ़ी, फु सर्कल, दिल्ली।

EDU 505P Field Based Research Project:

This course comprises of two major components:

(i) Research Project Plan:

Every student will prepare a research plan for field based research in guidance of Teacher Educators. Clarify and meaningfulness of the study as understood and reflected in proposal plan by student will be assessed by teacher Educators. This continuous assessment will be of 40 Marks.

(ii) Presentation of Research Project:

Student will execute the Research plan during the School Internship period, in real school settings and report will be prepared and presented.

This field based research Project will be presented by each student in the presence of Board. Head of the department will constitute the Board of Examiners as per requirements. In each Board there will be two Teacher Educators. Each board will evaluate maximum 25 students. Semester assessment of field based Research will be of 60 marks.

EDU 506P Internship-II:

School Internship: This programme will comprise the following components:

- I One week observation of a regular classroom and school activities with regular School teachers.
- II At least 30 lessons in respective teaching subjects at upper primary level to Secondary/Senior Secondary level in regular class.
- III Active participation and organization of school activities such as assembly, Attendance recording, lab/library management, Time Table preparation Co-curricular activities.
Parent Teacher Meeting (PTM), Guidance & Counselling programme and Examination programme.
- IV Prepare and conduct one Unit test for upper primary and secondary level and prepare a Result report.
Every student will submit the following documents and reports related to internship in school.
 - A. School At a Glance: Detail information about the school and its surroundings.
 - B. Lesson Plan diary (on each lesson plan, lesson delivery and feedback must be checked and mentioned by regular school teacher/Authority).
 - C. Report on Test conduction & Result analysis.
 - D. Report on participation & Organization of School activities.

Continuous Assessment will be on the overall performance during the internship on the following basis-

- Regularity & Discipline
- Involvement and active participation in teaching, various school activities and programmes.
- Submission of documents and reports of A, B, C and D component.
- Assessment of documents and reports submitted by the candidate related to Components by the related pedagogical/discipline mentor. This evaluation will be done of 40 marks.

Semester Assessment:

- Summative assessment of Internship II by the school authorities. This assessment will be done of 10 marks.
- Presentation of School internship activities and Experiences will be given by the student before the board duly constituted by the Vice-Chancellor of the Vidyapith.

This summative assessment will be done by a Board comprising three Teacher educators, respectively from Science, Social Science & Language Subject areas. Head of the Department will constitute the Board as per requirement.

This evaluation will be done of 50 marks.

Games and Sports Skills-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes: After completion of this course, the students will be able to:

Develop motor skills necessary to participate successfully in a variety of physical activities.

Fundamentals of various games, its rules and regulation.

- A (I) Track & Field (II) Gymnastics
 - (i) Jumping event: Long Jump (i) Floor Exercise
 - (ii) Throwing event: Shot Put (ii) Balancing Beam
 - (iii) Running event: 100 mt. start (iii) Vaulting horse
- B Secondary Sport (anyone)
 - (I) Throwball
 - (II) Hockey
 - (III) Netball
 - (IV) Martial Art (Combative Sport)
- C Specialization (one major Sport)
 - (i) Basic Skills (Elementary)

Recommended Books: -

1. Timothy, Noakes. (2003). *Lore of Running* (4thed.) US: Human Kinetics.
2. Tomlinson, Alan A Dictionary of Sports Studies. The Oxford Reference 2017. *My First Gymnastics Class* Capucilli, Alyssa Satin Simon and Schuster, 2017.

Suggested E-Learning Resources:

<https://epgp.inflibnet.ac.in>

epathshala.nic.in

Swayam.gov.in

www.wgcoaching.com

www.tandfofline.com

Foundation of Physical Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

Understand the nature and scope of physical education and the role of sport in today's world.

Knowledge and understanding of biological, physiological, psychological and sociological foundations in physical education.

Unit 1 Physical Education: Its aim and objectives:

- I. Introduction
 - (i) Meaning of Aim, Objective and Foundation
- II. Physical Education
 - (i) Aim of Physical Education
 - (ii) Objectives of Physical Education
 - (iii) Physical Education for National and International integration

Unit 2 Biological Foundation:

- I. Heredity and Environment and their influence on Performance.
- II. Principles governing physical and motor growth and development
- III. Anatomical and Physiological differences in male and female
- IV. Body types (Somato types)

Unit 3 Physiological Foundation:

- I. General benefits of exercise
- II. Benefits of exercise on the various Systems
 - (i) Circulatory system (ii) Respiratory system
 - (iii) Muscular system (iv) Nervous system
- III. Kinesthetic sense

Unit 4 Psychological foundation:

- I. Basic concepts of:
 - Impulse, Drives, motive, habits, emotion, anxiety, aggression, stress & motivation
- II. Theories of learning
 - (i) Conditioning theory
 - (a) Skinner (b) I. Pavlov
 - (ii) Gestalt theory
- III. The learning process
 - (i) Law's of learnin
 - (ii) Transfer of training/ learning
 - (iii) The learning curve
 - (iv) Factors and conditions which affect learning

Unit 5 Sociological Foundation:

- I. Physical Education and Sports as a need of society
- II. Game and Sport as man's cultural heritage
- III. Need and Importance of leadership in Physical Education

Recommended Books: -

1. Singh, Ajmer. (2016). *Essential of physical education. New Delhi, Kalyani Publisher.*

2. Singh, Ajmer. (2016). *Olympic Movement*. New Delhi, Kalyani Publisher.
3. Bucher C.A. (1983). *Foundations of Physical Education and Sport*. the C.V. Mosky Co. St. Louis Toroato-London.
4. Kamlesh M.L. and Sangral, *Principles & History of Physical Education*.

Reference Books: -

1. Kamlesh, M.L. and Sangral: *Principles and History of Physical Education*.
2. Kamlesh, M.L. (1998). *Psychology in Physical Education and Sports*. Metropolitan Book Co., New Delhi.
3. M.S. (1985). *Principles and History of Physical Education*. Prakash Brothers; Educational Publishers, Jalandhar.
4. Skinner, Charles E.: (1984). *Educational Psychology*. Prentice Hall of India, New Delhi.

Suggested E-Learning Resources: -

1. <https://epgp.inflibnet.ac.in/ahl.php?csrno=834>
2. www.humankinetics.net
3. www.brainmac.com

Games and Sports Skills-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes: After completion of this course, the students will be able to:

Knowledge of basic skills like running, jumping, throwing, kicking, pulling etc.

Students will learn basics of swimming, horse riding along with knowledge of Indian sports like kho-kho and kabaddi

A Basic Sport (any one)

I- Swimming

(i) Floating (ii) Start (iii) Basic Stroke

II- Equestrian

(i) Mount and Dismount

(ii) Posture on the horse back, walk and change of direction (Right & Left)

B Indian Sport (Any one)

I- Kho-Kho

II- Kabaddi

III- Rope Malkhamb

C Specialization (Continued from I Semester)

Basic Skills (Advanced)

Recommended Books: -

1. Timothy, Noakes. (2003). *Lore of Running* (4thed.). US: Human Kinetics.
2. Tomlinson, Alan A Dictionary of Sports Studies. The Oxford Reference 2017. *My First Gymnastics Class* Capucilli, Alyssa Satin Simon and Schuster, 2017.

Suggested E-Learning Resources:

<https://epgp.inflibnet.ac.in>

epathshala.nic.in

Swayam.gov.in

www.wgcoaching.com

www.tandfonline.com

Games and Sports Skills - III

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes:

Knowledge of basic gymnastic movements

Advance knowledge in a game of specialization.

A Basic Sports (anyone)

I- Track & Field

(i) Middle Distance Race: 800 mts.

(ii) Jumping event: High Jump

(iii) Throwing event: Discuss

II- Gymnastic

(i) Uneven bar

(ii) Rhythmic Gymnastic

(iii) Aerobic Dance

B Secondary Sport (any one)

I- Softball

II- Handball

III- Volleyball

IV- Archery

C Specialization (Continued from I Year)

I- Technique (Advance)

Recommended Books: -

1. Timothy, Noakes. (2003). *Lore of Running* (4thed.). Human Kinetics.
2. Tomlinson, Alan A Dictionary of Sports Studies. The Oxford Reference 2017. *My First Gymnastics Class* Capucilli, Alyssa Satin Simon and Schuster, 2017.

Suggested E-Learning Resources:

<https://epgp.inflibnet.ac.in>

epathshala.nic.in

Swayam.gov.in

www.wgcoaching.com

www.tandfonline.com

Health Education and First-Aid

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Apply the knowledge of health education and hygiene towards the welfare of society.

Manage causality with minor injuries like sprain, strain, bleeding, inflammation etc.

Unit 1 Health Education:

- I- Meaning
- II- Definition
- III- Aim
- IV- Objectives
- V- Principles of health education
- VI- Importance of health education

Unit 2 Mental Health:

- I- Its meaning and causes
- II- Relationship between Mental and Physical health
- III- Dimensions of Health

Unit 3 I- Hygiene:

- (i) Personal Hygiene
- (ii) Food Hygiene
- (iii) Environmental Hygiene
- II- Prevention of communicable diseases
- III- Modes of disease transmission

Unit 4 School health Programme:

- I - Health appraisal of school children and school personnel
- II - Healthful school environment and nutritional services
- III- Mid-day school meal programme
- IV- Dental and eye health

Unit 5 First-Aid:

- I- Introduction
- II- Types of First-Aid (self Aid & First-Aid)
- III- First-Aid Box
- IV- Reasons of sports injuries
- V- Principles of first Aid
- VI- Functions of First Aider
- VII-The First-Aid and emergency care in various cases.

Recommended Books: -

1. Singh, Ajmer. (2016). *Essential of physical education*. New Delhi, Kalyani Publisher.
2. Singh, Ajmer. (2016). *Olympic Movement*. New Delhi, Kalyani Publisher.
3. Park, J.E. & Park, K. (1983). *Preventive and Social Medicine*. Jabalpur: M/s. Banavidas Bhanot Publishers.

Reference Books: -

1. Anderson, C.L. and Chewell, William H. (1986). *School Health Practice*. St. Louis: The C.V. Mosby Company.
2. Bedi, Yashpal. (1985). *Social and Preventive Medicine*. New Delhi, Atmaram and Sons.
3. Dandiya, P.C., Jafer, Z.Y.K. & Jafer Afifa. (1996), (1998). *Health Education and Community Pharmacy*. (2nd ed.), Vallabh Prakashan, New Delhi.
4. Kanpur, N and Baliga, M. (1981). *Elements of Health Education*. Pitambar Publishing Company, (2nd revised Ed.). Karol Bagh, New Delhi.
5. Park, J. & Park, K. (1985). *Text Book of Preventive and Social Medicines*. (10th ed.), BanarasiDassBhanot, Jabalpur.
6. Ramachandran, L. & Dharmalingam, T. (1993). *Health Education: A New Approach*. Vikas Publishing House, New Delhi.
7. The St. John Ambulance Association of India, (1963). *First Aid*. 1. Red Cross Road, New Delhi.
8. Yudenich, V.V. (1982). *Accident First Aid*. Mir Publishers, Moscow.

Suggested E-Learning Resources: -

1. <https://epgp.inflibnet.ac.in/ahl.phpcsrno=834>
2. www.missiontolearn.com
3. www.aid-training.co.uk

Games and Sports Skills - IV

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes: After completion of this course, the students will be able to:

Students are able to perform advance skills of swimming and horse riding.

Student is able to play one racquet game.

- A. Basic Sport (Anyone)
 - I- Swimming (Any two stroke)
 - (i) Breast stroke
 - (ii) Back stroke
 - (iii) Free style
 - (iv) Butter fly
 - II- Equestrian
 - (i) Proficiency in Trot & Balance
 - (ii) Canter
- B. Racquet Game
 - I- Table Tennis
- C. Specialization (Continued from I Semester)

Recommended Books: -

1. Timothy, Noakes. (2003). *Lore of Running* (4thed.). US: Human Kinetics.
2. Tomlinson, Alan A Dictionary of Sports Studies. The Oxford Reference 2017. *My First Gymnastics Class* Capucilli, Alyssa Satin Simon and Schuster, 2017.

Suggested E-Learning Rseources:

<https://epgp.inflibnet.ac.in>

epathshala.nic.in

Swayam.gov.in

www.wgcoaching.com

www.tandfonline.com

Games and Sports Skills - V

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes:

Mastering in one specialized game.

Basic understanding of all secondary /minor games.

- A Heptathlon (Four events)
 - i- Long Jump
 - ii- 200 mt. Race
 - iii- 800 mt. Race
 - iv- High Jump
- B Secondary Sport (anyone)
 - i- Cricket
 - ii- Basketball
 - iii- Football
 - iv- Tennikoit
 - v- Tennis
- C Specialization (Continued from II Year)

Test will be conducted in its skills, rules and regulations.

 - I- Specialization skill test
 - (i) Hockey: Harbans Singh Hockey test
 - (ii) Basketball: Johnson Basketball ability test
 - (iii) Volleyball: Brady Volleyball test
 - (iv) Badminton: Lockart and Mc Pherson Badminton test
 - (v) Soccer: Mc Donald Soccer test
 - (vi) Cricket
 - (vii) Tennis
 - (viii) Swimming
 - (ix) Football
 - (x) Hand ball
 - (xi) Netball
 - (xii) Softball

Recommended Books: -

1. Timothy, Noakes. (2003). *Lore of Runnign* (4thed.). US: Human Kinetics.
2. Tomlinson, Alan A Dictionary of Sports Studies. The Oxford Reference, 2017. *My First Gymnastics Class* Capucilli, Alyssa Satin Simon and Schuster, 2017.

Suggested E-Learning Resources:

<https://epgp.inflibnet.ac.in>

epathshala.nic.in

Swayam.gov.in

www.wgcoaching.com

www.tandfoline.com

Introduction to Yoga

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After completion of this course, the students will be able to:

Students will be able to:

Understand of Yoga philosophy.

Understand of Yoga Asana and Pranayam.

Understand and apply Shatkarma for internal cleansing of the body.

Unit 1 Concept of Yoga System:

Meaning, Definition and Importance

Asthang Yoga

Types of Yoga

(i) Hath Yoga (ii) Gyan Yoga

(iii) Karma Yoga (iv) Raj Yoga

Historical back ground of the development of Yoga

Unit 2 Asanas:

Meaning, Definition and Importance

Types of Asanas:

(i) Meditative (ii) Body Building

(iii) Relaxive

Precautions and Prerequisites while performing Asanas

Unit 3 Pranayam:

Meaning, Definition and Importance

II- Types of Pranayam

III- Precautions to be observed while performing Pranayam

IV- Techniques of performing Pranayam

Unit 4 Women and Yoga:

I- Importance of Yoga for women

II- Three milestones in women's life and Yoga

III- Do's and Don'ts of Asanas for women.

Unit 5 Yogic Methods of Personal Hygiene (Shatkriya):

I- Dhauti II- Vasti III- Neti

IV- Tratak V- Nauli VI- Kapal Bhati

Text Books: -

Iyengar, B.K.S., (1981). *Light on Pranayama*. Harper Colling Publisher, India.

Iyengar, Geeta S. (2002). *Yoga: A Gem for Women*. Allied Publishers Pvt. Ltd.

Iyenger, B.K.S. (1982). *Light on Yoga*. Great Britain, George Allen and Unwin.

Reference Books: -

Ananda, Sri. (1999). *The Complete Book of Yoga Harmony of Body and mind*. Orient paperbacks. Madarsa Road, Kashmere Gate, Delhi.

Das, Gupta & Surendranath. (1987). *Yoga: As Philosophy & Religion*.

Joshi, K.S. (2003). *Yogic Pranayam*. Allied Publishers Pvt. Ltd.

Niranjanananda, Paramahansa, Yoga Darshan, Vision on Yoga upnishads. (1993). Sri PanchdashnamParanahamsaAlakh Bara, Deoghar, Bihar, India.

Pratap, Vijayendra; (1993). *A Teacher's Guide for Beginning Yoga*. Akash Prakashan, Preet Vihar Vikas Marg, New Delhi.

Saraswati, Swami Satyananda; (1995) *Asana Pranayama Mudra*. Bandha. Bihar School of Yoga Ganga Darshan Munger, Bihar, India.

Sharma, S.K. (2008). *Practical Yoga*. 7/12, Ground Floor, Ansari Road, Dariya Gang, New Delhi.

Sharma, Lalita. (1999). *All you wanted to know about Yoga*. Sterling Publishers Private Limited.

Singh, L.A. (2002). *Yogic Philosophy: Methods and approaches* Allied Publishers Pvt. Ltd.

Sinha, Phulgenda. (2003). *Yogic cure for common diseases*. Allied Publishers Pvt. Ltd.

Suggested E-Learning Resources: -

1. www.missiontolearn.com
2. www.mhfa.com.au
3. www.aid-training.co.uk

Games and Sports Skills - VI

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Learning Outcomes: After completion of this course, the students will be able to:

An understanding of heptathlon in athletics.

An understanding of yogasana for fitness.

- A. Heptathlon events
 - I- Hurdle
 - II- Shot-put
 - III- Javelin
- B. Racquet game
 - I- Badminton
- C. Specialization (Continued from V Semester)
 - I- Skill test
 - II- Specialization record book
- D. Yoga Asanas- (20 Asanas)
 - I- Meditative
 - II- Body Building
 - III- Relaxive

Recommended Books: -

1. Timothy, Noakes. (2003). *Lore of Running* (4thed.). US: Human Kinetics.
2. Tomlinson, Alan A Dictionary of Sports Studies. The Oxford Reference, 2017. *My First Gymnastics Class* Capucilli, Alyssa Satin Simon and Schuster, 2017.

Suggested E-Learning Resources:

<https://epgp.inflibnet.ac.in>

epathshala.nic.in

Swayam.gov.in

www.wgcoaching.com

www.tandfonline.com

Pedagogy of English-I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Enable Student Teachers to
acquire insight of nature & perspective of Teaching English
frame the objectives of Teaching English
apply teaching strategies in different context
appreciate different forms of planning for ELT.
assess ELT learning materials.

Course Outline:

Unit –I: Introduction to English.

Nature & Perspective to English Teaching.
Meaning and Principles of Learning English as second language.
Activity: Reading on scope of English language teaching as EFL, EST and ESP.

Unit –II: Objectives of ELT

Objectives of teaching English as set forth in NCF-2005.
Instructional Objectives & its relation to aims
Activity: Framing of Instructional Objectives in Behavioral terms.

Unit –III: Teaching Strategies

Definition of Approach, Method and Technique.
Approaches: Structural and Communicative Approach.
Methods: Grammar-Translation, Inductive-Deductive Method.
Activity: Discussion on adapting teaching strategy according to language forms.

Unit –IV: Planning in ELT

Need and relevance of planning in ELT
Different forms of Plan
Unit plan: concept and components
Lesson plan: concept and components
Difference between Unit and Lesson plan.
Activity: Practice in preparing unit and lesson plan.

Unit –V: Assessment in ELT

Continuous & Comprehensive Assessment
Meaning & Process.
Design of Test Paper
Framing of Test Items.

Activity: Practice in framing test Items

Practicum:

1. Development of Instructional Lesson Plan using non textual material.
2. Construction of an Achievement Test using Evaluation measures

References:

Mullick, R. & Shefali G. (1993). *English Language Teaching From Theory to Practice*. Calcutta: Specturum Inc.

NCERT. (2005). *National Curriculum Framework*. New Delhi: NCERT.

IGNOU. (1999). *Instructional Planning in Teaching of English*. New Delhi: Teaching of English, School of Education.

NCERT. (2000). *English Guidelines & Syllabi of Secondary Stage*. New Delhi: NCTERT.

Venkatesh. (1995). *Principles of Teaching English*. New Delhi: Vikas Publication House.

Mangal, S.K. & Uma Mangal. (2009). *Essential of Education Technology*. New Delhi: PHI Learning Private Ltd.

Amstrong, D. G., Tom V. S. (1983). *Secondary Education: An Introduction*. New York: Macmillan Publication Co. Inc.

Ahmad, J. (2010). *Teaching of Scientific English*. New Delhi: APH Publ.

Web Resources:

Thomas M. D'E. (2017), *Six Principles of Teaching English Language Learners in the Mainstream Classroom*.
<https://1.cdn.edl.io/P2EaJJFEFVYW92Clm3CyX9pLPcuvKI9E0G3w7KCBDSLX6mH2.pdf>

- NCERT(2005), *NCF 2005*

www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf

- NCERT (2005), *Teaching of English*

www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/english.pdf

Methods And Approaches Of English Language Teaching In India

http://shodhganga.inflibnet.ac.in/bitstream/10603/20567/10/10_chapter%203.pdf

Cunningham, Gini, *The New Teacher's Companion* (2009)

<http://www.ascd.org/publications/books/109051/chapters/Lesson-Plans-and-Unit-Plans@-The-Basis-for-Instruction.aspx>

Planning Guidelines

[https://educacion.gob.ec/wp-](https://educacion.gob.ec/wp-content/uploads/downloads/2013/09/Planning_Guidelines_anual_unidad_lecci%F3n-EFL_100913.pdf)

[content/uploads/downloads/2013/09/Planning_Guidelines_anual_unidad_lecci%F3n-EFL_100913.pdf](https://educacion.gob.ec/wp-content/uploads/downloads/2013/09/Planning_Guidelines_anual_unidad_lecci%F3n-EFL_100913.pdf)

NCERT (2018) *Continuous and Comprehensive Evaluation: Guidelines*, NCERT, New Delhi

www.ncert.nic.in/announcements/pdf/CCE-Guidelines.pdf

CBSC (2009). *Continuous and Comprehensive Evaluation*

www.cbse.nic.in/cce/cce-manual/chapter_1.pdf

Guidelines For Paper Setters - Curriculum

https://curriculum.gov.mt/en/Assessment/Assessment-of-.../guidelines_paper_setters.pdf

Pedagogy of English-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Enable Student Teachers to:

recognize English in School curriculum as L1, L2, L3 so as to teach differentially
discern the different language forms and dissemination through language skills

3. utilize media and resources in ELT according to the content
4. appreciate text book of English
5. employ reflective and remedial teaching in class accordingly

Course Outline:

Unit-I: English language in Present Day India

1. Position as Link Language, Library Language and Global Language.
2. Place of English in school curriculum with emphasis to L1, L2 & L3.

Activity: Discussion on Need for study of English with reference to its position

Unit-II: Essentials of Content in English

1. Language Forms & its dissemination strategy.
 - o Prose, Poetry and Grammar.
2. Language Skills
 - o Nature, Value and Techniques
 - Reading, Listening, Speaking and Writing.

Activity: Preparation of any activity related to receptive and productive language skills.

Unit-III: Media and Recourses in ELT.

1. Significance & use of Audio, Visual and Audio-Visual Media.
2. Language Laboratory (Nature, Function, Types)

Activity: Presentation of report on visit to Language Laboratory

Unit-IV: Curriculum Analysis

1. Characteristics of Good Text Book of English.
2. Critical Analysis of English Text Book.

Activity: Critical Analysis of prescribed English Text Book of a class.

Unit-V: Teaching Enhancement

Concept, Need, Process

1. Remedial Teaching
2. Reflective Teaching

Activity: Preparation of Teaching Portfolio

Practicum:

1. Report on Reflective Teaching.
2. Preparation of one model or language game for Instructional purpose.

References:

Mullick, R. & Shefali G. (1993). *English Language Teaching from theory to practice*. Calcutta: Spectrum Inc.
IGNOU. (1999). *Instructional Planning in Teaching of English*. Teaching of English, New Delhi: School of Education.

- NCERT. (2000). *English Guidelines & Syllabi for Secondary Stage*. New Delhi: NCERT.
- Venkatesh. (1995). *Principles of Teaching English*. New Delhi: Vikas Publication House.
- Mangal, S.K. & Uma M. (2009). *Essentials of Educational Technology*. New Delhi: PHI Learning Private Ltd.
- Amstrong, David G., Tom V. S. (1983). *Secondary Education: An Introduction*. New York: Macmillan Publication Co. Inc.
- Yadav, N. (2003). *A Handbook of Education Technology*. New Delhi: Anmol Publications Pvt. Ltd. India.
- Harmer, J. (1985). *The Practice of English Language Teaching*. Longman Handbooks for Language Teachers, New York: Longman.
- Vedanayagam, E.G. (1988). *Teaching Technology for College Students*. New Delhi: Sterling.

Pedagogy of Hindi-I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

छात्राध्यापिकाएँ :

- हिन्दी के विविध रूपों एवं भाषागत विशेषताओं के प्रति विद्यार्थियों में जिज्ञासा भाव जाग्रत कर भाषा सौंदर्य से परिचित करा सकेंगी।
- हिन्दी भाषा के विविध रूपों में विभेद कर सकेंगी।
- विद्यार्थियों में भाषा का सामान्य व सांदर्भिक अर्थग्रहण तथा अभिव्यक्त करने की क्षमता उत्पन्न कर सकेंगी।
- संदर्भ एवं परिस्थिति के अनुसार हिन्दी-शिक्षण की उपयुक्त एवं अभिनव विधियों व प्रविधियों का प्रयोग कर सकेंगी।
- हिन्दी शिक्षण के उद्देश्यों का व्यावहारिक लेखन कर सकेंगी।
- विद्यार्थियों में भाषायी कौशलों का विकास कर सकेंगी, जिसके परिणामस्वरूप विद्यार्थियों में सांदर्भिक अर्थग्रहण एवं अभिव्यक्ति क्षमता उत्पन्न कर सकेंगी।
- विविध साहित्यिक विधाओं (गद्य-पद्य, व्याकरण आदि) के शिक्षण उद्देश्यों को ध्यान में रखकर उपयुक्त योजना का निर्माण एवं उसका क्रियान्वयन कर सकेंगी।

पाठ्यवस्तु रूपरेखा :

इकाई-I: भाषा –प्रस्तावना एवं पार्श्वभूमि

- भाषा-विविध रूप (मातृभाषा, राष्ट्रभाषा, राजभाषा)
- भाषा-प्रकृति एवं महत्व
- भाषा की भूमिका-सांस्कृतिक, कार्यात्मक, साहित्यिक

गतिविधि-भाषा की विभिन्न भूमिकाओं पर चर्चा एवं कार्यात्मक हिन्दी पर आलेखन

इकाई-II: हिन्दी शिक्षण/भाषा-शिक्षण के उद्देश्य

- हिन्दी-शिक्षण के उद्देश्य – सामान्य और विशिष्ट,
 - स्तरानुकूल
 - भाषागत

गतिविधि – हिन्दी शिक्षण के उद्देश्यों का लेखन।

इकाई-III: भाषायी कौशलों का विकास

(अर्थ, महत्व, उद्देश्य एवं गतिविधियाँ)

- अभिव्यक्ति – लेखन कौशल एवं वदन (भाषण) कौशल
- अर्थग्रहण – श्रवण कौशल एवं पठन कौशल

गतिविधि- किसी एक भाषायी कौशल विकास के लिए योजना का निर्माण

इकाई-IV: साहित्यिक अभिव्यक्ति के विविध रूप एवं उनका शिक्षण

- साहित्यिक अभिव्यक्ति के विविध रूप एवं उनका शिक्षण-गद्य, पद्य, नाटक (अर्थ, उद्देश्य, महत्व, एवं शिक्षण विधियाँ)
- व्याकरण शिक्षण – अर्थ उद्देश्य, महत्व, एवं शिक्षण विधियाँ)

गतिविधि- किसी एक विधा की शिक्षण विधियों पर समीक्षात्मक आलेखन

इकाई-V: हिन्दी शिक्षण – योजना एवं मूल्यांकन

इकाई योजना-अर्थ, महत्त्व, एवं तत्त्व

- पाठ-योजना- अर्थ, महत्त्व, एवं तत्त्व
- भाषा विकास की प्रगति का मूल्यांकन/आकलन – अवधारणा, महत्त्व एवं विशेषताएँ

गतिविधि- विविध विधाओं पर पाठ योजना का विकास

व्यावहारिक कार्य –(कोई दो कार्य)

- हिन्दी शिक्षण के उद्देश्यों का विभिन्न विधा के अनुसार लेखन
- पठित विधाओं में से किसी एक विधा पर कम्प्यूटर आधारित शिक्षण पाठ का विकास
- व्याकरण शिक्षण से संबंधित चार्ट या भाषायी खेल का निर्माण

सन्दर्भ:

अवधेश, ए. (1973). हिन्दी भाषा का स्वरूप विकास. पटना: बिहार ग्रन्थ अकादमी.

गुप्त, एम. (1991). भाषा शिक्षण : सिद्धान्त एवं प्रविधि. आगरा: केन्द्रीय हिन्दी संस्थान.

लाल, आर. बी. (1965). हिन्दी शिक्षण. मेरठ: रस्तोगी एण्ड कम्पनी.

मित्तल, एम. एल. (2012). हिन्दी शिक्षण. दिल्ली: पियर्सन.

मित्तल, एस. (2005). शैक्षिक तकनीकी. मेरठ: आर. लाल बुक डिपो.

ओड, एल. के. (1982). हिन्दी शिक्षण में त्रुटि एवं उपचार. राजस्थान: बनस्थली विद्यापीठ.

पाटिल, एच. आर. और शेडके, एस. (2005). भाषा शिक्षण. कानपुर: विद्या प्रकाशन.

पाण्डेय, आर. एस. (1977). हिन्दी शिक्षण. आगरा: विनोद पुस्तक मन्दिर.

शर्मा, आर. ए. (2009). शिक्षा तकनीकी. मेरठ: आर. लाल बुक डिपो.

शर्मा, एल. (1989). हिन्दी संरचना का अध्ययन-अध्यापन. आगरा: केन्द्रीय हिन्दी संस्थान.

श्रीवास्तव, आर. (1979). भाषा शिक्षण. गाजियाबाद: मैकमिलन कम्पनी ऑफ इण्डिया.

तिवारी, पी. (1976). सर्वोपयोगी हिन्दी सुधार कार्यक्रम. अजमेर: मिश्रा ब्रदर्स.

योगेन्द्रजीत, बी. (1981). हिन्दी भाषा शिक्षण. आगरा: विनोद पुस्तक मन्दिर.

Web Resources:

Pedagogy of Hindi--<https://www.vmou.ac.in>

Pedagogy of Hindi—ncert.nic.in/rightsidelinks/pdf/h

Unit-1—[Wikipedia.org](https://en.wikipedia.org)

Pedagogy of Hindi—www.mannu.ac.org

Pedagogy of Hindi—[uou.ac.in](https://www.uou.ac.in)

Pedagogy of Hindi--www.uou.ac.in

Pedagogy of Hindi—www.uprtou.ac.in

Kendriya Hindi Sansthan Agra--<http://khsindia.org/> india/hi

Pedagogy of Hindi-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

छात्राध्यापिकाएँ :

अनुकूल परिस्थितियों उत्पन्न कर विद्यार्थियों को सौंदर्यबोध करा सकेंगी।

विद्यार्थियों की सृजनात्मकता को प्रेरित कर सकेंगी।

प्रभावी हिन्दी शिक्षण हेतु दृश्य-श्रव्य सामग्री/शिक्षण अधिगम संसाधनों का उपयुक्त प्रयोग कर सकेंगी।

हिन्दी शिक्षण में योगदान देने वाली गतिविधियों का आयोजन कर सकेंगी।

नवीन विधियों (हिन्दी शिक्षण में प्रयुक्त) का प्रयोग कर उद्देश्यों को ध्यान में रखकर प्रभावी शिक्षण कर सकेंगी।

विभिन्न शिक्षण एवं शिक्षणोत्तर कार्यक्रमों का आयोजन एवं मूल्यांकन कर सकेंगी।

पाठ्यवस्तु रूपरेखा :

इकाई-I: भाषिक दोष-निदान एवं उपचार

- उच्चारण – अशुद्धियाँ, कारण, निदान एवं उपचार
- वर्तनी – अशुद्धियाँ, कारण, निदान एवं उपचार

गतिविधि – शिक्षण-अभ्यास के समय विद्यार्थियों द्वारा की जाने वाली उच्चारण सम्बन्धी त्रुटियों की सूची तैयार करना तथा उनके सुधार के लिए उपचारात्मक कार्यक्रम का निर्माण

इकाई-II: हिन्दी शिक्षण में नवाचार या नवीन विधियाँ

- हिन्दी शिक्षण में नवीन विधियाँ
 - भूमिका पालन
 - प्रायोजना विधि
 - पर्यवेक्षित अध्ययन विधि

गतिविधि—किसी एक नवीन विधि के अनुसार पाठ-योजना का निर्माण

इकाई-III: हिन्दी शिक्षण में शिक्षण-अधिगम संसाधन

- शिक्षण-अधिगम संसाधन— अर्थ, महत्व, प्रकार, प्रयोग एवं प्रयोग में सावधानियाँ
- भाषा प्रयोगशाला एवं कम्प्यूटर— अर्थ, महत्व, प्रयोग एवं प्रयोग में सावधानियाँ

गतिविधि— हिन्दी शिक्षण हेतु दो शिक्षण-अधिगम संसाधनों का निर्माण

इकाई-IV: सहगामी क्रियाएँ एवं हिन्दी अध्यापक

- सहगामी क्रियाएँ एवं हिन्दी शिक्षण
 - साहित्यिक क्रियाएँ: महत्व, प्रकार, आयोजन एवं प्रतिवेदन लेखन
 - सांस्कृतिक क्रियाएँ: महत्व, प्रकार, आयोजन एवं प्रतिवेदन लेखन
- हिन्दी अध्यापक—गुण, दक्षता एवं कर्तव्य

गतिविधि— हिन्दी शिक्षण से संबंधित किसी साहित्यिक क्रिया की रूपरेखा का निर्माण

इकाई-V: हिन्दी मूल्यांकन की भूमिका और महत्व

- भाषा विकास की प्रगति का मूल्यांकन – गतिविधि आधारित मूल्यांकन
- प्रश्न-पत्र निर्माण के आधार-बिन्दु एवं प्रश्नों का स्वरूप
- नीलपत्र एवं परीक्षण पद निर्माण

■ प्रश्न-पत्र निर्माण

गतिविधि-नील-पत्र निर्माण एवं परीक्षण पद निर्माण

व्यावहारिक कार्य- (कोई दो कार्य)

- शिक्षण अभ्यास के समय विद्यार्थियों द्वारा की जाने वाली वर्तनी संबंधी त्रुटियों की सूची तैयार करना तथा उनके सुधार के लिए उपचारात्मक कार्यक्रम का निर्माण
- साहित्यिक विषय (थीम) आधारित अलबम तैयार करना
- इकाई परीक्षण के परिणामों (FA+SA) का कम्प्यूटर की सहायता से विश्लेषण एवं अर्थापन

सन्दर्भ :

- अवधेश, ए. (1973). हिन्दी भाषा का स्वरूप विकास. पटना: बिहार ग्रन्थ अकादमी.
- गुप्त, एम. (1991). भाषा शिक्षण : सिद्धान्त एवं प्रविधि. आगरा: केन्द्रीय हिन्दी संस्थान.
- लाल, आर. बी. (1965). हिन्दी शिक्षण. मेरठ: रस्तोगी एण्ड कम्पनी.
- मित्तल, एम. एल. (2012). हिन्दी शिक्षण. दिल्ली: पियर्सन.
- मित्तल, एस. (2005). शैक्षिक तकनीकी. मेरठ: आर. लाल बुक डिपो.
- ओड, एल. के. (1982). हिन्दी शिक्षण में त्रुटि एवं उपचार. राजस्थान: बनस्थली विद्यापीठ.
- पाटिल, एच. आर. और शेडके, एस. (2005). भाषा शिक्षण. कानपुर: विद्या प्रकाशन.
- पाण्डेय, आर. एस. (1977). हिन्दी शिक्षण. आगरा: विनोद पुस्तक मन्दिर.
- शर्मा, आर. ए. (2009). शिक्षा तकनीकी. मेरठ: आर. लाल बुक डिपो.
- शर्मा, एल. (1989). हिन्दी संरचना का अध्ययन-अध्यापन. आगरा: केन्द्रीय हिन्दी संस्थान.
- श्रीवास्तव, आर. (1979). भाषा शिक्षण. गाजियाबाद: मैकमिलन कम्पनी ऑफ इण्डिया.
- तिवारी, पी. (1976). सर्वोपयोगी हिन्दी सुधार कार्यक्रम. अजमेर: मिश्रा ब्रदर्स.
- योगेन्द्रजीत, बी. (1981). हिन्दी भाषा शिक्षण. आगरा: विनोद पुस्तक मन्दिर.

Web Resources:

- Unit-1—www.learning-hindi.com
- Pedagogy of Hindi—<https://www.v mou.ac.in>
- Pedagogy of Hindi—ncert.nic.in/rightsidelinks/pdf/h
- Unit-1—Wikipedia.org
- Pedagogy of Hindi—www.mannu.ac.org
- Pedagogy of Hindi—uou.ac.in
- Pedagogy of Hindi—www.uou.ac.in
- Pedagogy of Hindi—www.uprtou.ac.in
- Kendriya Hindi Sansthan Agra—<http://khsindia.org/india/hi>

Pedagogy of Sanskrit-I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

छात्राध्यापिकाएँ :

विद्यार्थियों में संस्कृत की भाषागत विशेषताओं के प्रति जिज्ञासा भाव जागृत कर भाषा-सौंदर्य से परिचित करा सकेंगी।

संस्कृत भाषा शिक्षण के उद्देश्यों को व्यवहारगत परिवर्तन के रूप में लिख सकेंगी।

भाषा एवं साहित्यिक दृष्टि से संस्कृत की समस्त विधाओं जैसे-गद्य, पद्य व व्याकरण का इनके शिक्षण उद्देश्यों को ध्यान में रखकर शिक्षण कर सकेंगी।

परिस्थित्यानुसार उपयुक्त विधियों एवं प्रविधियों का प्रयोग कर संस्कृत गद्य, पद्य व व्याकरण शिक्षण को सरस, सरल एवं अर्थपूर्ण बना सकेंगी।

संस्कृत गद्य, पद्य व व्याकरण शिक्षण के लिए विद्यार्थी उन्मुख पाठ योजना निर्मित कर सकेंगी।

संस्कृत को आत्मसात कराने के लिए शिक्षण तथा शिक्षणोत्तर कार्यक्रमों का आयोजन एवं मूल्यांकन करने की क्षमता विकसित कर सकेंगी।

दृश्य-श्रव्य सामग्री के सुरुचिपूर्ण उपयोग द्वारा प्रभावी शिक्षण कर सकेंगी।

पाठ्यवस्तु रूपरेखा :

इकाई-प्रथम: संस्कृत भाषा व शिक्षण के उद्देश्य

1. संस्कृत भाषा की प्रकृति
2. संस्कृत शिक्षण के उद्देश्य
 - सामान्य और विशिष्ट
 - स्तरानुकूल
 - भाषागत

गतिविधि : संस्कृत शिक्षण के उद्देश्यों का लेखन।

इकाई-द्वितीय : विविध विधा शिक्षण

1. गद्य शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ
2. पद्य शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ
3. व्याकरण शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ

गतिविधि : किसी एक विधा के शिक्षण की विधियों पर समीक्षात्मक आलेखन।

इकाई-तृतीय : संस्कृत शिक्षण में शिक्षण-अधिगम संसाधन

1. दृश्य संसाधन : महत्त्व, प्रकार, प्रयोग और प्रयोग में सावधानियाँ
2. श्रव्य संसाधन : महत्त्व, प्रकार, प्रयोग और प्रयोग में सावधानियाँ
3. दृश्य-श्रव्य संसाधन : महत्त्व, प्रकार, प्रयोग और प्रयोग में सावधानियाँ

गतिविधि : संस्कृत शिक्षण में प्रयुक्त हो सकने वाली दो सहायक सामग्रियों का निर्माण।

इकाई-चतुर्थ : संस्कृत के प्रति रुचि जाग्रत करने वाली क्रियाएँ

1. साहित्यिक क्रियाएँ : महत्त्व, प्रकार, आयोजन एवं प्रतिवेदन लेखन
2. सांस्कृतिक क्रियाएँ : महत्त्व, प्रकार, आयोजन एवं प्रतिवेदन लेखन

गतिविधि : संस्कृत शिक्षण से सम्बन्धित किसी साहित्यिक क्रिया की रूपरेखा का निर्माण, आयोजन एवं प्रतिवेदन लेखन।

इकाई-पंचम : संस्कृत शिक्षण में पाठ योजना एवं आकलन

1. इकाई योजना निर्माण
2. पाठ योजना निर्माण

- गद्य पाठ योजना
- पद्य पाठ योजना
- व्याकरण पाठ योजना
- 3. संस्कृत भाषा शिक्षण में मूल्यांकन की अवधारणा
- 4. अच्छे मूल्यांकन की विशेषताएँ

गतिविधि : विविध विधाओं के शिक्षण हेतु पाठ योजना का विकास।

व्यावहारिक कार्य – (निम्न में से कोई दो कार्य)

1. संस्कृत शिक्षण के उद्देश्यों का लेखन।
2. पठित विधाओं में से किसी एक विधा पर कम्प्यूटर आधारित शिक्षण पाठ का विकास।
3. संस्कृत शिक्षण से सम्बन्धित किसी सांस्कृतिक क्रिया की रूपरेखा का निर्माण।
4. एक नीलपत्र एवं प्रश्नपत्र का निर्माण।

सन्दर्भ पुस्तक :

- आप्टे, जी. डी. एण्ड डोगरे पी. के. (1960). *टीचिंग आफ संस्कृत इन सैकण्डरी स्कूल*. बड़ौदा: आचार्य बुक डिपो.
- भारत सरकार, शिक्षा विभाग (1957). *संस्कृत आयोग प्रतिवेदन 1956*. दिल्ली: भारत सरकार प्रेस.
- चतुर्वेदी, एस. (1960). *संस्कृत शिक्षण*. वाराणसी: नन्द किशोर एण्ड ब्रदर्स.
- द्विवेदी, के. (2016). *बृहद् रचना अनुवाद कौमुदी*. वाराणसी: विश्वविद्यालय प्रकाशन.
- मित्तल, एस. (2000). *संस्कृत शिक्षण*. मेरठ: आर. लाल बुक डिपो.
- मित्तल, एस. (2012). *शिक्षण तकनीकी*. मेरठ: आर. लाल बुक डिपो.
- पाण्डे, आर. (2000). *संस्कृत शिक्षण*. आगरा: विनोद पुस्तक मंदिर.
- साहू, आर. (2012). *संस्कृत व्याकरण*. जयपुर: हंसा प्रकाशन.
- सफाया, आर. (1997). *संस्कृत शिक्षण*. चण्डीगढ़: हरियाणा साहित्य अकादमी.
- शर्मा, आर. ए. (2009). *शिक्षा तकनीकी*. मेरठ: आर. लाल बुक डिपो.

Web Resourecs:

Pedagogy of Sanskrit Part-I: <http://uou.ac.in/sites/default/files/bed17/CPS-6.pdf>

Pedagogy of Sanskrit Part-II: <http://uou.ac.in/sites/default/files/bed17/CPS-14.pdf>

Sanskrit Language Teaching: http://www.sanskrit.nic.in/sanskrit_language_teaching.php

Rashtriya Sanskrit Sansthan e-book: <http://www.sanskrit.nic.in/ebooks.php>

Methodology of Teaching Sanskrit: <https://swayam.gov.in/courses/5292-discipline-methodology-of-teaching-sanskrit>

Pedagogy of Sanskrit-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

छात्राध्यापिकाएँ—

संस्कृत भाषा का महत्त्व स्पष्ट करते हुए पाठ्यक्रम में संस्कृत के स्थान का निर्धारण कर सकेंगी।

अशुद्ध उच्चारण एवं अशुद्ध वर्तनी के कारणों को ध्यान में रखकर निदान एवं निराकरण कर सकेंगी।

शिक्षण उद्देश्यों को ध्यान में रखकर संस्कृत नाटक, अनुवाद एवं रचना का प्रभावी शिक्षण कर सकेंगी।

परिस्थित्यानुसार उपयुक्त विधियों एवं प्रविधियों का प्रयोग कर संस्कृत नाटक, अनुवाद एवं रचना के शिक्षण को सरस, सरल एवं अर्थपूर्ण बना सकेंगी।

भारतीय संस्कृति को ध्यान में रखते हुए संस्कृत साहित्य-पठन में विद्यार्थियों की रुचि विकसित कर सकेंगी।

रचना, अनुवाद एवं नाटक शिक्षण के लिए विद्यार्थी उन्मुख पाठ योजना निर्मित कर सकेंगी।

पाठान्तर्गत एवं पाठोपरान्त आकलन कर सकेंगी।

पाठ्यवस्तु रूपरेखा :

इकाई-प्रथम: संस्कृत भाषा का महत्त्व व पाठ्यक्रम में स्थान

1. संस्कृत भाषा का महत्त्व (साहित्यिक, ऐतिहासिक, भाषिक एवं सांस्कृतिक दृष्टि से)
2. विद्यालयीन पाठ्यक्रम में संस्कृत का स्थान
3. संस्कृत शिक्षण के सम्बन्ध में विभिन्न मत एवं उनका अर्थ निर्णय

गतिविधि : — संस्कृत भाषा के महत्त्व की विवेचना।

— विद्यालयीन पाठ्यक्रम में संस्कृत के स्थान की समीक्षा।

इकाई-द्वितीय: भाषायी कौशलों का विकास

1. अर्थग्रहण: श्रवण एवं पठन
2. अभिव्यक्ति: वदन एवं लेखन

गतिविधि: किसी एक भाषायी कौशल विकास के लिए योजना का निर्माण।

इकाई-तृतीय: संस्कृत शिक्षण के विविध पहलू

1. संस्कृत में ध्वनियाँ एवं उनका वर्गीकरण
2. संस्कृत में उच्चारण एवं वर्तनी
 - अशुद्ध उच्चारण के कारण, निदान एवं उपचार
 - अशुद्ध वर्तनी के कारण, निदान एवं उपचार

गतिविधि: शिक्षण-अभ्यास के समय विद्यार्थियों द्वारा की जाने वाली उच्चारण सम्बन्धी त्रुटियों की सूची तैयार करना तथा उनके सुधार के लिए उपचारात्मक कार्यक्रम का निर्माण।

इकाई-चतुर्थ: विविध विधा शिक्षण :

1. नाटक शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ
2. अनुवाद शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ
3. रचना शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ

गतिविधि: किसी एक विधा के शिक्षण की विधियों पर समीक्षात्मक आलेखन।

इकाई-पंचम: संस्कृत शिक्षण में पाठ योजना एवं आकलन

1. पाठ योजना निर्माण
 - नाटक पाठ योजना
 - अनुवाद पाठ योजना
 - रचना पाठ योजना
2. इकाई प्रश्न पत्र निर्माण
3. पाठान्तर्गत एवं पाठोपरान्त आकलन

गतिविधि: इकाई परीक्षण के परिणामों का विश्लेषण एवं अर्थापन।

व्यावहारिक कार्य— (निम्न में से कोई दो कार्य)

- 1 शिक्षण—अभ्यास के समय विद्यार्थियों द्वारा की जाने वाली वर्तनी सम्बन्धी त्रुटियों की सूची तैयार करना तथा उनके सुधार के लिए उपचारात्मक कार्यक्रम का निर्माण।
- 2 विविध विधाओं में से किसी एक विधा पर कम्प्यूटर आधारित शिक्षण पाठ का विकास।
- 3 इकाई परीक्षण के परिणामों का कम्प्यूटर की सहायता से विश्लेषण एवं अर्थापन।

सन्दर्भ पुस्तक :

- आप्टे, जी. डी. एण्ड डोगरे पी. के. (1960). *टीचिंग आफ संस्कृत इन सैकण्डरी स्कूल*. बड़ौदा: आचार्य बुक डिपो.
- भारत सरकार, शिक्षा विभाग (1957). *संस्कृत आयोग प्रतिवेदन 1956*. दिल्ली: भारत सरकार प्रेस.
- चतुर्वेदी, एस. (1960). *संस्कृत शिक्षण*. वाराणसी: नन्द किशोर एण्ड ब्रदर्स.
- द्विवेदी, के. (2016). *बृहद् रचना अनुवाद कौमुदी*. वाराणसी: विश्वविद्यालय प्रकाशन.
- मित्तल, एस. (2000). *संस्कृत शिक्षण*. मेरठ: आर. लाल बुक डिपो.
- मित्तल, एस. (2012). *शिक्षण तकनीकी*. मेरठ: आर. लाल बुक डिपो.
- पाण्डे, आर. (2000). *संस्कृत शिक्षण*. आगरा: विनोद पुस्तक मंदिर.
- साहू, आर. (2012). *संस्कृत व्याकरण*. जयपुर: हंसा प्रकाशन.
- सफाया, आर. (1997). *संस्कृत शिक्षण*. चण्डीगढ़: हरियाणा साहित्य अकादमी.
- शर्मा, आर. ए. (2009). *शिक्षा तकनीकी*. मेरठ: आर. लाल बुक डिपो.

Web Resources:

- Pedagogy of Sanskrit Part-I: <http://uou.ac.in/sites/default/files/bed17/CPS-6.pdf>
- Pedagogy of Sanskrit Part-II: <http://uou.ac.in/sites/default/files/bed17/CPS-14.pdf>
- Sanskrit Language Teaching: http://www.sanskrit.nic.in/sanskrit_language_teaching.php
- Rashtriya Sanskrit Sansthan: <http://www.sanskrit.nic.in/ebooks.php>
- Methodology of Teaching Sanskrit: <https://swayam.gov.in/courses/5292-discipline-methodology-of-teaching-sanskrit>

Pedagogy of General Science -I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Students will be able to-

- explain the nature and importance of general science.
- discuss and correlate the general science with other school subject.
- analyze the NCF 2005 with reference to science education.
- frame instructional objectives in behavioural terms.
- prepare unit plan and lesson plan based on different method.

Course Outline:

Unit-I: Nature of Science

- Concept and nature of Science: Process and Product.
- Importance of General Science in School curriculum.
- Influence of Science on Man and Environment
- Co-relation of General Science with other School Subject.

Activity: Presentation on Contribution of Scientist in the field of Science.

Unit-II: Curriculum in General Science

- Concept of Curriculum & Syllabus.
- Difference between Curriculum and Syllabus
- Principles of Curriculum Construction in General Science.
- NCF 2005 with reference to Science Education.

Activity: Analysis of Science Curriculum with reference to NCF 2005

Unit-III: Objectives of General Science

- Meaning and difference between Objectives and Teaching Objectives in Science Teaching
- General Objectives of Science Teaching at Secondary stage
- Writing specific Objectives of Teaching in behavioral terms.

Activity: Practice on writing Teaching Objectives in behavioural term

Unit-IV: Planning in General Science

- Concept of Unit Plan and Lesson Plan.
- Difference between Unit Plan and Lesson Plan.
- Need of Planning.
- Consideration points of effective Lesson Plan and Unit Plan.

Activity: Practice on Preparing Unit Plan and Lesson Plan.

Unit-V: Methods of Teaching (I)

(Teaching Methods- Meaning, Advantages and Limitations.)

- Lecture –cum- Demonstration method.
- Problem Solving Method.

- Heuristic Method.

Activity: Preparation of Lesson Plan based on above methods.

Practicum: Any Two of the following-

- Term paper on “Correlation of General Science with other School Subject”.
- Present a Report of Critical Appraisal of NCF-2005 with Reference to General Science Education.
- Submission of Instructional Objectives in Behavioural Terms for One Unit.
- Preparation of One Unit and Lesson Plan.
- Preparation of Lesson Plan Based on any one Teaching method.

References:

- Bhandula, N. & Shrama, Sidheswar. (2009). *Teaching of Science*. Ludhiyana :Vijaya Publications.
- Das, D.N. (2007). *Practice Teaching*. Jaipur : Pointer Publisher.
- Gupta, Nirmala . (1967). *Method of Teaching Science*. Meerut :Rastogi and Company.
- Misra, Karuna Sankar. (2008). *Effective Science Education*. Allahabad : Anubhav Publishing House.
- Prasad, Janardhan.(1999). *Practical Aspects in Teaching of Science*. Delhi : Kanishka Publishers Distributors.
- Rajan, Sonika. (2012). *Methodology of Teaching Science (I ed.)*, Delhi : Pearson Publication.
- Rawat, Hemant, . (2009). *Teaching of Science*. New Delhi : Lakshay Publication.
- Sharma, R.C. (2001). *Modern Science Teaching*. New Delhi : Dhanpat Rai Publishing co. Pvt. Ltd.
- Sood, J.K. (1989). *New Direction in Science Technology*. Chandigarh : Kohli Publishers.
- Sen, B.R. (2005). *Teaching Science in Secondary school*. New Delhi : Commonwealth Publisher's.
- Vaidya, Narendra . (1996). *Science teaching for the 21st century*. New Delhi : Deep and Deep Publications.
- कुलश्रेष्ठ, अरुण कुमार एवं कुलश्रेष्ठ, नील कमल. (2013). *विज्ञान शिक्षण*. मेरठ : आर०लाल बुक डिपो.
- भटनागर, ए० बी०. (2014). *विज्ञान शिक्षण*. मेरठ : आर०लाल बुक डिपो.
- मंगल, एस० के०. (2007). *साधारण विज्ञान शिक्षण (पाँचवा संस्करण)*. नई दिल्ली : आर्य बुक डिपो.
- रावत, एम० एस०, एवं अग्रवाल, एम० बी० लाल. (2008). *नवीन विज्ञान शिक्षण (बारहवाँ संस्करण)*. आगरा : अग्रवाल पब्लिकेशन्स.
- सूद, जे० के०. (2010). *विज्ञान शिक्षण (पंचम संस्करण)*. आगरा : विनोद पुस्तक मन्दिर.
- श्रीमाली, नन्द किशोर., भूषण आनन्द एवं रिहानी, इन्दु. (2013). *विज्ञान शिक्षण (आठवाँ संस्करण)*. जयपुर : राजस्थान हिन्दी ग्रन्थ अकादमी.

Web Resources:

- Nature of Science- <http://www.project2061.org/tools/sfaaol/chap1.htm>
- Objective and Curriculum- <http://egyankosh.ac.in/bitstream/123456789/6665/1/Unit-1.pdf>
- Blooms Taxonomy of Learning Domain- <https://www.giocities.com/eltsqu/cognitive.htm>
- Correlation with other school subject- https://www.galaxy.org/correlations/gal_scope_seq.html
- <https://www.researchgate.net/publication/266884550> How to write behavioural objectives
- Lecture-method-<http://www.studylecturenotes.com/curriculum-instructions/lecture-method-of-teaching-focus-applications-merits-and-demerits>,
- Problem solving method-<https://unacademy.com/lesson/problem-solving-and-project-method/VWEX9NFB>
- Advantages and disadvantages of Problem solving method <https://www.prodigygame.com/blog/advantages-disadvantages-problem-based-learning/>, <https://4h.unl.edu/volun/ahlen/method1.htm>
- Heuristic Method- <http://www.preservearticles.com/201105216966/advantages-and-disadvantages-of-heuristic-method-of-teaching-science.html>

Web Resources:

Jessner U., Cenoz J. (2007) Teaching English as a Third Language, in: Cummins J., Davison C. (eds) *International Handbook of English Language Teaching*. Springer International Handbooks of Education, vol 15. Springer, Boston, retrieved from https://link.springer.com/chapter/10.1007/978-0-387-46301-8_12

Bianca T. M (2008), Learning english as a third language, retrieved from http://repositori.uji.es/xmlui/bitstream/handle/10234/78067/forum_2008_20.pdf?sequence=1

Jessner, U (2006). Linguistic Awareness in Multilinguals: English as a Third Language, *Edinburgh University Press* Pages: 192. <https://www.jstor.org/stable/10.3366/j.ctt1r27nr>

Teaching Speaking Skills retrieved from

thpt-lequydon-danang.edu.vn/upload/soft/teaching%20speaking.doc

- Need of teaching poetry (Aims and method), retrieved from <https://www.teachingonline.net/need-of-teaching-poetry-publishers-aims-and-method/>
- Lewis C.M.,(1979). Method of Teaching English Literature, The School Review
Vol. 11, No. 3 (Mar., 1903), pp. 187-199 (13 pages), jstor
<https://www.jstor.org/stable/1075357>

Reddy, N Y (2013). audio visual aids, retrieved from

krishikosh.egranth.ac.in/bitstream/1/2025225/1/G16702.pdf

A review of an English textbook - Academia Publishing, retrieved from

<https://academiapublishing.org/journals/ajer/pdf/2014/Oct/Sadeghi.pdf>

Pollard, A.(2019). Reflective Teaching in Schools, *Reflective Teaching*, Bloomsbury, UK. retrieved from <https://books.google.co.in/books?isbn=1350032956>

Kaplan, M. “The Teaching Portfolio”, *The Center for Research on Learning and Teaching*, University of Michigan. retrieved from

http://www.crlt.umich.edu/publinks/CRLT_no11.pdf

Pedagogy of General Science-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Students will be able to-

select and use of various methods of teaching general science.

select and use of ISM in teaching general science.

construct improvised apparatus in teaching general science.

explain and organize different strength activities in general science.

analyze related subject content for framing different types of test items.

discuss on different ways of professional development of Science teacher.

Course Outline:

Unit-I: Methods in General Science Teaching (II)

Meaning, Procedure, Advantage and Limitations of following-

- Project
- Seminar,
- Workshop

Activity: Organise a seminar on any Science theme.

Unit-II: Identifying and Developing Instructional Support Material (ISM) for General Science Teaching

- Concept, Classification, Importance of ISM
- Improvised Apparatus – Concept and Advantage
- Selection Criteria of ISM in General Science Teaching

Activity: Preparing one ISM for General Science Teaching.

Unit-III: Strengthening General Science Education

Developing creativity and discovery through

- Science Club
- Science Museum
- Science Fair

Activity: Organize Science Exhibition on the bases of above Activities

Unit-IV: Assessment in General Science

- Types of Assessment in General Science Teaching
 - Oral, Written and Practical
- Test Items for Assessment of learning out-comes
 - Objective Type
 - Short answer Type
 - Essay type

Activity: Framing different types of Test Items.

Unit-V: Professional Development of Science Teacher

- Qualities of an ideal Science Teacher
- Teacher as a Researcher

- Ways of Professional Development

Activity: List out the expected qualities of Science Teacher.

Practicum: Any two of the following:

1. Preparation of one Improvised apparatus.
2. Preparation of Scholastic Test including Different Types of Test Items
3. Term Paper on "Ways of Professional Development of a Teacher".
4. Preparation of Lesson Plan based on any one Method

References:

- Bhandula, N. & Shrama, Sidheswar. (2009). *Teaching of Science*. Ludhiyana :Vijaya Publications.
- Bhatt, Dipti Pinakin. (2011). *Teaching of Science*. New Delhi : A.P.H. Publishing Corporation.
- Mohan, Radha. (2002). *Innovative Science teaching (II edi)*. New Delhi: Prentice Hall of India Pvt. Ltd.
- Nagaraju, M.T.V. (2008). *Handbook for Teaching Physical Sciences (Methods and Techniques)*. New Delhi: Kanishka Publisher's.
- Sen, B.R. (2005). *Teaching Science in Secondary school*. New Delhi : Commonwealth Publisher's.
- Sharma, R.C. (2001). *Modern Science Teaching*. New Delhi : Dhanpat Rai Publishing co. Pvt. Ltd.
- Vaidya, Narendra . (1996). *Science teaching for the 21st century*. New Delhi : Deep and Deep Publications.
- Yadav, M.S. (2007). *Teaching of Science*. New Delhi : Anmol Publications Pvt. Ltd.
- Das, D.N. (2007). *Practice Teaching*. Jaipur : Pointer Publisher.
- Gupta, Nirmala . (1967). *Method of Teaching Science*. Meerut :Rastogi and Company.
- Misra, Karuna Sankar. (2008). *Effective Science Education*. Allahabad : Anubhav Publishing House.
- Prasad, Janardhan.(1999). *Practical Aspects in Teaching of Science*. Delhi : Kanishka Publishers Distributors.
- Rajan, Sonika. (2012). *Methodology of Teaching Science (I ed.)*, Delhi : Pearson Publication.
- Rawat, Hemant, . (2009). *Teaching of Science*. New Delhi : Lakshay Publication.
- Sharma, R.C. (1971). *Teaching of Science*. Delhi : Dhanpat Rai & Sons.
- Sood, J.K. (1989). *New Direction in Science Technology*. Chandigarh : Kohli Publishers.
- कुलश्रेष्ठ, अरुण कुमार एवं कुलश्रेष्ठ, नील कमल. (2013). *विज्ञान शिक्षण*. मेरठ : आर०लाल बुक डिपो.
- भटनागर, ए० बी०. (2014). *विज्ञान शिक्षण*. मेरठ : आर०लाल बुक डिपो.
- रावत, एम० एस०, एवं अग्रवाल, एम० बी० लाल. (2008). *नवीन विज्ञान शिक्षण (बारहवॉ संस्करण)*. आगरा : अग्रवाल पब्लिकेशन्स.
- सूद, जे० के०. (2010). *विज्ञान शिक्षण (पंचम संस्करण)*. आगरा : विनोद पुस्तक मन्दिर.
- श्रीमाली, नन्द किशोर, भूषण आनन्द एवं रिहानी, इन्दु. (2013). *विज्ञान शिक्षण (आठवॉ संस्करण)*. जयपुर : राजस्थान हिन्दी ग्रन्थ अकादमी .

Web Resources:

Project Method - <http://www.studylecturenotes.com/curriculum-instructions/project-method-of-teaching-meaning-advantage-disadvantages> , <https://unacademy.com/lesson/project-method-in-hindi/XQ0C6FFL>, <https://unacademy.com/lesson/project-method-in-hindi/XQ0C6FFL>

Importance of Audio-Visual aids - <http://www.lisbdnet.com/importance-of-audio-visual-aids-in/>

Science club - <http://www.vkmaheshwari.com/WP/?p=2380>

Science Museum - <https://www.fgsi.co.in/blog/best-science-museums/>

Science fair-<https://www.fgsi.co.in/blog/top-science-fairs-in-india/>

Assessment in Science Education -<https://www.nap.edu/read/4962/chapter/7>

Qualities of science teacher - <http://info.marygrove.edu/MATblog/bid/85000/Essential-Qualities-of-a-Highly-Effective-Science-Teacher>

Teacher as a Researcher- <https://www.ericdigests.org/1993/researcher.htm>

Ways of Professional Development- <https://www.teachhub.com/15-professional-development-skills-modern-teachers>

Pedagogy of Mathematics-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to:

apply various methods and techniques of teaching mathematics.

reflect on framing and marking test items of achievement test in mathematics.

demonstrate the models on audio visual aids.

prepare the ICT based materials in teaching mathematics.

'Course Outline:

Unit-I: Methods of Teaching

Concept, Procedure, Advantage and Limitation

- a) Laboratory,
- b) Problem-solving,
- c) Project

Activity- Workshop on Method based planning.

Unit-II: Techniques for meaningful learning

Importance & Implementation of

- a) Oral, written, drill & home-work
- b) Self-study, group study, supervised study
- c) Audio-Visual aids in teaching Mathematics

Activity- Construction of audio-visual aids.

Unit-III: Evaluation in Mathematics:

- a) Construction & Concept of achievement test:
 - Planning (blue print) and Preparation of different types of test items
 - Assessment of different types of items.
- b) Learning difficulty and backwardness in Mathematics:
 - Diagnostic testing
 - Remedial teaching

Activity-Workshop on planning of an Achievement test

Unit-IV: Strengthening Teaching of Mathematics

- a) Arousing and maintaining interest in learning of Mathematics.
- b) Enrichment programmes for gifted learners in Mathematics.
- c) Organising Mathematics club in school.

Activity-Collecting and reporting various ways of developing interest in Mathematics.

Unit-V: Use of ICT for Teaching Mathematics

- a) Scope of ICT in Mathematics teaching
- b) Interactive board for Mathematics teaching.
- c) Softwares - Geogebra, forums & blogs for Mathematics teachers

Activity-Workshop on using Geogebra.

Practicum: (Any two)

1. Planning & construction of a Diagnostic Test for a topic of Secondary Mathematics.
2. Planning, teaching & reporting of Secondary Level class using Geogebra.
3. Prepare a project based on computer assisted teaching and learning in Mathematics.
4. A term paper on softwares / forums / blogs of Mathematics.

Reference:

Butler, H.C. and Wren, F.L.(1965).*The Teaching of Secondary Mathematics*. New York:Mc Graw Hill Book Co.
 Chadha, B.N. (1961). *Teaching of Mathematics*. Delhi : Gurudas Kappor and Sons.
 Cornelius, Michael. (1982).*Teaching mathematics*. London : Croom Helm.
 Jain S.L. (1973). *Ganit Shikshan*. Jaipur: Rajasthan Hindi Granth Academy.
 Johnson, D.A. & Rahtz. R. (1961).*The New Mathematics in Our Schools*. New York:The macmillan Co.
 Maheshwari, Vijayandra Kishore . (1995).*Ganit Shikshan*. Meerut : Lay Book Deptt.
 Mangal, S.K. (1997). *Ganit Shikshan*. New Delhi : Arya Book Depot
 Sidhu, K.S. (1986). *The Teaching of Mathematics*. New Delhi : Sterling Publisher.

Web Resources:

Teaching of Mathematics Course Material Prepared by Bharathidasan University Retrieved From:

<http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20MATHEMATICS.pdf>

Pedagogy of Mathematic Prepared by Course Material s Prepared by Tamilnadu Teachers Education University
 Retrieved From: <http://www.tnteu.in/pdf/3-maths.pdf>

Pedagogy of Mathematics Course Material Prepared by IGNOU Retrieved From: <http://egyankosh.ac.in/bitstream/123456789/46799/1/BES-143B2-E.pdf>

Teaching of Mathematics Course Material Prepared by NCERT Retrieved From:

http://www.ncert.nic.in/departments/nie/dse/activities/advisory_board/PDF/teaching_maths.pdf

<https://webarchive.nationalarchives.gov.uk/20101119135224/http://www.standards.dcsf.gov.uk/ntrp/lib/pdf/wilsonmiller.pdf>

Furner, J.M. & Marinas,C.A., Teaching Math Concepts through Historical locations using Geogebra and Photography
 Retrieved From: <http://archives.math.utk.edu/ICTCM/VOL27/A017/paper.pdf>

Pedagogy of Social Science-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student teacher will be able to:

describe the nature of Social Science as a Subject and as a Discipline.

discuss the relevance of Social Science at School level and daily life.

formulate Instructional Objectives in behavioral terms in social science teaching.

plan their teaching on different methods in Social Science at Secondary Stage.

Course Outline:

Unit-I: Nature of Social Science

- Social Science
 - As a Discipline: Concept and Features
 - As a Subject: Concept and Features
- Relevance of Social Science Subject at School Level.
- Relationship of Social Science with other School Subjects and Daily Life

Activity: Identification of Social Science in Our Daily Life

Unit-II: Aims and Objectives of Social Science Teaching

- Aims of Teaching Social Science
 - at Elementary Level
 - at Secondary Level
- Instructional Objectives and Writing them in Observable Behaviour
- Linkage of IOs with
 - Aims of Social Science
 - Goals of Education
 - National Goals

Activity: Practice of Writing of IOs in Behavioural Term

Unit-III: Curriculum Frame work of Social Science

- NCF-2005 with reference to Social Science Subject
- Principles of Curriculum Construction in Social Science
- Critical Appraisal of existing Social Science Curriculum
- Content Analysis and Evolving Meaningful Messages/Ideas

Activity: Critical Appraisal of Social Science Curriculum of any Class

Unit-IV: Planning in Social Science Teaching

- Need and Relevance of Planning for Social Science Teaching
- Various forms of Plan
 - Unit Plan: Concept and Components

- Lesson Plan: Concept and Components
- Difference between Unit and Lesson Plan

Activity: Practice on Preparing a Lesson/Unit Plan

Unit-V: Methods of Teaching in Social Science

- Need of different methods in teaching Social Science
- Teacher centered method
 - Lecture Method
 - Story Telling
- Learner centered method
 - Supervised Study Method
 - Programmed Instruction Method
- Group centered method
 - Workshop Method
 - Discussion Method
- (Concept, Potentials and Specific Planning of above Methods)

Activity: Practice to Prepare a Lesson Plan based on Method

Practicum: Any two

1. “Social Science: As an area of Knowledge”, Presentation by Chart/Pictures/Poster/Folders.
2. Project Presentation on any them related to Socio-Geo-Eco and Political System: Such as – Metro, Smart City, Mobile Van, Migration, MNC’s, FDI’s, Resource Sharing, Inflation etc
3. Prepare ICT based learning Support Material.
4. A term Paper on course topic.

References:

- Agarwal, J. C. (1989). *Teaching Social Studies*. Delhi: Vikas Publishing House.
- Bining, A. C., & Bining, A. H. (1952). *Teaching the Social Study in Secondary School*. New York: MC- Graw Hill Company.
- Bhattacharya, S., & Darji, D. R. (1966). *Teaching of Social Studies in Indian Schools*. Baroda: Acharya Book Depot.
- Ellis, A. K. (1991). *Teaching and Learning Elementary Social Studies*. Boston: Allyw & Bacon.
- Kaushik, V. K. (1992). *Teaching of Social Studies in Elementary School*. Delhi: Anmol Publication.
- Sharma, B. (1998). *Samajik Adhyayan Shikshan*. Meerut: Surya Publication.
- Wesley, E. B., & Wronski, S. P. (1958). *Teaching Social Studies in High School*. Boston: D. C. Heath and Company.
- Yagnik, K. S. (1966). *Teaching of Social Studies in India*. Bombay: Orient Longmans.

Web Resources:

NCF2005 http://www.ncert.nic.in/rightside/links/pdf/framework/ncf_hindi_2005/ncf2005.pdf

Audio visual aids www.studylecturenotes.com>audio-visual

Use Social Science Resources: <https://study.com/academy/lesson/choosing-social-sciences-teaching-resources.html>

Innovative Teaching Methods of Social Science: <http://www.teachersofindia.org/en/article/innovative-teaching-methods-social-science>

Teaching in Social Studies: https://ssol.tki.org.nz/Social-studies-years-1-10/Teaching-and-learning/effective_teaching_in_social_studies

Evaluation in Teaching Learning Process- <http://www.yourarticlelibrary.com/statistics-2/evaluation-in-teaching-and-learning-process-education/92476>

Teaching and Learning Process in - <http://egyankosh.ac.in/handle/123456789/46729>

Tools of Teaching - <http://egyankosh.ac.in/handle/123456789/46746>

Pedagogy of Social Science-II

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to:

- select and use appropriate resources and media for Social Science Teaching.
- describe various activities for enrichment of Social Science learning.
- appreciate the role of social science teacher as a professional.
- design an effective assessment plan for Social Sciences learning.

Course Outline:

Unit-I: Media and Resources: For Making Learning Interesting

- Significance and use of Audio, Visual and Audio-Visual Media in Social Science teaching
- Use of Social Science Room
- Community Resources as a realistic experience

Activity: Workshop on presentation of Learning Resources for Social Science Teaching.

Unit-II: Enriching Social Science teaching

- Social Science Club
- Social Science Quiz
- Celebration of Important Days/Events
- Exhibition

Activity: Organize a Social Science Exhibition/Social Science Quiz/Celebration of Important Days/Events

Unit-III: Text Book and Related Materials

- Meaning and Features of Social Science Text Book
- Encyclopedia, Atlas
- Current Affairs – Meaning and Importance
– Linkage of Current Affairs to daily teaching.

Activity: Presentation of any Current Affair through Chart on Display Board

Unit-IV: Social Science Teacher: As a professional

- Specific Qualities of Social Science Teacher
- Participation in Different Professional Development Programme- (Seminar/ Conference/Workshop/Training)
- Identification of Student's problem related to content learning
- Identifying ways to develop Appropriate Attitude and Interest among Social Science Students

Activity: Preparation and Administration of a Questionnaire related to Students Interest/Problem in Social Science

Unit-V: Assessing Learning in Social Science

- Continuous and Comprehensive Assessment (CCE): As a Feedback and Acceleration of learning
- Designing of Test Paper and Blue Print
- Construction of different types of Test Items.

Activity: Practice of Construction Blue Print/Test Item

Practicum: Any Two

1. Prepare a Scrapbook/Folder/Model/Film to School Students on any Social Science Topic.

2. Organize Social Science Quiz/Posters/Slogans/Picture Competition/ Day Celebration in School during Internship.
3. Collection of Cartoons/ Poems related to any Social Science Theme.
4. A term paper on course topic.

Pedagogy of Biology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Students will be able to:

- explain the rationale of study of Biology.
- develop skill in framing instructional objective in behavioral terms.
- discuss the major principles of curriculum construction.
- identify and use various method of teaching Biology.
- develop skill in preparing unit and lesson plan.
- selection and use of ISM and related science activities.
- construct various test items for making question paper.

Course Outline:

Unit-I: Instructional Objectives of Teaching Biology

- Rationale behind the study of Biology.
- Objectives of Teaching Biology with special reference to Blooms Taxonomy.
- Writing Instructional Objectives in behavioural terms.

Activity: Group Discussion and Submission of Report on Correlation of Biology with other School Subjects.

Unit-II: Curriculum in Biology teaching

- Difference between the terms Syllabus and Curriculum.
- Major principles of curriculum construction

Activity: Group Discussion on Major Criteria of Curriculum Construction

Unit-III: Instructional Design and Planning in Biology teaching.

- Meaning, Steps, Merits and Demerits – Lecture Method, Problem solving method, Project Method.
- Unit and Lesson Planning in Biology Teaching.
- Difference between Unit and Lesson Plan .

Activity: Workshop on Preparation of a lesson plan using specific instructional method to teach Biology.

Unit-IV: Ancillary to Biology teaching

- Science Activity- Need and importance
 - Field trips
 - Science Exhibition
- Instructional Support Material- Model, Charts, Herbarium, Aquarium for teaching Biology.
- Importance of Biology Laboratory.

Activity: Prepare one Instructional Support Material to teach Biology in classroom

Unit-V: Assessment in Biology Teaching

- Preparation of a Question paper.
- Framing test item to assess various objectives in teaching Biology
- Prepare a Blue Print.

Activity: Workshop on Quality of good Question Paper in Biology Teaching.

Practicum: Any two

- 1 Prepare ten instructional objectives in behavioural terms from Cognitive, Affective and Psychomotor domain.
- 2 A critical appraisal of Biology curriculum at Senior Secondary level.
- 3 Prepare two computer based lesson plan on any topic from Biology.
- 4 Prepare One Power Point Presentation by using e-resources in teaching of Biology.
- 5 Prepare a Blue Print on any topic of Biology from class XII for 50 marks to assess Instructional Objectives from Cognitive, Affective and Psychomotor domain.

Reference:

- Arthur, Carwin., & Robers, B.(1970). *Teaching Modern Science*. U.S.A.: Charles E, Merrill Publishing Company.
- Das, R.C. (1985). *Science Teaching in schools*. New Delhi : Sterling Publishers Pvt. Ltd.
- Dave, R.M. (1969). *Taxonomy of Educational objectives and Achievement Teaching*. London: London University Press.
- Gupta, S.K. (1983). *Technology of Science Education*. New Delhi : Vikas publishing House Pvt. Ltd.
- Heiss, Obourm., & S. Hoffman W.(Ed). (1961). *Modern Science Teaching*. New York : The Macmillian company.
- Kohli, V.K. (1969). *Teaching of Science*. Jullundur : Krishna Brothers Chowk Adda Tanda.
- Mangal, S.K., . (1996). *Science teaching*. New Delhi : Arya Book Depot.
- Nathan, S. (1967). *Teaching Science Creatively in the Secondary School*, New Delhi : W.B. Saunders Company.
- Paul, B. Weize .(1969). *Elements of Biology (3ed.)*. NewYork : Mc Graw Hill Co.
- Pual, B. Weise., & Fuller Melvin S.(1962). *Science of Botany*. New York : Mc Grew hills Book Co.
- Ratho, T.N., & Prakash, Ravi .(1996). *Emerging trends in teaching of Botany*. New Delhi : Kanishka Publishers, Distributors.
- Ratho, T.N., & Prakash, Ravi .(1996). *Emerging trends in teaching of Zoology*. New Delhi : Kanishka Publishers, Distributors.
- Richardson, J.S. (1957). *Science Teaching in secondary schools*. Prentice Hall Inc. Englewood Cliff, New Jersey.
- Sharma, R.C. (1971). *Teaching of Science*, Jullundhur : Dhanpat Rai and Sons.
- Sood, J.K. (1980). *New Direction in Science Teaching*. Chandigarh : Kohli Publications.
- Sood, J.K., . (1987). *Teaching life Science*. Chandigarh : Kohli publishers.
- Sood, J.K., . (1989). *New Direction in Science teaching*. Kohli publishers, Chandigarh, 1989.
- Thurbur, W. and A Collette. (1959). *Teaching Science today's secondary schools*, New York: Boston Allyn and Bacon Inc.
- Vaidya, N. (1996). *Science teaching for the 21st century*. New Delhi : Deep and Deep publication.

Web Resource:

- Importance of the study of Biology - <https://www.quora.com/Why-is-biology-important-to-study>
- Inter relationship of biology with other school subjects-[https://www.galaxy.org/correlations/gal_scope seq.html](https://www.galaxy.org/correlations/gal_scope_seq.html)
- Objectives of teaching biology with special reference to Bloom's Taxonomy-
<https://www.giocities.com/eltsqu/cognitive.htm>
- Major principles of curriculum construction-<http://www.preservearticles.com/2012010920286/the-main-principles-of-curriculum-construction-may-be-mentioned-as-under.html>
- Developmental History of Science Curriculum- <http://www.ignouhelp.in/ignou-bes-141-study-material/>
- Lecture method-Merit and Demerit-<http://www.studylecturenotes.com/curriculum-instructions/lecture-method-of-teaching-focus-applications-merits-and-demerits>

Problem solving method-Merit and Demerit-[https:// unacademy.com/ lesson/problem-solving-and-project-method/VWEX9NFB](https://unacademy.com/lesson/problem-solving-and-project-method/VWEX9NFB)

Demerits of Problem solving method-[https://www. prodigygame.com/ blog/advantages-disadvantages-problem-based-learning/](https://www.prodigygame.com/blog/advantages-disadvantages-problem-based-learning/)

Community Resources-[http://www.sedl.org/scimath/ compass/v03n01/ usingcom.html](http://www.sedl.org/scimath/compass/v03n01/usingcom.html)

Use of audio visual aids-[https://www.elixirpublishers.com/ articles/1351336051 50%20\(2012\)%2010597-10605.pdf](https://www.elixirpublishers.com/articles/135133605150%20(2012)%2010597-10605.pdf)

Science club- <http://vigyanprasar.gov.in/science-communication-programs/vipnet/>

Pedagogy of Chemistry

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to:

analyze concepts and generalization used in framing chemistry curriculum.

analyze nature of chemistry and the relationship between nature of chemistry and objectives of teaching chemistry.

discuss role of laboratory, text book and other resources in teaching of chemistry formulate IOs for cognitive, affective & psychomotor domain.

frame test items for different types of test.

reflect on different teaching methods used in Chemistry.

Course Outline:

Unit I: Nature of Chemistry and Objectives of Teaching Chemistry

- Chemistry as a Specific Branch of Science
- Nature of Content in Chemistry
- Instructional Objectives in Chemistry teaching for Cognitive, Affective and Psychomotor Domain.

Activity: Practice on Writing the Instructional Objectives in Behavioural Terms.

Unit II: Curriculum and Planning in Chemistry Teaching

- Curriculum and Syllabus: Concept
- Consideration Points in Developing Learner Centered Curriculum in Chemistry
- Concept and Components of Unit Plan and Lesson Plan

Activity: Practice for Preparing of Unit Plan and Lesson Plan

Unit III: Teaching Methods in Chemistry

(Concept, Procedure, Advantage and Limitation)

- Lecture Cum Demonstration Method
- Problem Solving Method
- Laboratory Method

Activity: Preparation of Lesson Plan based on above method

Unit IV: Instructional Support Material in Chemistry Teaching

- Laboratory- Organization, maintenance and Importance in Chemistry Teaching
- Role of Chart, Model, Text Book and Internet in Chemistry Teaching

Activity: Designing a Layout for Chemistry Lab

Unit V: Assessment in Chemistry Teaching

- Types of Assessment in Chemistry
- Evaluation of Learning Outcomes in Chemistry Teaching by
 - o Preparing a Blue Print and Test Items
 - o Framing Test Items for Practical Examination

Activity: Practice on Preparation of Different Type of Test Items

Practicum: Any two of the following.

1. Term Paper on "Importance of Chemistry in Our Daily Life"
2. Critical Appraisal of Present Chemistry Curriculum at Senior Secondary Level
3. Lesson Plan Based on any One Method

4. Submission One ISM for Teaching Chemistry Content
5. Preparation One Scholastics Test Including Different Test Items

References:

- Bhandula, N. and Shrama Sidheswar. (2009). *Teaching of Science*. Ludhiyana: Vijaya Publications.
- Das, D.N. (2007). *Practice Teaching*. Jaipur: Pointer Publisher.
- Gupta, Nirmala. (1967). *Method of Teaching Science*. Meerut: Rastogi and Company.
- Prasad, Janardhan. (1999). *Practical Aspects in Teaching of Science*. Kanishka Publishers Distributors.
- Rajan, Sonika. (2012). *Methodology of Teaching Science*. Delhi: Pearson.
- Rawat, Hemant. (2011). *Teaching of Science*. New Delhi: Lakshay Publication.
- Sharma, R.C. (1971). *Teaching of Science*. Delhi: Dhanpat Rai & Sons.
- Sood, J.K. (1989). *New Direction in Science Technology*. Chandigarh: Kohli Publishers.
- Bhatt, Dipti. (2011). *Teaching of Science*. New Delhi: A.P.H. Publishing Corporation.
- Mohan, Radha. (2002). *Innovative Science teaching*. New Delhi: Prentice Hall of India Pvt. Ltd.
- Mishra, K. S. (2008). *Effective Science Teaching*. Allahabad: Anubhav publishing House.
- Nagaraju, M.T.V. (2008). *Handbook for Teaching Physical Sciences (Methods and Techniques)*. New Delhi: Kanishka Publishers.
- Sen, B.R. (2005). *Teaching Science in Secondary school*. New Delhi: commonwealth publishers.
- Sharma, R.C. (2001). *Modern Science Teaching*. New Delhi: Dhanpat Rai Publishing co., Pvt., Ltd.
- Vaidya, Narendra. (1996). *Science teaching for the 21st century*. New Delhi: Deep and Deep Publications.
- Yadav, M.S. (2007). *Teaching of Science*. New Delhi: Anmol Publications Pvt. Ltd.
- कुलश्रेष्ठ, अरुण, कुमार और कुलश्रेष्ठ, नीर, कमल. (2013). *विज्ञान शिक्षण*. मेरठ: आर० लाल बुक डिपो.
- भटनागर, ए०, बी०. (2014). *विज्ञान शिक्षण*. मेरठ: आर० लाल डिपो.
- रावत, एम० एस०, और अग्रवाल, एम० बी० लाल. (2007 / 2008). *नवीन विज्ञान शिक्षण (बारहवॉ संस्करण)*. आगरा: अग्रवाल पब्लिकेशन्स.
- सूद, जे० के. (2010). *विज्ञान शिक्षण (पंचम संस्करण)*. आगरा: श्री विनोद पुस्तक मन्दिर.
- श्रीमाली, नन्द किशोर., भूषण आनन्द., और रिहानी, इन्दु. (2013). *विज्ञान शिक्षण (आठवॉ संस्करण)*. जयपुर: राजस्थान हिन्दी ग्रन्थ अकादमी.
- Sunder, Prem. (2010). *Teaching of Chemistry*. New Delhi: KSK Publishers and Distributirs.
- Aggarwal, D. D. (2001). *Modern Methods of Teaching Chemistry*. New Delhi: Sarup and Sons Publishers.
- Singh, P. P. and Kalia, V. D. (2004). *Teaching of Chemistry: New Trends and Innovations*. New Delhi: Deep and Deep Publications Pvt. Ltd.
- Rathor, T. N. and Ravi Prakash. (2007). *Emerging Trends in Teaching of Chemistry*. New Delhi: Kanishka Publishers and Distributors.

Web Resources:

- Nature of Science- <http://www.project2061.org/tools/sfaaol/chap1.htm>
- Objective and Curriculum- <http://egyankosh.ac.in/bitstr eam/123456789/6665/1/Unit-1.pdf>
- Blooms Taxonomy of Learning Domain- <https://www.giocities.com/eltsqu/cognitive.htm>
- Correlation with other school subject- <https://www.galaxy.org/correlations/gal scope seq.html>
- https://www.researchgate.net/publication/266884550_How_to_write_behavioural_objectives

Lecture-method-<http://www.studylecturenotes.com/curriculum-instructions/lecture-method-of-teaching-focus-applications-merits-and-demerits>,

Problem solving method-<https://unacademy.com/lesson/problem-solving-and-project-method/VWEX9NFB>

Advantages and disadvantages of Problem solving method

<https://www.prodigygame.com/blog/advantages-disadvantages-problem-based-learning/>,
<https://4h.unl.edu.volun/ahlen/method1.htm>

Heuristic Method- <http://www.preservearticles.com/201105216966/advantages-and-disadvantages-of-heuristic-method-of-teaching-science.html>

References:

Pathak, R. P. (2012). *Teaching of Social Studies*. New Delhi: Pearson publication.

Jha, A. S. (2001). *Teaching of Social Studies*. New Delhi: A. P. H. Publishing Corporation.

Mangal, S. K., & Mangal, U. (2008). *Teaching of Social Studies*. New Delhi: PHI Learning Pvt. Ltd.

Singh, Y. K. (2004). *Teaching of Social Studies*. New Delhi : APH Publishers.

प्रसाद, बी. (1969). *भारतीय स्कूलों में समाज अध्ययन का शिक्षण*. पटना: ज्ञानपीठ प्राइवेट लिमिटेड.

सिंह, आर. (1977). *समाजिक अध्ययन का शिक्षण*. आगरा: लक्ष्मीनारायण अग्रवाल.

रखेजा, यू. (2013). *समाजिक अध्ययन शिक्षण*. नई दिल्ली: पीयरसन.

बक्शी, एन. एस. (2014). *समाजिक अध्ययन शिक्षण*. नई दिल्ली: प्रेरणा प्रकाशन.

Web Resources:

Use Social Science Resources: <https://study.com/academy/lesson/choosing-social-sciences-teaching-resources.html>

Innovative Teaching Methods of Social Science: <http://www.teachersofindia.org/en/article/innovative-teaching-methods-social-science>

Professional Development: <https://classroom-aid.com/educational-resources/social-study/>

Teaching in Social Studies: <https://ssol.tki.org.nz/Social-studies-years-1-10/Teaching-and-learning/effective-teaching-in-social-studies>

Strategies for Teaching in Social Studies:

https://www.socialstudies.org/publications/socialeducation/january-february2011/effective_strategies_for_teaching_social_studies

Padagogy of Home Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to:

explain the Nature and Relevance of Home Science.

formulate IOs in Behavioural Terms.

design appropriate Instructional Process.

discuss various Teaching Methods and activities.

prepare plans based on different Teaching Methods.

describe the Importance and Role of Lab and Other (Aids) ISM in Home Science Teaching.

preparation of Blue Print and Question Paper.

Course Outline:

Unit-I: Nature and Relevance of content in Home Science

Nature of Content in Home Science.

Relevance of Home Science subject at Senior Secondary Level.

Correlation of Home Science with other school subjects.

Content Analysis – Concept, Steps and Importance.

Activity: Analysis of content in Home Science at Senior Secondary Level.

Unit-II: Instructional Design in Home Science

Subject objectives of Home Science

Instructional Objectives in Cognitive, Affective and Psychomotor Domain.

Annual, Unit and Lesson designing in Home Science Teaching

Difference between unit and lesson designing.

Basic considerations of designing in Home Science.

Activity: Framing IO's in behavioral terms in workshop.

Unit-III: Learning Experiences in Home Science Teaching

Learning experience as Method-Lecture, Demonstration, Discussion, Workshop, Practical, Project (Concept, Steps, Potential and limitations of above methods).

Learning experience as an activity- Home Science club, field trip (Importance and Limitations).

Activity: Prepare Lesson Plans based on different Teaching Methods in small groups.

Unit- IV: Enhancing Home Science Teaching

Home Science Laboratory:

(i) Importance of lab in Home Science Teaching.

(ii) Basic considerations in planning Home Science Lab

(iii) Instructions for working in Home Science Lab.

Role of Chart, Flashcards, Models, Puppets, Computer in Home Science Teaching

Activity: Discussion on consideration, while selection/preparation of ISM.

Unit- V: Assessment in Home Science Teaching

Different Test Items

Preparation of question paper with blue print.

Critical Apraisal of present Evaluation system in Home Science at Senior Secondary Level.

Activity: Practice of Blue print and Test items preparation in small group.

Practicum: Any two of the following-

1. Analysis of Home Science content from Home Science text books (minimum five chapters of any text book).
2. Prepare a unit plans above content analysis.
3. Prepare a lesson plans based on different teaching methods.
4. Prepare computer based self learning material for Home Science.
5. Develop a plan for Home Science Laboratory at Sr. Secondary Level.
6. Preparation of one improvised material for Home Science teaching.

References:

- Chandra, A. et al. (1989). *Fundamentals of Home Science*. New Delhi : Sterling Publishers.
- Chandra A. et al. (1989). *Introduction to Home Science*. New Delhi: Metropolitan Book.
- Das, R. and Ray B. (1983). *Teaching of Home Science*. New Delhi: Sterling Publishers.
- Devdas, R. (1978). *Methods of Teaching Home Science*. New Delhi: NCERT.
- Malik, P. (1984). *Elements of Home Science*. New Delhi: Kalyani.
- Siddiqui, M. H. (2014). *Teaching of Home Science*. New Delhi: APH.
- Sharma, S. (2006). *Grih Vigyan Shikshan*. New Delhi: Kavita Publishing House.
- Sharna, N. K. (2014). *Teaching of Home Science*. New Delhi: K.S.K. Publishers.
- Shery, S. P. (1976). *Grih Vigyan Shikshan*. Agra: Vinod Pustak Mandir.
- Varna, A. (2007). *Grih Vigyan Shikshan*. New Delhi: Vandana Publishing House.

Web Resources:

Meaning and Importance of Home Science:

[http://cms.gcg11.ac.in/attachments/article/86/Meaning%20and%20importance%20of%20Home%20Science%20\(1\).pdf](http://cms.gcg11.ac.in/attachments/article/86/Meaning%20and%20importance%20of%20Home%20Science%20(1).pdf)

Methods of Teaching Home Science:

https://books.google.co.in/books/about/Methods_Of_Teaching_Home_Science.html?id=gspWblElFiUC&redir_esc=y

<https://delhi.gov.in/wps/wcm/connect/a04f310048bf0dbeb053f1c48a411e20/4-Home-Science-2011.pdf?MOD=AJPERES>

Home Science Lab Equipments:

http://www.cismmv.in/images/Affidavit_Disclosures_ListOfAllEquipments.pdf

Pedagogy of Political Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student teacher will be able to:

analyse the importance of teaching Political Science at Higher Secondary level.

apply the basic concepts of teaching in the subject.

develop instructional objectives and plan for teaching accordingly.

apply appropriate methods in teaching the subject.

select and use relevant teaching aids to make learning meaningful.

develop competency in organising effective evaluation programme in the subject.

Course Outline:

Unit- I: Relevance of Teaching Political Science in School

- (i) Meaning and Nature of Political Science
- (ii) Relevance of teaching Political Science at Senior Secondary level.
- (iii) Objectives of Political Science teaching.

Activity: Writing of Instructional Objectives in behavioral terms.

Unit-II: Curriculum and Designing Instruction

- (i) Curriculum of Political Science in reference to NCF-2005
- (ii) Analysis of Political Science curriculum
- (iii) Unit Plan
- (iv) Lesson Plan

Activity: Preparing a Unit Plan.

Unit-III: Methods of Teaching in Political Science

(Potential, Planning and Limitations)

- (i) Lecture cum discussion
- (ii) Problem Solving
- (iii) Supervised Study
- (iv) Project

Activity: Preparing a Lesson Plan based on any one of the method.

Unit-IV: Role of Instructional Support Method for Political Science teaching

(Significance, Application and Limitations)

- (i) Audio Aids
- (ii) Visual Aids
- (iii) Audio Visual Aids
- (iv) Role of Newspaper, Magazine, Internet and Television in reference to political awareness.

Activity: Developing an Instructional Support Materials for a Topic

Unit-V: Assessing Pupil Learning in Political Science

- (i) Framing test Items for evaluation in Political Science
- (ii) Blue Print.
- (iii) Issues related to assessment in Political Science

Activity: Preparing a Blue Print

Practicum:

Any one of the Following –

- (i) A term paper on any one Current Political Issue
- (ii) A file on use of Current Political events in Political Science Teaching

References:

Aggrawal, J.C. (1983). *Teaching of Political Science and Civics*. New Delhi: Vikas Publishing House Ltd.
Sharma, P.L. (2002). *Modern Methods of Teaching Political Science*. New Delhi: Sarup & Sons.
Chopra, J.K. (2004). *Teaching of Political Science*. New Delhi: Commonwealth Publishers.
Sharma, R.N. (2005). *New Methods of Teaching Political Science*. Jaipur: ABD Publishers.

Web Resources:

Meaning and nature of political science <https://www.enotes.com/homework-help>

NCF2005 http://www.ncert.nic.in/rightside/links/pdf/framework/ncf_hindi_2005/ncf2005.pdf

Audio visual aids [www.studylecturenotes.com>audio-visual](http://www.studylecturenotes.com/audio-visual)

Evaluation in Teaching Learning Process- <http://www.yourarticlelibrary.com/statistics-2/evaluation-in-teaching-and-learning-process-education/92476>

Teaching and Learning Process - <http://egyankosh.ac.in/handle/123456789/46729>

Tools of Teaching - <http://egyankosh.ac.in/handle/123456789/46746>

Introduction of Curriculum Construction- <http://egyankosh.ac.in/bitstream/123456789/31625/1/Unit-1.pdf>

Pedagogy of History

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student teacher will be able to:

discuss the nature of History.

construct different lesson planning in History teaching.

apply different methods for teaching History.

state various appropriate innovative learning resources for teaching History.

apply alternative assessment tools for teaching learning evaluation in History.

Course Outline:

Unit –I : Understanding History

- Concept, Nature and Scope of History.
- Aims and Objective of History teaching at Senior Secondary Level, Writing Objectives in behavioural terms.
- Correlation of History with other school subjects.

Activity: Writing of Instructional Objectives in behavioural terms.

Unit –II: Curriculum and Designing Instruction

- Curriculum of History in reference to NCF-2005.
- Analysis of History Curriculum
- Lesson Plan, Unit Plan, Annual Plan

Activity: Prepare a unit plan.

Unit –III: Instructional Methods

- Concept, Steps, advantages and limitations
 - o Lecture cum Discussion Method
 - o Story telling Method
 - o Role-play Method
 - o Supervised study Method
 - o Source Method

Activity: Prepare a Lesson Plan based on any one of the method.

Unit –IV: Learning Resources in History Teaching

- Concept and use of learning resources
- Audio aids
- Visual aids.
- Audio-Visual aids
- Monuments, historical maps, text books in reference to relevance as a learning resource
- History room: lay out and functions
- Essential qualities of an Ideal History Teacher

Activity: Developing an instructional support material for a topic.

Unit –V: Evaluation in History Teaching

- Need of evaluation in History
- Types of evaluation-
 - o Formative evaluation
 - o Summative evaluation
- Construction of test paper (Blue Print)
- Construction of different test items.

Activity: Plan and Prepare a test paper of History.

Practicum (Any two)

1. Preparation of historical theme based album, model or PPT as learning resources.
2. Preparation of one lesson plan on any topic of History using ICT.
3. Preparation of Scrapbook on any History topic.
4. Write down your experiences after visiting historical places and submit report.
5. Exhibition of different ancient culture, civilization, weapons, etc.

References:

- Aggarwal, J.C. (1983). *Teaching of History*. New Delhi: Vikas Publishing House.
- Dash, B.N.(2006). *Teaching of History*. Hyderabad: Neelkamal Publication.
- Gbate, V.D.(1964). *The Teaching of History*,. London: Oxford University Pres.
- IGNOU (2000). *Pedagogy of Teaching Social Studies*. New Delhi: School of Education, ES-343-1.
- IGNOU (2000). *Teaching of History*. New Delhi: School of Education, ES-343-2.
- IGNOU (2000). *Educational Technology: State of the Art*. New Delhi: School of Education, ES-361- 2.
- IGNOU (2000). *Curriculum and Instruction: Curriculum Planning*. New Delhi: School of Education, ES-331- 1.
- IGNOU (2000). *Planning and Management of Instruction*. New Delhi: School of Education, ES-331- 3.
- IGNOU (2000). *Teaching Skills*. New Delhi: School of Education, ES-331- 4.
- Johnson, A. (1963). *The Teaching of History in Elementary and Secondary School*. New York : Mc Millan.
- Kochar, S.K. (1979). *Teaching of History*. New Delhi: Sterling.
- NCERT (1970). *Teaching History in Secondary School : A Handbook of History Teacher*. New Delhi: NCERT.
- Raina, V.K. (1992). *The Realities of Teaching History*. New Delhi: NCERT.
- Sahoo, P.K., Yadav, D. and Das, B.C. (2009). *Professionalism in Teacher Education*. New Delhi: Concept.
- Sharma, Sita Ram (2003). *Effective Methods of Teaching History*. New Delhi: Shri Sai Printography.
- Tripathy, Bhushan H. (2013). *Effective Teaching: A Workshop Based on IUCEE Effective Teaching Workshop by Drs. Richard Felder and Rebecca Brent, 2008, Mysore- A Workshop Module*. Ahemdabad: GLS Institute of Computer Technology.
- Vajreswari, R. (1966). *A Handbook for History Teachers*. Calcutta: Allied Publishers.
- Yadav, M.S. and Lakshmi, T.K.S. (2003) *Conceptual Inputs for Secondary Teacher Education: The Instructional Role*. New Delhi: NCTE.
- दीक्षित उपेन्द्रनाथ एवं बघेला हेत सिंह. (1972). *इतिहास शिक्षण* . जयपुर: राजस्थान हिन्दी ग्रंथ अकादमी.
- घाटे, बी. डी. (1971). *इतिहास शिक्षण*. चंडीगढ़: हरियाणा हिन्दी ग्रन्थ अकादमी.

- सिंह, रामपाल. (1994). *इतिहास शिक्षण*. मेरठ: आर. लाल बुक डिपो.
- शर्मा, आर. ए. (1994). *इतिहास शिक्षण*. मेरठ: लायल बुक डिपो.
- त्यागी, गुरसरन दास. (2001). *इतिहास शिक्षण*. आगरा: विनोद पुस्तक मंदिर.

Web Resources:

Understanding History:

<http://kasturicollege.org/downloads/History.pdf>

Curriculum and Designing Instruction :

<http://assets.vmu.ac.in/BED127.pdf>

Instructional Methods:

<http://mooc.nios.ac.in/mooc/pluginfile.php?file=/11673/course/summary/UNIT%20%20TEACHING%20LEARNING%20STRATEGIES.pdf> ,

Learning Resources in History Teaching:

<http://assets.vmu.ac.in/BED127.pdf>,

<http://mooc.nios.ac.in/mooc/pluginfile.php?file=/11673/course/summary/UNIT%20%20TEACHING%20LEARNING%20STRATEGIES.pdf>

Evaluation in History Teaching:

<http://assets.vmu.ac.in/BED127.pdf>

Pedagogy of Economics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to
interpret concept of Economics.

correlate Economics with other subjects.

frame instructional objectives for economics teaching at Senior Secondary Level.

develop the curriculum of Economics at Senior Secondary Level.

plan the lesson for teaching Economics using different methods and media.

construct an achievement test for Senior Secondary Learners.

Course Outline:

Unit –I: Nature and Relevance of Economics as a Subject

- Meaning, Nature and Scope of Economics
- Relevance of Economics as a Subject at Senior Secondary level
- Correlation of Economics with other subjects.

Activity: Paper/ Poster/ P.Pt presentation based on practical application of Economics in daily life.

Unit –II : Curriculum of Economics

- Aims and Instructional Objectives of teaching Economics at Senior Secondary level.
- Principles of curriculum development
- Critical analysis of Economics Curriculum at Senior Secondary Stage (CBSE)

Activity: Formulation of Instructional objectives with behavioral terms in Economics Teaching.

Unit –III: Planning in Economics Teaching

- Need and relevance of planning for Economics Teaching
- Planning for teaching- (Concept and Components)
 - o Unit Plan
 - o Lesson Plan
 - o Annual Plan

Activity: Preparing a Unit Plan.

Unit–IV: Useful Methods and ISM in Teaching of Economics

- Preparation of different plans based on various Teaching Methods-Lecture, Project, Discussion, Analytic-Synthetic
- Relevance and uses of Audio, Visual, Audio-Visual aids.
- Activities in teaching of Economics: Field Trip, Exhibition, Quiz, Economics Club

Activity: Organizing an Exhibition on current Economical issues.

Unit –V : Assessing pupil's learning in Economics

- Need of Evaluation in teaching of Economics.
- Different types of Items (Objective, Short and Essay)
- Planning for achievement test and construction of test paper.

Activity: Construction of an achievement test.

Practicum: Any Two.

1. Prepare a lesson plan based on any one teaching method.
2. Develop an Instructional Support Material to teach a lesson.
3. Critical appraisal of an economics textbook at senior secondary level.
4. Plan a group activity to teach an economical issue.

References:

- Aggarwal, J.C. (2014). *Teaching of Economics: A Practical Approach*. Agra: Vinod Pustak Mandir.
- Knoph J.H. (1965). *The Teaching of Elementary Economics*. New York: Holt Rinehart & Winston.
- Mustafa, M. (2005). *Teaching of Economics New Trends and Challenges*. New Delhi: Deep and Deep Publication Pvt. Ltd.
- Oliver, J.M. (1975). *The Principles of Teaching Economics*. New Delhi: Heinmann Educational Books Ltd.
- Rai, B.C. (1986). *Methods of Teaching Economics*. Lucknow: Publication Centre.
- Siddiqui, M.H. (1993). *Teaching of Economics*. New Delhi: Ashish Publishing House
- Yadav. (1993). *Teaching of Economics*. New Delhi; Anmol Publications Pvt. Ltd.
- National Curriculum Framework 2005. NCERT. New Delhi.
- कुमार, आर. (2002). *अर्थशास्त्र शिक्षण*. आगरा: साहित्य प्रकाशन
- त्यागी, जी. (1968). *अर्थशास्त्र शिक्षण*. आगरा: पुस्तक मंदिर
- नागर, डी. (1999). *अर्थशास्त्र शिक्षण*. जयपुर: राजस्थान प्रकाशन
- सक्सेना एन. (1991). *अर्थशास्त्र शिक्षण*. जयपुर: राजस्थान हिन्दी ग्रन्थ अकादमी

Web Resources:

- Unit plan and Lesson Plan [https://drive.google.com/uc? export=download&id=1wQkwLKqTat7_u0JjX-luY_tS-ioin3Xz](https://drive.google.com/uc?export=download&id=1wQkwLKqTat7_u0JjX-luY_tS-ioin3Xz)
- Unit plan and Lesson Plan <https://www.ncertbooks.guru/ncert-economics-books/>
- Methods of Teaching <http://collections.infocollections.org/ukedu/en/d/Jgtz017e/6.9.1.html>
- Quiz <http://edufive.com/quiz/quiz-rules-regulations.html>
- Quiz https://www.educationworld.com/a_curr/profdev/profdev188.shtml
- Exhibition <http://tquest.org.uk/significance-conducting-exhibitions-schools/>

Pedagogy of Commerce

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to

clarify Commerce as a subject.

frame instructional objectives for Commerce Teaching at Senior Secondary Level.

plan for teaching Commerce at Senior Secondary Level.

apply different methods and media for teaching Commerce.

construct an achievement test for Senior Secondary Learners

Course Outline:

Unit-I: Concept and Scope of Commerce Subject

- Meaning, Nature, Scope and Relevance of Commerce as a subject.
- Correlation of Commerce with other subject.
- Aims and Objectives of teaching Commerce at Senior Secondary Level.
- Instructional Objectives of teaching commerce at Senior Secondary Level.

Activity: Frame Instructional Objective in behavioural term.

Unit-II: Planning for Commerce Teaching

- Contents analysis for Commerce Teaching
- Principles and Maxims of Teaching Commerce
- Daily Lesson Plan and Unit Plan- (meaning, need and format).

Activity: Content Analysis of any unit of commerce at school level.

Unit-III: Method of Teaching Commerce

Meaning, Steps, Merit and Limitation-

- Lecture cum Demonstration
- Group Discussion
- Problem Solving
- Project
- Workshop
- Team Teaching

Activity: Lesson Plan based on any method

Unit-IV: Instructional material and curriculum for commerce

- Critical Analysis of text books in Commerce at Senior Secondary Level.
- ISM used in Commerce Teaching (Need, Types, Selection)
- Co-curricular activities.
- Commerce teachers-qualities and professional growth

Activity- Development of ISM for commerce teaching.

Unit-V: Evaluation in Teaching of Commerce

- Meaning and importance of Evaluation.
- Forms of Evaluation –Formative

- Summative

c. Achievement Test- Meaning, use and Process of Development.

Activity: Development of an achievement test based on blue print.

Practicum (any two):

- a. Study and compare the Commerce syllabus at Senior secondary level of any two different boards.
- b. Collection of e-learning resources in Commerce .
- c. ICT based presentation for commerce teaching.

References:

- Singh, Y.K. (2009). *Teaching of Commerce*. New Delhi:APH Publishing Corporation.
- Rao, S. (2000). *Teaching of Commerce*. New Delhi: Anmol Publication Pvt. Ltd.
- Aggrawal, J.C. (2008). *Teaching of Commerce-A practical Approach*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Singh, R.P. (2004). *Teaching of Commerce*. Meerut: R. Lall Book Depot.
- Brintha, S. (2015). *Teaching of Commerce*. New Delhi: APH Publishing Corporation,.
- Bhanot, S. (2013). *Commerce Education and Teaching*. New Delhi: Kanishka Publishers.
- Lulla, B.P. (1960). *Teaching of Commerce in Secondary Schools*. Baroda: University Publication sales unit,
- Monga, V. (2009). *Teaching of Commerce*. Patiala: Twenty First Century Publications.

Web Resources:

Planning for commerce Teaching <https://drive.google.com/file/d/1JHpjUhQsIRYr4yARXQHy>

ZMugmszJvMz/view

Planning for commerce Teaching https://drive.google.com/file/d/12m6tO_vpSsx7CBzAW

wcnVLACZ4FI5ATI/view

Planning for commerce Teaching <https://drive.google.com/file/d/1JKn8cH1CRbTAMH75re>

t4fbUnapKc6ZGr/view

Planning for commerce Teaching <https://drive.google.com/file/d/1ZbINr7SJWgEmXQ28N1BN>

wTNq-ASLN5Hd/view

Method of Teaching <http://collections.infocollections.org/ukedu/en/d/Jgtz017e/6.9.1.html>

Pedagogy of Physics

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student teacher will be able to:

discuss the nature and relevance of Physics as a School Subject.

identify Aim and objectives of teaching Physics.

discuss various methods of Physics teaching.

organize and develop Physics lab.

Unit I: Concept, Nature and Scope of Physics as a School Subject.

- Concept and Nature of Physics
- History of Physics and its branches
- Relevance of Physics in School Curriculum at Secondary and senior secondary level

Activity: Preparation of a chart based on any of above topic

Unit II: Aims, Objectives and Curriculum of Physics

- Aims and Objectives of teaching Physics
- Physics Curriculum at School Level
Nuffield, PSSC (Physical Science Study Committee) and HPP (Harvard Physics Projects)

Activity: Preparation of a chart based on any of above project

Unit III: Methods in Teaching Physics

(Concept, Procedure, Advantage and Limitation)

- Laboratory Method
- Problem Solving Method

Project Method

Demonstration Method

Development of Unit Plan and Lesson Plan

Activity: Prepare a Lesson Plan based on any one method

Unit IV: Resources for Physics Teaching

Role of audio-visual Resources in Physics Teaching

- Preparation and use of Improvised Teaching Aids
- Organization and maintenance of physics laboratory in school

Activity: Preparation of an improvised material.

Unit V: Assessment and Trends in Physics Teaching Development of Achievement Test

Construction of Test items

Assessment of Practical work in Physics

- Use of ICT and Virtual Laboratory for Physics Teaching

Activity: Practice on preparation of different type of test items for Practical Examination

Practicum: Any two of the following.

1. Term Paper on 'Importance of Physics in Our Daily Life'
2. Critical Appraisal of Present Physics Curriculum at School Level
3. Preparation of a Unit Plan.

4. Preparation One Scholastics Test Including Different Test Items

References:

- Bhandula, N. & Shrama, S. (2009). *Teaching of Science*. Ludhiyana :Vijaya Publications.
- Das, D.N. (2007). *Practice Teaching*. Jaipur: Pointer Publisher.
- Gupta, N. (1967). *Method of Teaching Science*. Meerut: Rastogi and Company.
- Mishra, K.S. (2008). *Effective Science Education*. Uttar Pradesh: Anubhav Publishing House.
- Prasad, J. (1999). *Practical Aspects in Teaching of Science*. New Delhi: Kanishka Publishers Distributors.
- Rajan, S. (2012). *Methodology of Teaching Science*. Delhi: Pearson.
- Rawat, H. (2011). *Teaching of Science*. New Delhi : Lakshay Publication.
- Sharma, R.C. (1971). *Teaching of Science*. Delhi : Dhanpat Rai & Sons.
- Sood, J.K. (1989). *New Direction in Science Technology*. Chandigarh : Kohli Publishers.
- Bhatt, D.P. (2011). *Teaching of Science*. New Delhi : A.P.H. Publishing Corporation.
- Mohan, R. (2002). *Innovative Science Teaching*. New Delhi : Prentice Hall of India Pvt. Ltd.
- Nagaraju, M.T.V. (2008). *Handbook for Teaching Physical Sciences (Methods and Techniques)*. New Delhi: Kanishka Publisher's.
- Sen, B.R. (2005). *Teaching Science in Secondary School*. New Delhi: Commonwealth publisher's.
- Sharma, R.C. (2001). *Modern Science Teaching*. New Delhi : Dhanpat Rai Publishing co., Pvt., Ltd.
- Vaidya, N. (1996). *Science Teaching for the 21st century*. New Delhi : Deep and Deep publications.
- Yadav, M.S. (2007). *Teaching of Science*, New Delhi : Anmol Publications Pvt. Ltd.
- Brandwein Paul, F. et. al. (1958). *Teaching High School Science, A Book of Methods*. New York: Harcourt Brace Jovanovich, Columbus, Ohio: Carless E. Merrill Books, Inc.
- Croxtan, W.C. (1937). *Science Teaching in the Elementary School*. New York: Mcgraw Hill.
- Gupta, S.K. (1985). *Teaching Physical Science in Secondary Schools*. New Delhi: Sterling Publishers.
- Gaez, Albert V. (nd). *Innovations in Science Education world wide* paris. UNESCO Press.
- Negi, J.S. (1999). *Bhautiki Shikshan*. Agra: Vinod Pustak Mandir.
- Bhaskara Rao, D. (2016). *Methods of Teaching Physics*. New Delhi: Discovery Publishing House.
- Vanaja, M. & Rao, B.D. (2016). *Methods of Teaching Physics*. New Delhi: Discovery Publishing House.
- कुलश्रेष्ठ, अरुण कुमार और कुलश्रेष्ठ, नील कमल. (2013). *विज्ञान शिक्षण*. मेरठ: आर०लाल बुक डिपो.
- भटनागर, ए. बी. (2014). *विज्ञान शिक्षण*. मेरठ: आर० लाल डिपो.
- रावत, एम० एस०, और अग्रवाल, एम० बी० लाल. (2008). *नवीन विज्ञान शिक्षण*. आगरा: अग्रवाल पब्लिकेशन्स.
- सूद, जे० के०. (2010). *विज्ञान शिक्षण*. आगरा: श्री विनोद पुस्तक मन्दिर.
- श्रीमाली, नन्द किशोर, भूषण आनन्द और रिहानी इन्दु. (2013). *विज्ञान शिक्षण*. जयपुर: राजस्थान हिन्दी ग्रन्थ अकादमी.

Web Resources:

Concept and Nature of Physics:

http://scert.cg.gov.in/pdf/bedmedstudy2015/bed/pedagogyof_science.pdf

<http://assets.vmu.ac.in/BED123.pdf>

http://www.iapweb.org/nature_of_physics.pdf

<https://hemantmore.org/physics-1/p11101001/2760/>

<https://www.univie.ac.at/pluslucis/Archiv/ICPE/B1.html>

History of Physics and its Branches:

http://poincare.matf.bg.ac.rs/~zarkom/Book_Wikipedia_PHYSICS.pdf

Methods in Teaching Physics: http://www.ncert.nic.in/departments/nie/desm/publication/pdf/phy_sci_partI.pdf

<https://www.aapt.org/resources/policy/roleoflabs.cfm>

https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_073330.pdf

<https://www.britishcouncil.org.za/sites/default/files/163275-planning-practical-science-interactive.pdf>

Use of ICT and Virtual Laboratory for Physics Teaching:

<http://www.ipedr.com/vol37/062-ICMEI2012-E10015.pdf>

<http://ndpublisher.in/admin/issues/tlv3n1f.pdf>

<http://blog.scientix.eu/2015/08/virtual-laboratories-in-teaching-and-learning-science/>

UNESCO Source Book of Science Teaching.

UNESCO Publication in new methods and techniques in education.

Pedagogy of Computer Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to

- Acquaint with the aims and objectives of pedagogy of computer science
- Familiarize with the various methods that can be employed for the pedagogy of computer science.
- Acquaint in preparation of instructional materials for Computer Science teaching.
- Acquire knowledge of latest trends in Information Technology and assessment practices.

Course Outline:

Unit I: Computer Science as a School Subject

- Concept, Need and Scope of Computer Science.
- Need and Significance of Teaching Computer science at various levels.
- Aims and Objectives of Teaching Computer Science
- Writing objectives in behavioral terms
- Activity:** Practice on Writing the Instructional Objectives in Behavioural Terms.

Unit II: Methods and Techniques of Teaching Computer Science

- Methods of Teaching (Concept, Procedure, Advantages and Limitation)
 - Lecture-cum-Demonstration
 - Laboratory
 - Project
 - Problem Solving
- Techniques of Teaching: CML, CAI, Mobile Learning, Buzz session, e-learning, smart classroom, surfing, blogging
- Activity:** Preparation of Lesson plan based on above method

Unit-III: Designing for Instruction

- Concept, Need, Preparation of Unit plan and Lesson plan
- Preparation of Blue-print and Test items
- Techniques and Tools of Evaluation, E-assessment
- Types of Tests used in Computer Science.
- Activity:** Preparation of question paper based on Blue-print

Unit-IV: Development of Instructional material

- Meaning, Importance, classification and preparation of Instructional Material.
- Text Books: Characteristics and Criteria for Selection of Computer Books with special Reference to Theory and Practical Books of Computer Subject
- Self-Instructional Material
- Computer Assisted Instructional Material
- Computer Science Laboratory: Planning, Organization and its importance
- Activity:** Prepare a material on Computer Assisted Instruction

Unit-V : Trends and Issues in Teaching-Learning

- LMS, PODCAST

Multimedia
Virtual Learning,
Web based Learning,
Teleconferencing,
Interactive Boards
Technophobia (difficulties in handling hardware and software)

Practicum: Any two of the following.

Preparation of Lesson plan based on above method

Preparation of question paper based on Blue-print

Prepare a material on computer assisted Instruction

Prepare a material on computer assisted Instruction

References:

Chauhan, S.S. (1985). *Innovations in teaching learning process*. New Delhi: Vikas Publishing Ltd

Goel, H.K. (2005). *Teaching of Computer Science*. New Delhi: R.Lall Book Depot.

Kochchar, S.K.(1992). *Methods and techniques of teaching*. New Delhi: Sterling Publishers Pvt Ltd.

Mangal, S.K., Uma Mangal, (2009). *Essentials of Educational Technology*. New Delhi: PHI learning Private Limited.

Sharma, R.A.(2008). *Technological foundation of Education*. Meerut: R.Lall Book Depot.

Web Resources:

Concept, Need and Scope of Computer Science.

Need and Significance of Teaching Computer science at various levels.

General Aims and Objectives of Teaching Computer Science

<http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf>

General Aims and Objectives of Teaching Computer Science

http://tnteu.in/pdf/BED_CMmaterial_2016-17.pdf

Methods of Techniques of Teaching Computer Science-[http://www.bdu.ac.in/cde/docs/ebooks/B-](http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf)

[Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf](http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf)

http://tnteu.in/pdf/BED_CMmaterial_2016-17.pdf

Designing for Instruction

<http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf>

http://tnteu.in/pdf/BED_CMmaterial_2016-17.pdf

Development of Instructional material-[http://www.bdu.ac.in/cde/docs/ebooks/B-](http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf)

[Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf](http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf)

Trends and Issues in Teaching-Learning- [http://www.bdu.ac.in/cde/docs/ebooks/B-](http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf)

[Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf](http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20COMPUTER%20SCIENCE.pdf)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

छात्राध्यापिकाएँ :

- हिन्दी के विविध रूपों एवं भाषागत विशेषताओं के प्रति विद्यार्थियों में जिज्ञासा भाव जाग्रत कर भाषा सौंदर्य से परिचित करा सकेंगी।
- हिन्दी भाषा के विविध रूपों में विभेद कर सकेंगी।
- विद्यार्थियों में भाषा का सामान्य व सांदर्भिक अर्थग्रहण तथा अभिव्यक्त करने की क्षमता उत्पन्न कर सकेंगी।
- संदर्भ एवं परिस्थिति के अनुसार हिन्दी-शिक्षण की उपयुक्त एवं अभिनव विधियों व प्रविधियों का प्रयोग कर सकेंगी।
- हिन्दी शिक्षण के उद्देश्यों का व्यावहारिक लेखन कर सकेंगी।
- विद्यार्थियों में भाषायी कौशलों का विकास कर सकेंगी, जिसके परिणामस्वरूप विद्यार्थियों में सांदर्भिक अर्थग्रहण एवं अभिव्यक्ति क्षमता उत्पन्न कर सकेंगी।
- विविध साहित्यिक विधाओं (गद्य-पद्य, व्याकरण आदि) के शिक्षण उद्देश्यों को ध्यान में रखकर उपयुक्त योजना का निर्माण एवं उसका क्रियान्वयन कर सकेंगी।

पाठ्यवस्तु रूपरेखा :

इकाई-I: भाषा-प्रस्तावना एवं पार्श्वभूमि

- भाषा-विविध रूप (मातृभाषा, राष्ट्रभाषा, राजभाषा)
- भाषा-प्रकृति एवं महत्व
- भाषा की भूमिका-सांस्कृतिक, कार्यात्मक, साहित्यिक

गतिविधि-भाषा की विभिन्न भूमिकाओं पर चर्चा एवं कार्यात्मक हिन्दी पर आलेखन

इकाई-II: हिन्दी शिक्षण/भाषा-शिक्षण के उद्देश्य

- हिन्दी-शिक्षण के उद्देश्य
 - सामान्य और विशिष्ट,
 - स्तरानुकूल
 - भाषागत

गतिविधि - हिन्दी शिक्षण के उद्देश्यों का लेखन।

इकाई-III: (अर्थ, महत्व, उद्देश्य एवं गतिविधियाँ) भाषायी कौशलों का विकास

- अभिव्यक्ति - लेखन कौशल एवं वदन (भाषण) कौशल
- अर्थग्रहण - श्रवण कौशल एवं पठन कौशल

गतिविधि- किसी एक भाषायी कौशल विकास के लिए योजना का निर्माण

इकाई-IV: साहित्यिक अभिव्यक्ति के विविध रूप एवं उनका शिक्षण

- साहित्यिक अभिव्यक्ति के विविध रूप एवं उनका शिक्षण-गद्य, पद्य, नाटक (अर्थ, उद्देश्य, महत्व, एवं शिक्षण विधियाँ)
- व्याकरण शिक्षण - अर्थ उद्देश्य, महत्व, एवं शिक्षण विधियाँ)

गतिविधि- किसी एक विधा की शिक्षण विधियों पर समीक्षात्मक आलेखन

इकाई-V: हिन्दी शिक्षण – योजना एवं मूल्यांकन

इकाई योजना-अर्थ, महत्त्व, एवं तत्व

- पाठ-योजना- अर्थ, महत्त्व, एवं तत्व
- भाषा विकास की प्रगति का मूल्यांकन/आकलन-अवधारणा, महत्त्व एवं विशेषताएँ

गतिविधि- विविध विधाओं पर पाठ योजना का विकास

व्यावहारिक कार्य – (कोई दो कार्य)

- हिन्दी शिक्षण के उद्देश्यों का विभिन्न विधा के अनुसार लेखन
- पठित विधाओं में से किसी एक विधा पर कम्प्यूटर आधारित शिक्षण पाठ का विकास
- व्याकरण शिक्षण से संबंधित चार्ट या भाषायी खेल का निर्माण

सन्दर्भ:

अवधेश, ए. (1973). हिन्दी भाषा का स्वरूप विकास. पटना: बिहार ग्रन्थ अकादमी.
गुप्त, एम. (1991). भाषा शिक्षण : सिद्धान्त एवं प्रविधि. आगरा: केन्द्रीय हिन्दी संस्थान.
लाल, आर. बी. (1965). हिन्दी शिक्षण. मेरठ: रस्तोगी एण्ड कम्पनी.
मित्तल, एम. एल. (2012). हिन्दी शिक्षण. दिल्ली: पियर्सन.
मित्तल, एस. (2005). शैक्षिक तकनीकी. मेरठ: आर. लाल बुक डिपो.
ओड, एल. के. (1982). हिन्दी शिक्षण में त्रुटि एवं उपचार. राजस्थान: बनस्थली विद्यापीठ.
पाटिल, एच. आर. और शेडके, एस. (2005). भाषा शिक्षण. कानपुर: विद्या प्रकाशन.
पाण्डेय, आर. एस. (1977). हिन्दी शिक्षण. आगरा: विनोद पुस्तक मन्दिर.
शर्मा, आर. ए. (2009). शिक्षा तकनीकी. मेरठ: आर. लाल बुक डिपो.
शर्मा, एल. (1989). हिन्दी संरचना का अध्ययन-अध्यापन. आगरा: केन्द्रीय हिन्दी संस्थान.
श्रीवास्तव, आर. (1979). भाषा शिक्षण. गाजियाबाद: मैकमिलन कम्पनी ऑफ इण्डिया.
तिवारी, पी. (1976). सर्वोपयोगी हिन्दी सुधार कार्यक्रम. अजमेर: मिश्रा ब्रदर्स.
योगेन्द्रजीत, बी. (1981). हिन्दी भाषा शिक्षण. आगरा: विनोद पुस्तक मन्दिर.

Web Resources:

Pedagogy of Hindi-<https://www.v mou.ac.in>
Pedagogy of Hindi-ncert.nic.in/rightsidelinks/pdf/h
Unit-1-Wikipedia.org
Pedagogy of Hindi-www.mannu.ac.org
Pedagogy of Hindi-uou.ac.in
Pedagogy of Hindi-www.uou.ac.in
Pedagogy of Hindi-www.uprtou.ac.in
Kendriya Hindi Sansthan Agra-<http://khsindia.org/india/> hi

Pedagogy of Sanskrit

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

छात्राध्यापिकाएँ :

विद्यार्थियों में संस्कृत की भाषागत विशेषताओं के प्रति जिज्ञासा भाव जागृत कर भाषा-सौंदर्य से परिचित करा सकेंगी।

संस्कृत भाषा शिक्षण के उद्देश्यों को व्यवहारगत परिवर्तन के रूप में लिख सकेंगी।

भाषा एवं साहित्यिक दृष्टि से संस्कृत की समस्त विधाओं जैसे—गद्य, पद्य व व्याकरण का इनके शिक्षण उद्देश्यों को ध्यान में रखकर शिक्षण कर सकेंगी।

परिस्थित्यानुसार उपयुक्त विधियों एवं प्रविधियों का प्रयोग कर संस्कृत गद्य, पद्य व व्याकरण शिक्षण को सरस, सरल एवं अर्थपूर्ण बना सकेंगी।

संस्कृत गद्य, पद्य व व्याकरण शिक्षण के लिए विद्यार्थी उन्मुख पाठ योजना निर्मित कर सकेंगी।

संस्कृत को आत्मसात कराने के लिए शिक्षण तथा शिक्षणेतर कार्यक्रमों का आयोजन एवं मूल्यांकन करने की क्षमता विकसित कर सकेंगी।

दृश्य—श्रव्य सामग्री के सुरुचिपूर्ण उपयोग द्वारा प्रभावी शिक्षण कर सकेंगी।

पाठ्यवस्तु रूपरेखा :

इकाई—प्रथम: संस्कृत भाषा व शिक्षण के उद्देश्य

1. संस्कृत भाषा की प्रकृति
2. संस्कृत शिक्षण के उद्देश्य
 - सामान्य और विशिष्ट
 - स्तरानुकूल
 - भाषागत

गतिविधि: संस्कृत शिक्षण के उद्देश्यों का लेखन।

इकाई—द्वितीय: विविध विधा शिक्षण

1. गद्य शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ
2. पद्य शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ
3. व्याकरण शिक्षण : अर्थ, उद्देश्य, महत्त्व एवं शिक्षण विधियाँ

गतिविधि : किसी एक विधा के शिक्षण की विधियों पर समीक्षात्मक आलेखन।

इकाई—तृतीय: संस्कृत शिक्षण में शिक्षण—अधिगम संसाधन

1. दृश्य संसाधन : महत्त्व, प्रकार, प्रयोग और प्रयोग में सावधानियाँ
2. श्रव्य संसाधन : महत्त्व, प्रकार, प्रयोग और प्रयोग में सावधानियाँ
3. दृश्य—श्रव्य संसाधन : महत्त्व, प्रकार, प्रयोग और प्रयोग में सावधानियाँ

गतिविधि: संस्कृत शिक्षण में प्रयुक्त हो सकने वाली दो सहायक सामग्रियों का निर्माण।

इकाई—चतुर्थ: संस्कृत के प्रति रुचि जाग्रत करने वाली क्रियाएँ

1. साहित्यिक क्रियाएँ : महत्त्व, प्रकार, आयोजन एवं प्रतिवेदन लेखन
2. सांस्कृतिक क्रियाएँ : महत्त्व, प्रकार, आयोजन एवं प्रतिवेदन लेखन

गतिविधि: संस्कृत शिक्षण से सम्बन्धित किसी साहित्यिक क्रिया की रूपरेखा का निर्माण, आयोजन एवं प्रतिवेदन लेखन।

इकाई—पंचम: संस्कृत शिक्षण में पाठ योजना एवं आकलन

1. इकाई योजना निर्माण
2. पाठ योजना निर्माण
 - गद्य पाठ योजना
 - पद्य पाठ योजना
 - व्याकरण पाठ योजना
3. संस्कृत भाषा शिक्षण में मूल्यांकन की अवधारणा
4. अच्छे मूल्यांकन की विशेषताएँ

गतिविधि: विविध विधाओं के शिक्षण हेतु पाठ योजना का विकास।

व्यावहारिक कार्य— (निम्न में से कोई दो कार्य)

1. संस्कृत शिक्षण के उद्देश्यों का लेखन।
2. पठित विधाओं में से किसी एक विधा पर कम्प्यूटर आधारित शिक्षण पाठ का विकास।
3. संस्कृत शिक्षण से सम्बन्धित किसी सांस्कृतिक क्रिया की रूपरेखा का निर्माण।
4. एक नीलपत्र एवं प्रश्नपत्र का निर्माण।

सन्दर्भ पुस्तक :

आप्टे, जी. डी. एण्ड डोगरे पी. के. (1960). *टीचिंग आफ संस्कृत इन सैकण्डरी स्कूल*. बड़ौदा: आचार्य बुक डिपो.
भारत सरकार, शिक्षा विभाग (1957). *संस्कृत आयोग प्रतिवेदन 1956*. दिल्ली: भारत सरकार प्रेस.
चतुर्वेदी, एस. (1960). *संस्कृत शिक्षण*. वाराणसी: नन्द किशोर एण्ड ब्रदर्स.
द्विवेदी, के. (2016). *बृहद् रचना अनुवाद कौमुदी*. वाराणसी: विश्वविद्यालय प्रकाशन.
मित्तल, एस. (2000). *संस्कृत शिक्षण*. मेरठ: आर. लाल बुक डिपो.
मित्तल, एस. (2012). *शिक्षण तकनीकी*. मेरठ: आर. लाल बुक डिपो.
पाण्डे, आर. (2000). *संस्कृत शिक्षण*. आगरा: विनोद पुस्तक मंदिर.
साहू, आर. (2012). *संस्कृत व्याकरण*. जयपुर: हंसा प्रकाशन.
सफाया, आर. (1997). *संस्कृत शिक्षण*. चण्डीगढ़: हरियाणा साहित्य अकादमी.
शर्मा, आर. ए. (2009). *शिक्षा तकनीकी*. मेरठ: आर. लाल बुक डिपो.

Web Resources:

Pedagogy of Sanskrit Part-I:

<http://uou.ac.in/sites/default/files/bed17/CPS-6.pdf>

Pedagogy of Sanskrit Part-II:

<https://uou.ac.in/sites/default/files/bed17/CPS-14.pdf>

Sanskrit Language Teaching:

http://www.sanskrit.nic.in/sanskrit_language_teaching.php

Rashtriya Sanskrit Sansthan:

<http://www.sanskrit.nic.in/ebooks.php>

Methodology of Teaching Sanskrit:

<https://swayam.gov.in/courses/5292-discipline-methodology-of-teaching-sanskrit>

Pedagody of English

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Enable Student Teachers to
acquire insight of nature & perspective of Teaching English
develop the objectives of Teaching English
apply teaching strategies in ELT
appreciate different forms of planning for ELT.
comprehend the role of assessment in ELT.

Course Outline:

Unit –I: Introduction to English.

- Nature & Perspective to English Teaching.
- Meaning and Principles of Learning English as second language.

Activity: Reading on scope of English language teaching as EFL, EST and ESP.

Unit –II: Objectives of ELT

- Objectives of teaching English as set forth in NCF-2005.
- Instructional Objectives & its relation to aims

Activity: Framing of Instructional Objectives in Behavioral terms.

Unit –III: Teaching Strategies

- Definition of Approach, Methods and Technique
- Approaches: Structural and Communicative Approach
- Methods: Grammar-Translation, Inductive-Deductive Methods

Activity: Discussion on adapting teaching strategy according to language forms.

Unit –IV: Planning in ELT

- Need and relevance of planning in ELT
- Different forms of Plan
 - o Unit plan: concept and components
 - o Lesson plan: concept and components
- Difference between Unit and Lesson plan.

Activity: Practice in preparing unit and lesson plan.

Unit –V: Assessment in ELT

- Continuous & Comprehensive Assessment
 - o Meaning & Process.
- Designing of Test Paper
- Framing of Test Items.

Activity: Practice in framing test Items

Practicum:

- 1 Development of Instructional Lesson Plan using non textual material.

References:

- Allen, Harold B. & Campbell, Russel N., Teaching of English as a second language, Tata Mcgraw Hill Publishing Co. Ltd., New Delhi, 1973.
- Allen, W.S., Living English speech, Orient Logmans, Bombay, 1968.
- Agnihotri, R.K. & Khanna, A.L. (ed.), English Language Teaching in India-issues and innovations, sage Publications, New Delhi, 1995.
- Agnihotri, R.K. & Khanna, A.L. (ed.), Problematizing English in India, Sage Publications New Delhi, 1997.
- Baruah, T.C. The English Teachers Handbook, Sterling Publishers Pvt. Ltd., New Delhi 1984.
- Billows, F.L. Techniques of Language Teaching, Longman Green Ltd., London 1968.
- Bright, J.A. & Mcgreger, G.P. Teaching English as a second language, English Language Book Society of Longmans, London, 1982.
- Choudhary, Namita Roy, Teaching English in Indian Schools, A.P.H. Publishing House, New Delhi, 1998.
- Frishy, A.C. Teaching English, Longmans Green & Co. Ltd., London 1961.
- Gautam, Kripa K., English Language Teaching - a critical study of methods and approaches, Harman Book House, New Delhi, 1988.
- Italiano, Graciela & Rounds, Patricia, English as a second language-Teacher Resource Handbook : A Practical Guide for K-12 ESL Programs, Corwin Press, Inc., California, 1993.
- Kaul, Omkar N., English in India - Theoretical and Applied Issues, Creative Publishers, New Delhi, 1992.
- Lado, E., Language Teaching, Mcgraw Hill Inc. New York 1964.
- Mukalel, Joseph C., Approaches to English Language Teaching, Discovery Publishing House, New Delhi, 1998.
- Mullick, Ratna & Ghosh, shefali, English Language Teaching from theory to practice, spectrum Inc., Calcutta, 1993.
- Regional Institute of English, Chandigarh, Teaching English-Notes for teachers in Training. Oxford University Press, Delhi, 1972.
- Sharma, Kadambari & Tuteja, Tripat (ed.) Teaching of English, Commonwealth Publishers, New Delhi, 1994.
- Sharma, Kadambari & Tuteja, Tripat (ed.) Teaching of Language and Linguistics, Commonwealth Publishers, New Delhi, 1994.
- Sharma, Kadambari & Tuteja, Tripat (ed.) Principles and Practices of Language Teaching, Commonwealth Publishers, New Delhi, 1997.
- Vergheese, B.V., Modern Methods of Teaching English, Vols. I to V, Anmol Publication Pvt. Ltd., New Delhi, 1997.

Web Resources:

- Thomas M. D'Elia (2017) Six Principles of Teaching English Language Learners in the Mainstream Classroom,
<https://1.cdn.edl.io/P2EaJJFEFVYW92Clm3CyX9pLPcuvKI9E0G3w7KCBDSLX6mH2.pdf>
NCERT(2005), NCF 2005
www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf
NCERT (2005), Teaching of English www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/english.pdf
- Methods And Approaches Of English Language Teaching In India
http://shodhganga.inflibnet.ac.in/bitstream/10603/20567/10/10_chapter%203.pdf
- Cunningham, Gini (2009) The New Teacher's Companion
<http://www.ascd.org/publications/books/109051/chapters/Lesson-Plans-and-Unit-Plans@-The-Basis-for-Instruction.aspx>

Planning Guidelines

https://educacion.gob.ec/wp-content/uploads/downloads/2013/09/Planning_Guidelines_anual_unidad_lecci%F3n-EFL_100913.pdf

NCERT (2018) Continuous and Comprehensive Evaluation: Guidelines, NCERT, New Delhi

www.ncert.nic.in/announcements/pdf/CCE-Guidelines.pdf

CBSE (2009). Continuous and Comprehensive Evaluation

www.cbse.nic.in/cce/cce-manual/chapter_1.pdf

Guidelines For Paper Setters - Curriculum

https://curriculum.gov.mt/en/Assessment/Assessment-of.../guidelines_paper_setters.pdf

Pedagogy of Mathematics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student teacher will be able to:

discuss the nature of Mathematics.

critically analyze the Mathematics Text Book.

reflect on different methods of teaching Mathematics.

prepare the lesson plan in teaching mathematics.

reflect on framing and marking test items of achievement test in mathematics.

Course Outline:

Unit-I: Nature & Scope of Mathematics

- a) Nature of mathematics
- b) Place in Secondary School Curriculum
- c) Correlation with other School Subjects

Activity – Poster making on any one of above topics

Unit-II: Aims and objectives of Teaching Mathematics

- a) Aims and General Objectives of Teaching Mathematics at school level
- b) Formulation of Instructional Objectives with respect to Arithmetic, Algebra, Geometry, Mensuration and Trigonometry
- c) Value development through Teaching of Mathematics

Activity- Workshop to formulate the Instructional Objectives.

Unit-III: Curriculum and Textbook of Mathematics

- a) Content and branches of Mathematics at Secondary Level
- b) Curriculum of Mathematics at Secondary level in reference to NCF-2005
- c) Characteristics of a good Mathematics Text Book

Activity- Critical Analysis of Mathematics Text Book of class X.

Unit-IV: Planning for Teaching

- a) Annual plan – Need, Main consideration and Format
- b) Unit plan - Concept and steps of planning
- c) Lesson plan – Need and preparation

Activity- Workshop on Planning at different level.

Unit-V: Approaches to Teach Mathematics

Concepts, Procedures, Advantages and Limitations of following approaches/ methods

- a) Analytical – Synthetical
- b) Inductive – Deductive

c) Lecture cum Demonstration

Activity- Workshop on Method based planning.

Practicum: (Any two)

1. Prepare a scrap book on 'Mathematics in News Paper'.
2. Develop strategy to connect any three teaching points with value inculcation.
3. Develop a Annual Plan of teaching Mathematics at secondary level.

Reference :

Butler, H.C. and Wren, F.L.(1965). *The Teaching of Secondary Mathematics*. New York: Mc Graw Hill Book Co.

Chadha, B.N. (1961). *Teaching of Mathematics*. Delhi : Gurudas Kappor and Sons.

Cornelius, Michael. (1982). *Teaching mathematics*. London : Croom Helm.

Jain, S.L. (1973). *Ganit Shikshan*. Jaipur :Rajasthan Hindi Granth Academy.

Johnson, D.A. & Rahtz. R. (1961). *The New Mathematics in Our Schools*. New York: The macmillan Co.

Maheshwari, Vijayandra Kishore (1995). *Ganit Shikshan*. Meerut :Lal Book Depott.

Mangal, S.K.(1997). *Ganit Shikshan*. New Delhi :Arya Book Depot.

Sidhu, K. S. (1986). *The Teaching of Mathematics*. New Delhi :Sterling Publisher.

Web Resources:

Nature of Mathematics, Aims and General Objectives of Teaching Mathematics at school level, Approaches to Teach Mathematics, Unit Plan, Lesson Plan:

<http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20MATHEMATICS.pdf>

<http://www.tnteu.in/pdf/3-maths.pdf>

<http://egyankosh.ac.in/bitstream/123456789/46799/1/BES-143B2-E.pdf>

Place in Secondary School Curriculum:

<http://egyankosh.ac.in/bitstream/123456789/46799/1/BES-143B2-E.pdf>

Planning for Teaching:

<http://pedagogybyvasu.blogspot.com/2015/08/unit-test.html>

<https://repository.nie.edu.sg/bitstream/10497/1824/1/TL-9-1-15.pdf>

<http://egyankosh.ac.in/bitstream/123456789/6691/1/Unit-4.pdf>

<https://ndpublisher.in/admin/issues/EQv8n32.pdf>

Pedagogy of Drawing & Painting

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to:

explain the nature and importance of Drawing & Painting in school education

discuss the correlation of Drawing & Painting with other school subjects

formulate instructional objectives in behavioral terms

design unit plan and lesson plan based on different methods.

acquire skill in planning and organize Drawing & Painting labs for Sec. and Sr. Sec. class

prepare Blue print and question paper

Course Outline:

Unit-I: Drawing & Painting as a School Subject

Concept and place of Drawing & Painting in school Education.

Relevance of Drawing & Painting as a subject at secondary and Senior Sec. Level.

Correlation of Drawing & Painting subject with other school subjects.

Activity: Poster making on any one theme of above.

Unit-II: Instructional Design in Drawing & Painting Aims of Drawing and Painting

Teaching objectives in cognitive, affective, Psychomotor Domain

Unit and lesson designing in Drawing & Painting teaching

Basic consideration in designing Drawing & Painting teaching

Activity: Framing IOs in behavioral terms in workshop.

Unit-III: Learning Experiences in Drawing & Painting Teaching Methods as LEs- lecture cum

demonstration, Project, Practical, workshop (Concept, Steps, Potential, Limitation)

Activities as LEs - Field trip, Exhibition

LEs as ISM- Role of computer, Models, Magazine, in Drawing & Painting Teaching

Activity: Prepare lesson plans based on different teaching method in small group

Unit-IV: Learning Resources in Drawing & Painting Teaching Learning resources in Drawing & Painting

teaching - Museum, Art galleries, Art exhibition

Laboratory for teaching - Importance, Planning and instruction for working in lab

Qualities of a good Drawing & Painting teacher

Activity: Discussion on selection/preparation of ISM in Drawing & Painting teaching

Unit-V: Assessing Learning in Drawing & Painting

(Types of assessment on Drawing & Painting)

Formative, Summative assessment

Continuous & comprehensive assessment in

Written, practical, viva-voce

Preparation of question paper and Blue print

Activity: Preparation on Blue prints & formulation of test items

Practicum:

Planning for visual for field or art gallery

Critical analysis of existing Drawing & Painting curriculum at Sec. & Sr. Sec. level

Plan a lab for Drawing & Painting teaching with material & equipments

References:

Jeswani, K.K. (1967). *Art in education*. New Delhi: Atma Ram and Sons.

Pappas, George. (1970). *Concepts in Art and Education*. London: Collier Macmillan Ltd.

Prasad, Janardan. (2005). *Art education, Concepts, Epistemic and Role*. New Delhi: Kanishka Publishers, Distributors.

Mock, Ruth. (1959). *Principles of Arts Teaching*. London: University of London press Ltd.

Stanfield, N.F. (1958). *A handbook of Art teaching in tropical schools*. London: Evans Brothers Ltd.

गोंधी, प्रेमलता. (2016). *कला शिक्षा*. जयपुर: राजलक्ष्मी पब्लिकेशन.

शर्मा, रमा, शर्मा, वी.पी. (2015). *कला शिक्षा*. नई दिल्ली: अर्जुन पब्लिशिंग हाउस.

गोदिका, साधना, माथुर, सावित्री. (2008). *कला शिक्षा शिक्षण*. जयपुर: आस्था प्रकाशन.

शर्मा, माता, प्रसाद. (2008). *कला शिक्षा शिक्षण*. जयपुर: अपोलो प्रकाशन.

शर्मा, प्रभा. (2007). *कला शिक्षा शिक्षण*. जयपुर: श्रुति पब्लिकेशन.

Web Resources:

importance of art in schools

<http://www.pbs.org/parents/education/music-arts/the-importance-of-art-in-child-development/>

<https://www.theodysseyonline.com/importance-of-the-arts-in-education>

correlation of fine arts with school subjects

<https://learnerlog.org/socialstudies/teaching-the-arts-across-the-curriculum-2/>

teaching methods in fine arts

<https://lindsays-art-room.weebly.com/teaching-strategies.html>

Assessment in fine Arts

<https://www.google.com/search?q=assessment+in+fine+arts&ie=utf-8&oe=utf-8&client=firefox-b>

Pedagogy of Mathematics-I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Student Teacher will be able to:

Discuss the nature of Mathematics.

Critically analyze the Mathematics Text Book.

Eeflect on different methods of teaching Mathematics.

Prepare the lesson plan in teaching mathematics.

Reflect on framing and marking test items of achievement test in mathematics.

Course Outline:

Unit- I: Nature & Scope of Mathematics

- a) Nature of mathematics
- b) Place in Secondary School Curriculum
- c) Correlation with other School Subjects

Activity – Poster making on any one of above topics

Unit-II: Aims and objectives of Teaching Mathematics

- a) Aims and General Objectives of Teaching Mathematics at school level
- b) Formulation of Instructional Objectives with respect to Arithmetic, Algebra, Geometry, Mensuration and Trigonometry
- c) Value development through Teaching of Mathematics

Activity- Workshop to formulate the Instructional Objectives.

Unit-III: Curriculum and Textbook of Mathematics

- a) Content and branches of Mathematics at Secondary Level
- b) Curriculum of Mathematics at Secondary level in reference to NCF-2005
- c) Characteristics of a good Mathematics Text Book

Activity- Critical Analysis of Mathematics Text Book of class X.

Unit-IV: Planning for Teaching

- a) Annual plan – Need, Main consideration and Format
- b) Unit plan - Concept and steps of planning
- c) Lesson plan – Need and preparation

Activity- Workshop on Planning at different level.

Unit-V: Approaches to Teach Mathematics

Concepts, Procedures, Advantages and Limitations of following approaches/ methods

- a) Analytical – Synthetical
- b) Inductive – Deductive
- c) Lecture cum Demonstration

Activity- Workshop on Method based planning.

Practicum: (Any two)

1. Prepare a scrap book on 'Mathematics in News Paper'.
2. Develop strategy to connect any three teaching points with value inculcation.
3. Develop a Annual Plan of teaching Mathematics at secondary level.

Reference:

Butler, H.C. and Wren, F.L.(1965). *The Teaching of Secondary Mathematics*. New York: Mc Graw Hill Book Co.
Chadha, B.N. (1961). *Teaching of Mathematics*. Delhi : Gurudas Kappor and Sons.
Cornelius, Michael. (1982). *Teaching mathematics*. London : Croom Helm.
Jain, S.L. (1973). *Ganit Shikshan*. Jaipur :Rajasthan Hindi Granth Academy.
Johnson, D.A. & Rahtz. R. (1961). *The New Mathematics in Our Schools*. New York: The macmillan Co.
Maheshwari, Vijayandra Kishore (1995). *Ganit Shikshan*. Meerut :Lay Book Deptt.
Mangal, S.K.(1997). *Ganit Shikshan*. New Delhi :Arya Book Depot.
Sidhu, K. S. (1986). *The Teaching of Mathematics*. New Delhi :Sterling Publisher.

Web Resources:

Nature of Mathematics, Aims and General Objectives of Teaching Mathematics at school level, Approaches to Teach Mathematics, Unit Plan, Lesson Plan:

<http://www.bdu.ac.in/cde/docs/ebooks/B-Ed/I/TEACHING%20OF%20MATHEMATICS.pdf>

<http://www.tnteu.in/pdf/3-maths.pdf>

<http://egyankosh.ac.in/bitstream/123456789/46799/1/BES-143B2-E.pdf>

Place in Secondary School Curriculum:

<http://egyankosh.ac.in/bitstream/123456789/46799/1/BES-143B2-E.pdf>

Stage Performance - I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	16	8

Learning Outcomes:

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments.

Content -

One Vilambit and Fast khayal or one Masitkhani or Rajakhani Gat should be prepared from the list of Ragas.

Any Raga may be selected from the practical course for the paper.

- (i) Performance of a choice lasting approximately for 20 minutes.
- (ii) Thumri, Dadra or Bhajan should be sung, lasting approximately 5-10 minutes.
- (iii) For instrumental music, any dhun based on any Raga, lasting approximately 5-10 minutes.

Paper-III-IV (Practical)

List of Ragas:

1. Yaman
2. Shyam-Kalyan
3. Pooriya Kalyan
4. Hansdhwani
5. Alhaiya Bilawal
6. Yamni Bilawal
7. Devgiri Bilawal
8. Bhairav
9. Jogia
10. Vibas
11. Gunkari
12. Basant Mukhari
13. Kedar
14. Gorakh Kalyan
15. Bhinna Shadaj

Note:

1. Candidate are required to prepare 4 Vilambit Khyal or Masitkhani Gats, 2 Drut Khyals/Gat in detail and 2 Drut Khyals/Gat in short from the given list of Ragas.
2. Candidate are required to prepare one Dhrupad/Dhamar with layakari. For instrumental music – any Dhun based on any Raga.
3. Special attention should be given towards presentation while preparing all the Ragas.
4. Variety of Taals may be kept in view for the composition of Gats and Khayals.

E-Resources :

1. RAAG YAMAN- <https://www.youtube.com/watch?v=RSba7WebiXo> (BY KISHORI AMONKER)
2. RAAG SHYAM KALYAN— <https://www.youtube.com/watch?v=B-vmBO05G8A> (BY PRABHA ATRE)

3. POORIYA KALYAN—<https://www.youtube.com/watch?v=czCfXSNQHcY> (BY KAUSHIKI CHAKROBARTY)
4. HANSDEHWANI-<https://www.youtube.com/watch?v=XHDUITMkXQQ> (BY PARVEEN SULTANA)
5. ALHAYA BILAWAL-<https://www.youtube.com/watch?v=my5Zh8ze3Ey> (BY KISHORI AMONKER)
6. YAMANI BILAWAL-https://www.youtube.com/watch?v=Prte0_3UBng (BY SHRUTI SADOLIKER)
7. DEVGIRI BILAWAL-<https://www.youtube.com/watch?v=nj1RoNfN-Qe> (by kishori amonker)
8. BHAIKAV-<https://www.youtube.com/watch?v=R34akeCzJIU> (BY PRABHA ATRE)
9. JOGIA-<https://www.youtube.com/watch?v=TSvwJMGbN0Q> (BY GANGU BAI HANGAL)
10. VIBHAS-<https://www.youtube.com/watch?v=UwTRQ3iYkiQ> (BY ASHWINI BHINDE)
11. GUNKARI-<https://www.youtube.com/watch?v=VmGLgfGgsFM> (BY KISHORI AMONKER)
12. BASANT MUKHARI-<https://www.youtube.com/watch?v=IXExtS3WHyY> (BY KAUSHIKI CHAKRABARTY)
13. KEDAR-<https://www.youtube.com/watch?v=RAgsGqkUoTk> (BY ASHWINI BHINDE)
14. GORAKH KALYAN –
<https://www.youtube.com/watch?v=wnBmvhXtxFM&t=183s>
(BY RASHID KHAN)

Planning for Teaching:

<http://pedagogybyvasu.blogspot.com/2015/08/unit-test.html>

<https://repository.nie.edu.sg/bitstream/10497/1824/1/TL-9-1-15.pdf>

<http://egyankosh.ac.in/bitstream/123456789/6691/1/Unit-4.pdf>

<https://ndpublisher.in/admin/issues/EQv8n32.pdf>

Stage Performance - II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	16	8

Learning Outcomes:

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments.

Content -

One Vilambit and Fast khyal or one Masitkhani or Rajakhani Gat should be prepared from the list of Ragas.

Any Raga may be selected from the practical course for the paper.

- (i) Performance of Raga of candidates own choice lasting approximately for 20 minutes.
- (ii) Thumri, Dadra or Bhajan should be sung, lasting approximately 5-10 minutes.
- (iii) For instrumental music, any dhun based on any Raga, lasting approximately 5-10 minutes.

Paper-III-IV (Practical)

List of Ragas:

1. Bageshri
2. Darbari Kanhara
3. Nayaki Kanhara
4. Abhogi Kanhara
5. Marwa
6. Bhatiyar
7. Puriya
8. Lalit
9. Jhinjhoti
10. Rageshree
11. Narayani
12. Shuddha Sarang
13. Madmad Sarang
14. Saraswati
15. Hemant

Note:

1. Candidate are required to prepare 4 Vilambit Khyal or Masitkhani Gats, 2 Drut Khyals/Gat in detail and 2 Drut Khyals/Gat in short from the given list of Ragas.
2. Candidate are required to prepare one Dhrupad/Dhamar with layakarries. For instrumental music – any Dhuns based on any Ragas.
3. Special attention should be given towards presentation while preparing all the Ragas.
4. Variety of Tals may be kept in view for the composition of Gats and Khyals.

E-Resources :

1. BAGESHREE-<https://www.youtube.com/watch?v=4pjfRy7QpRI> (BY ASHWINI BHIDE)

2. DARBARI KANHRA-<https://www.youtube.com/watch?v=oF2hZcbBRIM> (BY VEENA SAHASTRABUDDHE)
3. NAYAKI KANHARA-<https://www.youtube.com/watch?v=XQBSkESiuZI> (BY SHRUTI SHADOLIKER)
4. ABHOGI KANHARA-<https://www.youtube.com/watch?v=b21NWM6otKM> (BY VEENA SAHASRABUDHE)
5. MARWA-<https://www.youtube.com/watch?v=vlUvz333vUc> (BY AMIR KHAN SAHEB)
6. BHATIYAR-<https://www.youtube.com/watch?v=4c9DI3sUD2s> (BY VEENA SAHASRABUDHE)
7. POORIYA-https://www.youtube.com/watch?v=f_2WTGrm9l8 (BY PT.JASRAJ)

Stage Performance - III

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	14	7

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments.

Content -

One Vilambit and Fast khyal or one Masitkhani or Rajakhani Gat should be prepared from the list of Ragas.

Any Raga may be selected from the practical course for the paper.

- (i) Performance of Raga of candidates own choice lasting approximately for 20 minutes.
- (ii) Thumri, Dadra or Bhajan should be sung, lasting approximately 5-10 minutes.
- (iii) For instrumental music, any dhun based on any Raga, lasting approximately 5-10 minutes.

Paper-III-IV (Practical)

List of Ragas:

1. Bihag
2. Nand
3. Bihagda
4. Marubihag
5. Kalawati
6. Patdeep
7. Kirvani
8. Miyan Malhar
9. Megh Malhar
10. Ahir Bhairav
11. Bairagi Bhairav
12. Nat Bhairav
13. Multani
14. Madhuwanti
15. Pooriya Dhanashree

Note:

1. Candidates are required to prepare 4 Vilambit Khyal or Masitkhani Gats, 2 Drut Khyals/Gat in detail and 2 Drut Khyals/Gat in short from the given list of Ragas.
2. Students are required to sing one Folk style of Singing.
3. Special attention should be given towards presentation while preparing all the Ragas.
4. Variety of Tals may be kept in view for the composition of Gats and Khayals.

E-Resources :

1. MEGH MALHAR- https://www.youtube.com/watch?v=OHn6a-_Dt5w (BY PT BHIM SEN JOSHI)
2. AHIR BHAIRAV- <https://www.youtube.com/watch?v=3xSsJ9GC6lQ> (BY ASHWINI BHIDE)

- 3 BAIRAGI BHAIKAV- <https://www.youtube.com/watch?v=KWeBy3be2JE> (BY AJOY CHAKRABORTY)
- 4 NAT BHAIKAV- <https://www.youtube.com/watch?v=3R0oIDTS9wI> (BY VASANT RAO DESHPANDE)
- 5 MULTANI- <https://www.youtube.com/watch?v=bv6Q9G9w0VA> (BY VEENA SAHASRA BUDDHE)
- 6 MADHUVANTI- <https://www.youtube.com/watch?v=16580uFJmr8> (BY KAUSHAKI CHAKRABORTY)
- 7 POORIYA DHANASHREE- <https://www.youtube.com/watch?v=P1XDfgjYgqo> (BY ASHWINI BHIDE)

Stage Performance - IV

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	14	7

Learning Outcomes:

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments

Content -

One Vilambit and Fast khayal or one Masitkhani or Rajakhani Gat should be prepared from the list of Ragas.

Any Raga may be selected from the practical course for the paper.

- (i) Performance of Raga of candidates own choice lasting approximately for 20 minutes.
- (ii) Thumri, Dadra or Bhajan should be sung, lasting approximately 5-10 minutes.
- (iii) For instrumental music, any dhun based on any Raga, lasting approximately 5-10 minutes.

Paper-III-IV (Practical)

List of Ragas:

1. Malkauns
2. Jog
3. Jog Kauns
4. Chandra Kauns
5. Kaunsi Kanhara
6. Todi
7. Gujri Todi
8. Bilaskhani Todi
9. Bhupal Todi
10. Poorvi
11. Shree
12. Basant
13. Desi
14. Komal Rishabh Asawari
15. Gawati

Note:

1. Candidates are required to prepare 4 Vilambit Kahyal or Masitkhani Gats, 2 Drut Khayals/Gat in detail and 2 Drut Khayals/Gat in short from the given list of Ragas.
2. Students should be able to sing Thumari/Dadara styles of singing.
3. Special attention should be given towards presentation while preparing all the Ragas.
4. Variety of Tals may be kept in view for the composition of Gats and Khayals.

E-Resources :

1. BILASKHANI TODI- https://www.youtube.com/watch?v=qgEcVsU0_Ng (BY MEETA PANDIT)
2. BHUPAL TODI- <https://www.youtube.com/watch?v=dQBTrtP7etk> (BY VEENA SAHASRA BUDDHE)

3. POORVI- <https://www.youtube.com/watch?v=8C-EKDwOIJc> (DHRUPAD BY KAUSHIKI CHAKRABORTY)
4. SHREE- <https://www.youtube.com/watch?v=pQoXziLD97U> (BY ASHWINI BHIDE)
5. BASANT- <https://www.youtube.com/watch?v=-r8MGl2FqYk> (BY PT BHIMSEN JOSHI)
6. DESI- https://www.youtube.com/watch?v=jwZ_aXzWlZQ (BY PRABHA ATRE)
7. KOMAL RISHABH ASAVARI- <https://www.youtube.com/watch?v=6cQ3ICceot0> (BY GANGU BAI HANGAL)
8. GAWATI- <https://www.youtube.com/watch?v=sKpcbUA5FQk> (BY VEENA SAHASRA BUDDHE)

Comparative Study of Ragas - I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	16	8

Learning Outcomes:

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & performance.

Student will be able to learn & voice modulation techniques in all three octaves.

Move a step lighter from easy to complex ragas.

Content -

(Lasting for 1½ hours per candidate)

Division of Marks:

(a)	Choice Rag	10 Marks
(b)	Question Rag (Slow Khayal or gat)	10 Marks
(c)	Question Rag in fast Khayal or Gat	10 Marks
(d)	Critical and comparative study of the prescribed Ragas	20 Marks
(e)	Singing one Dhrupad/Dhamar etc.	
	Playing Basic Thekas on Tabla	10 Marks

or

Gats composed in tals other than Trital.

Total = 60 Marks

E-Resources :

1. RAAG YAMAN- <https://www.youtube.com/watch?v=RSba7WebiXo> (BY KISHORI AMONKER)
2. RAAG SHYAM KALYAN— <https://www.youtube.com/watch?v=B-vmBO05G8A> (BY PRABHA ATRE)
3. POORIYA KALYAN—<https://www.youtube.com/watch?v=czCfXSNQHcY> (BY KAUSHIKI CHAKRABORTY)
4. HANSDEHWANI-<https://www.youtube.com/watch?v=XHUITMkXQQ> (BY PARVEEN SULTANA)
5. ALHA YA BILAWAL-<https://www.youtube.com/watch?v=my5Zh8ze3Ey> (BY KISHORI AMONKER)
6. YAMANI BILAWAL-https://www.youtube.com/watch?v=Prte0_3UBng (BY SHRUTI SADOLIKER)
7. DEVGIRI BILAWAL-<https://www.youtube.com/watch?v=nj1RoNfN-Qe> (by kishori amonker)

Comparative Study of Ragas - II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	16	8

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments.

Content -

Division of Marks:

(Lasting for 1½ hours per candidate)

(a)	Choice Rag	10 Marks
(b)	Question Rag (Slow Khayal or gat)	10 Marks
(c)	Question Rag in fast Khayal or Gat	10 Marks
(d)	Critical and comparative study of the prescribed Ragas	20 Marks
(e)	Singing one Dhrupad/Dhamar etc.	10 Marks

or

Gats composed in tals other than

Trital

Total = 60 Marks

E-Resources

1. BAGESHREE-<https://www.youtube.com/watch?v=4pjfRy7QpRI> (BY ASHWINI BHINDE)
2. DARBARI KANHARA-<https://www.youtube.com/watch?v=oF2hZcbBRIM> (BY VEENA SAHASTRABUDDHE)
3. NAYAKI KANHARA-<https://www.youtube.com/watch?v=XQBSkESiuZI> (BY SHRUTI SHADOLIKER)
4. ABHOGI KANHARA-<https://www.youtube.com/watch?v=b21NWM6otKM> (BY VEENA SAHASRABUDHE)
5. MARWA-<https://www.youtube.com/watch?v=vlUvz333vUc> (BY AMIR KHAN SAHEB)
6. BHATTIYAR-<https://www.youtube.com/watch?v=4c9DI3sUD2s> (BY VEENA SAHASRABUDHE)
7. POORIYA-https://www.youtube.com/watch?v=f_2WTGrm9l8 (BY PT.JASRAJ)
8. LALIT-<https://www.youtube.com/watch?v=0xb3rorA4Wo> (BY PT, RAJAN & SAJAN MISHRA)
9. JHINJHOTI-<https://www.youtube.com/watch?v=dOLfAJRFIfk> (BY ASWINI BHIDE)
10. RAGESHWARI-https://www.youtube.com/watch?v=fzko_t39_Ga (BY ASHWINI BHIDE)

Comparative Study of Ragas - III

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	14	7

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments.

Content -

(Lasting for 1½ hours per candidate)

Division of Marks:

(a)	Choice Rag	10 Marks
(b)	Question Rag (Slow Khayal or gat)	10 Marks
(c)	Question Rag in fast Khayal or Gat	10 Marks
(d)	Critical and comparative study of the prescribed Ragas	20 Marks
(e)	Singing one Dhrupad/Dhamar etc.	10 Marks

or

Gats composed in tals other than Trital.

Total = 60 Marks

E-Resources :

1. BIHAG- <https://www.youtube.com/watch?v=j6DlmUaxnhQ> (BY VEENA SAHASRABUDHE)
2. NAND- <https://www.youtube.com/watch?v=GyHQF84kMsY> (BY RAJAN SAJAN MISHRA)
3. BHIGADA- <https://www.youtube.com/watch?v=K0eXpE1OjI4> (BY ASHWINI BHIDE)
4. MARUBIHAG- <https://www.youtube.com/watch?v=kNt9N6O1QDE> (BY SHRUTI SHADOLIKER)
5. KALAVATI- <https://www.youtube.com/watch?v=YoJpW7xB80M> (BY PRABHA ATRE)
6. PATDEEP- <https://www.youtube.com/watch?v=lSuZb20moz4> (BY PRABHA ATRE)
7. KIRVANI- <https://www.youtube.com/watch?v=xrhtPK5-RSM> (BY RASHID KHAN)

Comparative Study of Ragas - IV

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	14	7

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments.

Content

Division of Marks:

(Lasting for 1½ hours per candidate)

(a)	Choice Rag	10 Marks
(b)	Question Rag (Slow Khayal or gat)	10 Marks
(c)	Question Rag in fast Khayal or Gat	10 Marks
(d)	Critical and comparative study of the prescribed Ragas	20 Marks
(e)	Singing one Dhrupad/Dhamar etc.	10 Marks

or

Playing Basic Thekas on Tabla

or

Gats composed in tals other than Trital.

Total = 60 Marks

E-Resources :

1. MALKAUNS- <https://www.youtube.com/watch?v=xv6A5hvCBQk> (BY KAUSHIKI CHAKRABORTY)
2. JOG- <https://www.youtube.com/watch?v=pFsqzKxAtj4> (BY ASHWINI BHIDE)
3. JOG KAUNS- <https://www.youtube.com/watch?v=mUXJu4YjYkY> (BY VEENA SAHASRA BUDDHE)
4. CHANDRA KAUNS- https://www.youtube.com/watch?v=IRj_F5BGMhw (BY PRABHA ATRE)
5. KAUNSI KANADA- <https://www.youtube.com/watch?v=l1uIL24TZZk> (BY PT RAJAN SAJAN MISHRA)
6. TODI- <https://www.youtube.com/watch?v=ctLaRB0pdDk> (BY KISHORI AMONKER)
7. GUJRI TODI- https://www.youtube.com/watch?v=5_TCUuC0NRQ (BY PARVEEN SULTANA)
8. BILASKHANI TODI- https://www.youtube.com/watch?v=qgEcVsU0_Ng (BY MEETA PANDIT)
9. BHUPAL TODI- <https://www.youtube.com/watch?v=dQBTrtP7etk> (BY VEENA SAHASRA BUDDHE)
10. POORVI- <https://www.youtube.com/watch?v=8C-EKDwOIJc> (DHRUPAD BY KAUSHIKI CHAKRABORTY)

Aesthetics and Culture of Music - I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

The following programme will enable the students to:

Acquaint with movement of art and aesthetic thoughts in different historical, cultural, social, political, ideologies and religious context.

Learn the impact of the above mentioned contexts on the expression, aesthetical techniques and languages of art.

Acquaint with the approaches and methodologies that help, understand the work, place and inter relationship of music with other forms of fine arts.

Content -

Section-I

- (a) Art and concept of Beauty
- (b) Application of general principles and ideals of Aesthetics in Music.

Section-II

- (a) Place of Music in Fine Arts
- (b) Interrelationship of Fine Arts

Section-III

- (a) Pictorial aspect of Music

Books-

1. Philosophy of Music : William Pole.
2. Kala aur Sanskriti : Dr. Vasudev Sharan

Aesthetics and Culture of Music - II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcomes:

The following programme will enable the students to:

Acquaint with the movement of art and aesthetical thoughts in different historical, cultural, social, political, ideological, psychological and religious.

Learn the impact of the above mentioned contexts on the expression, aesthetical techniques and languages of art in indian's western form of music.

Acquaint with the approaches and methodologies that help, understand the work, place audience, cultures & beliefs and their relation with music and musicians.

Content -

Section-I

- (a) Importance of Music in human life
- (b) Role of Music in Indian culture with special reference to Philosophical and devotional aspect of Music

Section-II

- (a) Concept of Music in Western World.
- (b) Art appreciation and taste of Music listeners.

Section-III

Rag and Ras

Books-

1. Comparative Aesthetics : K.C. Pande
2. Effects of Music : Max. Schoche and Extern
3. Arts and the Man : Irwin Edman
4. Civilization, Science and Religion : A Righole
5. Form in Music : Stewart Macpherson.

Comparative Study of Ragas - II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	16	8

The following programme will enable the students to:

Attain rigorous practical training of Indian classical music, enabling students to acquire leadership roles in the professional field of music composition, production and performance.

Improvise & perform bandish (composition) into a performance.

Learn techniques for easy, flow in all 3 octaves.

Move a step higher from easy to complex ragas.

Learn fingering techniques of specific instruments.

Content -

Division of Marks:

(Lasting for 1½ hours per candidate)

(a)	Choice Rag	10 Marks
(b)	Question Rag (Slow Khayal or gat)	10 Marks
(c)	Question Rag in fast Khayal or Gat	10 Marks
(d)	Critical and comparative study of the prescribed Ragas	20 Marks
(e)	Singing one Dhrupad/Dhamar etc.	10 Marks

or

Gats composed in tals other than

Trital

Total = 60 Marks

E-Resources

1. BAGESHREE-<https://www.youtube.com/watch?v=4pjfRy7QpRI> (BY ASHWINI BHINDE)
2. DARBARI KANHARA-<https://www.youtube.com/watch?v=oF2hZcbBRIM> (BY VEENA SAHASTRABUDDHE)
3. NAYAKI KANHARA-<https://www.youtube.com/watch?v=XQBSkESiuZI> (BY SHRUTI SHADOLIKER)

History of Indian Music - II

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
5	0	0	5

Learning Outcome

Explore the historical, political and social context of south Indian & North Indian music.

Recognize styles and characteristics of different Gharanas of Indian music.

Learn elementary features of Western Notation System.

Students are able to differentiate between Hindustani and Karnatik music

Recognize styles and characteristics of each genre of Hindustani music.

Identify musicians who contributed to the popularity of Indian music.

Recognize western music symbols and use music terminology to explain their functions.

Content -

Section - I

- (a) General idea of the factors that differentiate Karnatak Music and Hindustani Music.
- (b) Special study of the Trinity of South Indian Music.

Section - II

- (a) The Evolution of Indian and Western Notation Systems.
- (b) Importance of present day electronic gadgets in the field of Indian Music.

Section - III

- (a) Origin and development of Gharanas in Hindustani Music. Role of Gharanas in development and presentation of Music.
- (b) Relevance of Gharanas in present age and the study of important Gharanas of Vocal Music and Instrumental Music.

Books Recommended:

1.	Composers of Karnatak Music	-	Prof. Sambarmurti
2.	Music of India	-	Popley
3.	Music of Hindustan	-	Fox Strangways
4.	Indian Music of the South	-	R. Srinivasan

Advanced Business Laws-I

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

To develop knowledge about the sources of Indian law and the basic legal concepts

To differentiate among offer, agreement and contract

To study the different concepts of bailment and pledge

To deliver knowledge about partnership firms, registration and partnership deeds

To discuss the contract of sales of goods act and its performance

To sensitize students of useful terminologies like price, warranty, guarantee etc.

Note: The paper will contain 3 questions from every section aggregating nine questions. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction to Business Law: Introduction, Meaning and Nature of Law, Sources of Indian Law, Legal Environment of Business, Mercantile Law, Some Basic Legal Concepts, Essentials of Law. Law of contract - Introduction, Objectives, Definition of a Valid Contract, Offer and Acceptance, Capacity to Contract, Consent, Consideration, Performance of Contracts, Discharge of Contracts, Breach of Contract and Void Agreements, Quasi Contracts, Freedom to Contract, Contracts of Guarantee and indemnity - Introduction, Contract of Indemnity, Contract of Guarantee, Kinds of Guarantee, Creditor, Surety.

Section B

Contracts of Bailment and Pledge - Introduction, Bailment and its Kinds, Definition of bailment, Kinds of bailment, Bailor and Bailee, Termination of Bailment, Finder of Lost Goods, Pledge or Pawn, Pledge by Non-owners, Pledgor and Pledgee, Contract of Agency - Introduction, Agent and Agency, Kinds of Agencies, Classification of Agents, Duties and Rights of Agents, Principal's Duties to the Agent and his Liability to Third Parties, Personal Liability of Agent, Termination of Agency, Power of Attorney.

Section C

Law of Partnership: Introduction, Meaning and Nature of Partnerships, Registration of Firms, Partnership Deed, Relations of Partners to One Another, Relations of Partners to Third Parties, Changes in a Firm, Dissolution. Law of sales of Goods - Contract of sale, Goods and their classification, Meaning of price, Conditions and Warranties, Passing of property in goods, Transfer of title by non-owners, Performance of a contract of sale, Unpaid seller and his rights, Remedies for breach of contract.

Learning Outcomes:

Upon completion of the course student will be able to :

Understand business law and related terminologies.

Gain knowledge about partnership firms, registration and partnership deed.

Understand key terms like price, warranty, guarantee.

Suggested Readings:

Tulsian, P.C. (2018). *Business Laws* (3 ed.). New Delhi: Tata Mcgraw Hill Education.

Nolakha, R. L. (2015). *Business Laws* (25 ed.). New Delhi: R.B.D. Publishing House

Kelly, David (2011). *Business Laws* (1 ed.). Routledge Publication.

Suggested E Learning Materials :

Sachdeva, S. (2017, Dec 28). *Nature of contract*. Retrieved from Youtube:

https://www.youtube.com/watch?v=jnNHtCODRFw&list=PLVE_dFhGA23xpZE8CMqm5rIZj5Pftnsli

Advocate Khoj (2012). *Partnership Act 1932*. Retrieved from:

<http://www.advocatekhoj.com/library/bareacts/partnership/index.php?Title=Indian%20Partnership%20Act,%201932>

Khandelwal, P. (2015, Dec 3). *Sale of Goods Act 1930* . Retrieved from Youtube:

https://www.youtube.com/watch?v=fXK7F_W5yJI.

4. Vyas,S.(2017) *Special Contract-Pledge and Bailment* Retrieved from Youtube:

https://www.youtube.com/watch?v=MQR_eqP9IEw

Application Software for Accounting

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

To understand the application of computers in the field of accounting.

To understand the application of Tally ERP 9 as accounting software package

To understand the preparation of books of accounts in MS Excel.

To understand calculation of TDS and file e-TDS return.

Note: The paper will contain three questions from every section aggregating nine questions. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content

Section A

Definition, Characteristics and limitations of computers - Elements of Computers - IT enabled services - BPO, KPO, Call centers. Computerized Accounting: Meaning and Features; An overview of Accounting Information System - AIS and Business organization, Production of Accounting Information - Accounting and System work, Information Concepts & Processing; Accounting procedures and controls in computer environment, Application of Information Technology, Business Applications, Security Measures. Company creation and set-up of accounts in Tally (8.1 or higher version) Startup Tally, Quitting Tally, Creation of a Company, Alteration, deleting, and shut a company - Concepts of Grouping of Accounts - Predefined account groups, display or alter groups.

Section B

Creating Ledger Accounts - Predefined ledger accounts, creation, display, alter and deleting ledger accounts - Inventory - Items, Groups, Units, Creating a single stock group, Creating a multiple stock groups. Preparation of Accounting vouchers and its advanced usages, Types of Vouchers used in Tally, Creation of Voucher type, Types of accounting Vouchers, Accounting Features, Maintaining Bill-wise Details, Cost centre and cost category, interest calculation, Reversing journals and optional voucher, Memorandum Voucher - Inventory vouchers - Delivery note, Physical stock voucher, Purchase order, Sales order, Receipt note, Rejection in, rejection out, stock journal, Stock category, Bill-wise details, Multiple Godowns, Different and actual bill quantity- Working with payroll info menu- payroll configuration and pay head creation- Pay roll vouchers- Payroll reports.

Section C

Preparation of Books of accounts with the help of windows based word processing and spreadsheet application software- Cash book, Bank book, Journal Register, Ledger, Purchase, Register, Sales Register, Display of Trial balance, Manufacturing account, Profit and loss accounts, Balance sheets, Consolidated statements companies/branches. Preparation of bank reconciliation Statement

Analysis of Financial statements in spreadsheet application software - calculating key financial ratios, Cash flow, Preparation of budgets and controlling through variance analysis. Calculation of Capital Budgeting techniques. Calculation of TDS in spreadsheet application software, Generation and Reconciliation of TDS Challans, Filing e-TDS return

Learning Outcomes:

Upon completion of the course student will be able to

Learn usage of Tally ERP 9 for accounting purposes.

Learn usage of MS Excel in maintaining books of accounting.

Procure a job in the field of accounting.

Suggested Readings:

Nadhani, Asok K. (2015), *Implementing Tally. ERP 9* (2 ed.). New Delhi: BPB Publications.

Bodnar, G.H., & Hopwood, W.S. (2012), *Accounting Information Systems* (7ed.). Pearson.

Turner, L., & Weickgenannt, A.B. (2016), *Accounting Information Systems: The Processes and Controls* (3 ed.). John Wiley & Sons.

Smith, G (2011), *Excel Application for Accounting Principles* (4 ed.), Nelson Education.

Suggested E Learning Materials :

Income Tax Department, Govt. of India, E-filing of TDS, Retrieved from <https://www.incometaxindia.gov.in/Pages/tax-services/online-filing.aspx>

Parmar, Amir. (2013, Oct 14), Finance Functions in Excel, Retrieved from <https://www.youtube.com/watch?v=-6ERqkxlcFY>

Gaddam Subramanyam (2014, March 15). How to Learn Tally ERP 9, Retrieved from <https://www.youtube.com/watch?v=wIFdDoYc6Zc>

Das, Mim. (2016, Sep 3). Cash Flow Statement in Excel, Retrieved from <https://www.youtube.com/watch?v=3I4s3Gq9US8>

My eSheet (2016, Oct 1). How to Prepare Trading and Profit & Loss Account in excel spreadsheet, Retrieved from <https://www.youtube.com/watch?v=TgBULNacfGw>

Mangesh, B. (2017, March 26). How to Prepare Vouchers in Tally ERP9, Retrieved from <https://www.youtube.com/watch?v=PnzUiMLtQMk>

Auditing

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

To understand the basic of auditing.

To understand audit planning and implementation of audit programme.

To comprehend various practical aspects like audit note book, audit papers, audit file, audit memorandum.

To understand preparation of audit report and its contents.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction to Auditing - Meaning - Definition - Objectives - Differences between Accountancy and Auditing - Types of Audit - Advantages of Auditing - Preparation before commencement of new Audit - Audit Notebook - Audit Working Papers - Audit Program, Recent Trends in Auditing: Nature & Significance of Tax Audit - Cost Audit - Management Audit. Appointment of Auditor - Appointment of first auditor - Filling of casual vacancy - Ceiling on number of audits - Appointment of auditor of Government company. Auditor's remuneration - Removal of auditors- Qualifications and disqualifications, Powers and duties of auditors, liabilities of auditors. Professional Ethics of an Auditor.

Section B

Audit planning: Engagement letter - Audit programme - Audit note book -Audit papers - Audit work book - Audit contents - Audit markings; Internal Control: Meaning and objectives. Internal control for Sales - Purchases - Fixed assets - Cash - Bank - Pay Roll. Internal Check: Meaning, objectives and fundamental principles. Internal Check as regards: Wage Payments, Cash Sales, Cash Purchases. Internal Audit: - Advantages and Disadvantages of Internal Audit - Differences between Internal Check and Internal Audit. Checking and Vouching: Meaning - Definition - Importance - Routine, Voucher -Types of Vouchers - Vouching of Receipts: Cash Sales, Receipts from debtors, Proceeds of the sale of Investments. Vouching of Payments:

Section C

Cash Purchases, Payment to Creditors, Deferred Revenue Expenditure. Verification and Valuation of assets and liabilities - Differences between vouching, investigation, verification and valuation. Audit of Financial Statements: Receipts - Payments - Sales - Purchases - Fixed assets -Investments - Personal ledger - Inventories - Capital and Reserves - Other assets - Other liabilities. Audit of share capital, Audit of dividends and debentures . Audit of institutions: Partnership, Manufacturing and other Non-trading concerns, Audit of Educational Institutions - Audit of Insurance Companies- Audit of Co-operative societies. . Audit Report: Contents - Preparation of audit report - Fair report - Qualified report.

Learning Outcomes:

Upon completion of the course student will be able to:

Understand importance of auditing.

Comprehend the practical dimensions of audit.

Practically implement an audit programme.

Suggested Readings:

Kumar, R., & Sharma, V. (2015). Auditing: Principles and Practices. (1 ed.). New Delhi: New Century Publications.

Basu, S.K. (2009).Fundamentals of Auditing (3 ed). Noida: Pearson India

Ainapur, V. & Ainapur, M. (2009). Auditing and Assurance (1 ed). New Delhi: PHI Learning Pvt. Ltd.

Gomez, C. (2012). Auditing and Assurance-Theory and Practice (3 ed). New Delhi: PHI Learning Pvt.Ltd.

Suggested E Learning Materials:

Ahmad, A.B. (2014) *The Relationship between Planning of Audit Process and Total Quality Management*. Retrieved from

https://www.researchgate.net/publication/314375321_The_Relationship_between_Planning_of_Audit_Process_and_Total_Quality_Management.

HUB India (2017). *What an Audit is and Types of*

Audit. RetrievedFrom https://www.youtube.com/watch?v=KM_ntoyBYMs

Zuin, S .(2017). *The hidden power of auditing*. Retrieved from

<https://www.youtube.com/watch?v=465Bkxh4uMw>

EsfahaniSmith,E. (2017). *There's more to life than being happy*. Retrieved

From https://www.ted.com/talks/emily_esfahani_smith_there_s_more_to_life_than_being_happy

Business Economics

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

To familiarize students with concepts and analytical tools from micro economic theory that are useful to managers in making decisions at the enterprise level, large, medium, small, tiny and other types.

To aware the students about various concept of demand, production, cost and implication of these concepts in managerial decision making.

To make clarity about the different market structures and price and output determination under different market structures.

To develop the knowledge about the macro economics concepts, national income, circular flow trade cycles

To aware the students about recent trends and policies of Indian Economy.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content

Section A

Basic Economic Problem- Choice and Scarcity- Consumer preferences, Opportunity sets, Optimum choices, Indirect utility demand functions, Income and substitution effects, , Normal versus inferior goods, Types of demand functions, Elasticity, Consumer surplus, Revealed preference Concept of Equilibrium: General Equilibrium v/s Partial Equilibrium.

Section B

Production functions, Types of production functions- Marginal products, Rate of technical substitution, Technical progress, Cost functions, Average and marginal costs, Short run versus long run costs, Economies of scale and scope, Profit maximization, Cost minimization, derivation of input demand- Short Run and Long Run Cost Curve.

Theory of Pricing: The Market and the criteria for market classification, Perfect competition, Main Features, Shutdown point for a perfectly competitive firm, Supply curve, Price determination in perfectly competitive industry. Pure monopoly, Features, causes of origin of monopoly, Equilibrium of monopoly firm. Monopolistic competition, Meaning and features. Oligopoly, features classifying oligopoly situations, Differentiated oligopoly pricing under perfect collusion, Sweezy's kinked model.

Section C

National Income - Concept and Measurement - GDP - GNP - Different forms of national income accounting: Social accounting, flow of funds accounting and balance of payments accounting- Difficulties in the Measurement of National Income - Social Accounting - Presentation of Social Accounts - Importance of Social Accounting - Difficulties in Social Accounting. Concept and Recent Trends in Indian Economy (An Overview). Monetary Policy, Fiscal Policy, Foreign Trade Policy, Exchange Rate Policy

Learning Outcomes:

Upon completion of the course student will be able to :

Understand macroeconomic environment and its implications on decision making.

Understand role of economic theory in managerial decision making.

Learn about concept of demand, production and cost.

Accurate business decisions.

Understand the macro economics concepts and its impact on business

Suggested Readings:

Ahuja, H. L. (2014). *Advance Economic Theory* (8 ed.). New Delhi: Sultan Chand & Sons.

Diwedi, D. N. (2015). *Managerial Economics* (8 ed.). New Delhi: Vikas Publications.

Mehta, P. L. (2016). *Managerial Economics, Analysis, Problems, and Cases* (10 ed.). New Delhi: Sultan Chand & Sons.

Varshney, R. L., & Maheshwari, K. L. (2014). *Managerial Economics* (22 ed.). New Delhi: Sultan Chand & Sons.

Gupta G. S., Paul S, Mote V.L. (2007). *Managerial Economics Concepts & Cases* (1 ed.)Tata Mc Graw Hill Publication.

Suggested E-Learning Materials:

Agrawal, D. (2017, Mar 8). *Indifference Curve*. Retrieved from Youtube:
https://www.youtube.com/watch?v=3l_rYca4eio.

econ (2012). *Cost*. Retrieved from: Guide:<http://www2.econ.iastate.edu/classes/econ301/jintanakul/Notes/Ch7.pdf>

Khan, Y. (2014, Dec 18). *Production Function* . Retrieved from Youtube:
<https://www.youtube.com/watch?v=MwuTt3L2hEQ>.

Bhogal, S. (2018, June 04). *Income and Cross Elasticity*. Retrieved from Youtube:
<https://www.youtube.com/watch?v=i7O4CwiwrY>.

5. [Dani, S. \(2016, Nov 20\). A Research Paper on an Impact of Goods and Service Tax \(GST\) on Indian Economy. Retrieved Jan 9, 2019, from www.omicsonline.org: https://www.omicsonline.org/open-access/a-research-paper-on-an-impact-of-goods-and-service-tax-gst-on-indianeconomy-2151-6219-1000264.php?aid=82626](https://www.omicsonline.org/open-access/a-research-paper-on-an-impact-of-goods-and-service-tax-gst-on-indianeconomy-2151-6219-1000264.php?aid=82626)

[Gangwani, K. \(2011, April\). Emerging Trends in Indian Capital Market. Retrieved March 1, 2019, from www.nevillewadia.com: http://www.nevillewadia.com/images/Cronicle2011/Miss.%20Kiran%20Gangwani_FIN_40-45.pdf](http://www.nevillewadia.com/images/Cronicle2011/Miss.%20Kiran%20Gangwani_FIN_40-45.pdf)

[RBI. \(n.d.\). Monetary Policy. Retrieved Feb 28, 2019, from www.rbi.org.in: https://www.rbi.org.in/scripts/FS_Overview.aspx?fn=2752](https://www.rbi.org.in/scripts/FS_Overview.aspx?fn=2752)

Financial Institutions and Markets

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

To develop the knowledge about financial market and financial system and its relation with economic development

To understand the theoretical concepts underlying money market, capital markets, financial instruments etc.

To understand the role of development banks, NBFIs and their role in financial system.

To gain the insight about financial services, fund based and non fund based services.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction: Nature and role of financial system; financial system and financial markets; Financial system and economic development; Indian financial system-an overview.

Financial Markets: Money and capital markets; Money market- meaning, constituents, functions of money market; Money market instruments - Call money, Treasury bills, Certificates of deposits , Commercial bills, Trade bills etc.; Recent trends in Indian money markets;

Section B

Capital-market-primary and secondary markets; Depository system; government securities market; Role of SEBI-AN overview; Recent developments.

Development Banks: Concept, Objectives, and functions of development banks; Operational and promotional activities of development banks; IFCI, ICICI, IDBI, IRBI, SIDBI, NABARD; State Development Banks, State Financial Corporations.

Section C

Unit Trust of India: Objectives, functions and various schemes of UTI; Role of UTI in industrial finance. Mutual Funds: Concept, performance appraisal and regulation of mutual funds (with special to reference to SEBI guidelines); Designing and marketing of mutual funds schemes; Latest mutual fund schemes in India- an overview.

Non-Banking Financial Institutions: Concept and role of non-banking financial institutions; Source of Finance; Functions of non-banking financial institutions; Investment policies of non banking -financial institutions in India. Merchant Banking: Concept, functions and growth; Government policy on merchant banking services; SEBI guidelines; Future of merchant banking in India.

Learning Outcomes:

Upon completion of the course student will be able to :

Develop capacity to work within financial institutions.

Develop practical knowledge about Money market and capital market.

Understand the concept of development banks and non banking financial institutions.

Suggested Readings:

Saha, S. (2017) *Indian Financial Systems and Markets (1 ed)*. McGrawHill Education, New Delhi.

Gupts, S, Aggarwal, N., Gupta, Neeti. (2015) *Financial Institutions & Markets (1 ed)*. Kalyani Publishers, New Delhi.

Singh, P. (2017) *Dynamics of Indian Financial System-Markets, Institutions & Services (3 ed)* . Ane Books Pvt Ltd, New Delhi.

Suresh, P. (2017) . *Management of Banking and Financial Services (2 ed)*. Pearson, New Delhi.

Suggested E Learning Materials :

1. Kothair, M. (2016) *Capital Market and Money Market*. Retrieved from <https://www.youtube.com/watch?v=0bDygBciD>

Waghamare, S. and Kumar, S. M. (2015) *Performance evaluation of merchant banking in India*. Retrieved from <http://epratrust.com/articles/upload/23.Dr.%20Waghamare%20Shivaji%20%20&%20Mr.%20Sandeep%20Kumar%20M.pdf> .

Meenakshi, Yadav, M. (2016) *A Critical Analysis of Indian Mutual Funds Sector: A Case Study of Unit Trust of India (UTI) Mutual Fund, Bank of India (BOI) Mutual Fund and Tata Mutual Fund*. Retrieved from https://www.researchgate.net/publication/296752070_A_Critical_Analysis_of_Indian_Mutual_Funds_Sector_A_Case_Study_of_Unit_Trust_of_India_UTI_Mutual_Fund_Bank_of_India_BOI_Mutual_Fund_and_Tata_Mutual_Fund

Indian Ethos and Culture

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

To assimilate Indian ethos and values relevant for management development.

To understand the main characteristics of Indian Society and Culture: unity, diversity, change, dissent, continuity, learning society and resilience.

To generate management wisdom through Indian folk lores, proverbs and local idioms

To understand the Indian models of holistic person - OSHA, Corporate Rishi, VEDA Model society and their implications for modern managers.

5. To empower women students to managerial approaches in conformity with Indian ethos/realities.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content :

Section A

Rationale for studying Indian ethos, Overcoming cognitive dominance, Concept of Indian ethos and culture, Indian cultural traditions, Indian folk lores, proverbs and local idioms as a source of management, Insights for commerce from Panchtantra stories.

Concept of Yin Trinity and implications, Vivekananda's ideas on Vedant, Concept of Purusharth, Karma Yog, Basket of needs, Harm minimization & harmonization, Commerce principles in Kautilya's Arthshastra.

Section B

Character competence, Values & ethics, Value categorization, Panchmukhi Vikas, Dada Bhai Naoroji's Drain theory, Brain Drain and economic implications, Integrative intelligence as a solution to VUCA.

Section C

Indian models of holistic approach - OSHA, VEDA Model, Indian tools of creativity: Techniques for mind liberation, Arrival of best: A foundation principle for human values.

Indian ethics & the spirit of development, Business Systems in Ancient India, Business ethos & the concept of ShubhLabh, Spiritually guided materialism, Bharatiya Model of Financial Literacy.

Learning Outcomes:

Upon completion of the course student will be able to :

Understand ancient Indian spiritual teachings.

Develop value oriented approach in life.

Develop capacity to deal with women issues.

Suggested Readings:

Sharma, S. (1996). *Management in New Age: Western Windows, Eastern Doors (2 ed.)*, New Age International Publication.

Sharma, S. (2007). *New Mantras In Corporate Corridors From Ancient Roots To Global Routes (2 ed.)*. New Delhi: New Age Int. Pvt. Ltd.

Dasgupta, Ajit K. (1993). *A History of Indian Economic Thought* (1 ed.). London and New York: Routledge history of economic thought series.

4. Sharma, S. (2013). *Wisdom & Consciousness from the East: Life Living & Leadership* (2 ed.). Bengaluru: IBA Publications.
5. Dave, N.V. (1997). *Vedanta and Management: Relevance of Vedantic Concepts in Modern Management Practices* (3 ed.). New Delhi: Deep & Deep Publications.

Suggested E-Learning Materials:

- Joshi, A. (2018, Jan 3). Indegeneous Management System an introduction. Retrieved Feb 12, 2019, from [www.youtube.com: https://www.youtube.com/watch?v=q5K2Hff85MM](https://www.youtube.com/watch?v=q5K2Hff85MM)
- Joshi, A. (2016, Dec 7). Management from Bhagwad Geeta :A Few Insights. Retrieved Feb 18, 2019, from Shastriya Prabandhan - A Bharatiya Design Thinking Approach to Education and Management: <http://ankurjoshi.in/bhagwad-gita-management/>
- Sharda, N. S., & Bindlish, P. K. (2017). Managing VUCA Through Integrative Self-Management. Retrieved Feb 24, 2019, from [books.google.co.in: https://books.google.co.in/books?id=vKnNDgAAQBAJ&pg=PA325&lpg=PA325&dq=Integrative+intelligence+as+a+solution+of+VUCA&source=bl&ots=P7PmomwwA0&sig=ACfU3U3zkWF2mhFm4a5wa8ufS1ArFgkwrq&hl=en&sa=X&ved=2ahUKEwjoppKSOPgAhUWiHAKHbO3AgQ4ChDoATAAegQIChAB#v=onepag](https://books.google.co.in/books?id=vKnNDgAAQBAJ&pg=PA325&lpg=PA325&dq=Integrative+intelligence+as+a+solution+of+VUCA&source=bl&ots=P7PmomwwA0&sig=ACfU3U3zkWF2mhFm4a5wa8ufS1ArFgkwrq&hl=en&sa=X&ved=2ahUKEwjoppKSOPgAhUWiHAKHbO3AgQ4ChDoATAAegQIChAB#v=onepag)
- Sharma, S. (1999, Oct 1). Corporate Gita: Lessons for Management, Administration and Leadership. Retrieved March 1, 2019, from [journals.sagepub.com: https://journals.sagepub.com/doi/10.1177/097168589900500203](https://journals.sagepub.com/doi/10.1177/097168589900500203)
- Sharma, S. (2006, Jan). Management In New Age: Western Windows Eastern Doors. Retrieved Feb 21, 2019, from [www.researchgate.net: https://www.researchgate.net/publication/304935846_Management_In_New_Age_Western_Windows_Eastern_Doors](https://www.researchgate.net/publication/304935846_Management_In_New_Age_Western_Windows_Eastern_Doors)
- Sanskriti Culture (2013, Aug 12). Swami Vivekananda Chicago Speech on 15th September, 1893. Retrieved Jan 5, 2019, from [www.youtube.com: https://www.youtube.com/watch?v=TIwZNmgFBWM](https://www.youtube.com/watch?v=TIwZNmgFBWM)

International Business and Finance

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Course Objectives:

To understand the concept of business environment, globalization and International trade.

To study the roles of International economic Institution and International financial management

To understand the concept of Balance of payment and FOREX market.

To understand the trading concept of direct and indirect quotation of currency.

Note: The paper will contain three questions from every section aggregating nine questions. In any one of the sections, there will be a 'case study problem' which will be compulsory for the candidates. Candidates are required to attempt total of six questions, taking at least one question from each section.

Course Content:

Section A

Introduction: International Business - Importance, nature and scope; Globalization; Drivers of Globalization. Basic Entry Decisions; Modes of entry into international business, selecting an Entry Strategy; IT and international business, India's involvement in International Business. International Business Environment: Political, Legal, Economic and Cultural environment and associated risks; Framework for analyzing international business environment.

International Trade: Reasons for international trade; Theories of international trade; Foreign trade multiplier; World trading environment - Pattern and structure of world trade in goods and services;

Section B

Government intervention in International Trade: Arguments for Government intervention; Instruments of Commercial Policy: Tariffs, quotas and other measures and their effects. World Trade and Protectionism: GATT, The Uruguay Round, WTO, Evaluation of WTO, Important Agreements of WTO - Agriculture Agreements; SPS, TBT, GATS, TRIPS; WTO and Developing Countries, WTO and India.

International Economic Institutions and Financial Environment: IMF, World Bank, UNCTAD, International commodity trading and agreements - India's involvement and consequences; International Financial Environment: International Monetary System; Exchange rate mechanism and arrangement; Types of Exchange rate systems in the world; International money and capital markets; Movements in foreign exchange and interest rates. Foreign Direct Investment: Types of FDI; Theories of FDI, Cost and Benefit of FDI to Host and Home Countries, Government Policy Instruments and FDI, Trends in FDI.

Section C

Introduction: Growing importance of international finance, costs of international investment crisis & contagion. Balance of Payments-current account, capital account, official reserve account, the J curve, forex reserves-costs and benefits. BOP trends in major countries, persistent current account deficits & surpluses among nations (Global Imbalances) & their repercussions. Shifting global dominance of the U.S.A., growing importance of a unified Europe and emerging Asia.

International Financial Markets: Forex Markets; spot market, direct & indirect exchange quotations, bid ask spread, cross exchange rates, forwards, futures & options market. International money markets, international credit markets, international bond markets & international stock markets. Regulatory asymmetry & its implications. Exchange Rate Determination & Forecasting: Measuring exchange rate movements & volatility, factors influencing exchange rates, Government intervention-direct & indirect intervention and sterilized & non-sterilized intervention

Learning Outcomes:

Upon completion of the course student will be able to :

Understand business environment and globalization affect.
Understand the working of International economic Institution.
Develop capacity to advice and guide in FOREX market.
Procure jobs as currency strategist and analyst.

Suggested Readings:

Cherunilam, F., (2011) International Business Text and Cases (5 ed). PHI, New Delhi.
Daniels, Jhon D., Radebaugh, Lee H. Sullivan, Daniel P. and Salwan,P., (2017) International Business: Environment and Operations (15 ed), Prentice Hall, New Delhi.
Shapiro, A., (2014) Multinational Financial Management (10 ed), Prentice Hall, New Delhi.

Suggested E Learning Materials :

Sharma, M. & Mittal, R. (2015) *An Effective analysis on Status of International Trade Polices in India*. Retrieved from <http://www.ijecbs.com/July2015/20.pdf> .

Tucci,L.A.(2013) The General Agreement on Tariffs and Trade (GATT): Implications for Consumer Products Marketing. Retrieved from <https://www.emeraldinsight.com/doi/abs/10.1108/07363769610107383>

Shivkuamr.M., & Moses L.J.P.,(2016) *Impact of FDI With Reference to Indian Retail Sector*. Retrieved from http://ijariie.com/AdminUploadPdf/Impact_of_FDI_with_reference_to_Indian_Retail_Sector_C_1116.pdf .

Goyal M. (2015) *Foreign Exchange Markets, Intervention and Exchange Rate Regimes*.Retrieved from <http://www.igidr.ac.in/pdf/publication/WP-2015-011.pdf>

Techniques of Studying Human Development and Scientific Writing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Appraise various methods and techniques of studying and researching in human development

Prepare, implement and evaluate tools appropriate in context of the Human Development discipline

Write correct in text citations and complete references in approved style(s)

Communicate effectively with a range of audiences

Get proficiency in scientific writing for different types of publication

Syllabus:

Section A

Human Development study: Time span approach – longitudinal, cross sectional and sequential approach, ethnographical approach, life span approach – Birth to old age

Methods of Studying Growth and Body Size– Significance of Anthropometric measurements – Height, Weight, Mid upper arm circumference, Skin fold thickness, Head and Chest circumference, Waist and Hip circumference

Psychological Test –ways of constructing a good psychological test and steps for standardization, limitations and ethical considerations in testing

Personality Assessment – Purpose and developmental procedures,

Projective Techniques – importance and limitations

Planning and execution of symposium, seminars, workshops and panel discussion

Section B

Different tools to measure human attributes: importance, construction and administration, advantages and disadvantages - Observation schedule, Interview, Questionnaire, Case history

Scaling Techniques and construction: (The summated Rating, The Likert- type scale, The Thurstone Equal- Appearing Interval Scale, Guttman Scaling, The Semantic Differential Technique, The Bogardus Social Distance Scale)

Assessment of Attitudes – Types and uses (Batteries and specific subject test, attitudes of various persons towards various social issues)

Measurement of Social Development – Sociometric method and sociogram

Emotional intelligence and competencies – Uses and limitations

Section C

Scientific writing as a means of communication:

Important points in scientific writing (brevity and precision in writing, drafting and redrafting based on critical evaluation)

Writing for : Articles in journals, Research notes and reports, Review articles, Monographs, Dissertation, Bibliographies, Book chapter and articles, Book review

Outlining a research proposal (Introduction, review of literature, significance of study, operational definition of terms and concepts, delimitations of study, basic assumptions/hypothesis, sampling, tool and procedure of collecting data, analysis technique, references)

Writing for Grants:

Writing proposal (empirical and theoretical framework presenting pilot study/ background information, time frame budgeting, available infra-structure and resources, appraisal feedback and follow-up procedure)

Presentation of report and executive summary

Preparing C.V., facing interview and group discussion

References :

Aylward, G. (1994). *Practitioner's Guide to Development and Psychological Testing*. New York: Plenum Press.

Bamji, M.S. Rao, P.N. & Reddy, V. (Ed.). (1996). *Textbook of Human Nutrition*. New Delhi: Oxford and IBH Publishing CO. Pvt. Ltd.

Berk, L.E. (2006). *Child Development*. New Delhi: Prentice Hall.

Glatthorn, A.A. & Joyner, R.L. (2005). *Writing the Winning Thesis or Dissertation: A Step by Step Guide* (2nd ed.). California: Corwin Press.

Hayes, N. (Ed.) (1997). *Doing Qualitative Analysis in Psychology*. Hove: Psychology Press.

Loke, I.F., Spirduso, W.W. & Silverman, S.J. (2007). *Proposals that Work: A Guide for Planning Dissertation & Grant Proposals* (5th ed.). New Delhi: Sage Publication.

Santrock, J.W. (1998). *Child Development* (8th ed). New York: Mc.Graw Hill.

Saraswathi, T.S. & Kaur, B. (1993). *Human Development and Family Studies in India*. New Delhi: Sage Publications.

E-Resources:

शैक्षिक मूल्यांकन 14MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxb2lRelA1Mk5za>

Social Research Methods 5MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxQk5yOWpXdUl>

Techniques of Studying Human Development and Scientific Writing Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

- 1) Construction of different tools of assessment -
 - (i) Observation Schedule
 - (ii) Interview Schedule
 - (iii) Questionnaire
 - (iv) Rating scale
 - (v) Check list
 - (vi) Sociometry and sociogram
 - (vii) Case study Manual
- 2) To review articles from journals, magazines, news papers, chapter from books
- 3) Preparation of thesis abstracts
- 4) Writing articles for journals, magazines, news papers, books and monographs
- 5) Outlining a research proposal

Theories of Human Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Describe a theory, need for theory, different perspectives and approaches

Equipped with knowledge regarding general issues of different theories and their classification

Design practical applications of different theories

Critically analyze theories in relation to various aspects of human development

Syllabus :

Section A

1. Theory : Meaning, Definition, Importance of theory.
2. Brief Introduction to different perspectives and approaches of personality
3. Psychoanalytic theory of Sigmund Freud
4. Psychoanalysis and Neo Freudians
 - (a) Carl Gustav Jung – Analytical Psychology
 - (b) Alfred Adler – Individual Psychology
 - (c) Psycho – Social theory of Erick H. Erickson

Section B

1. Research Oriented theory of personality –
 - (a) Gordon W. Allport - Trait theory
 - (b) Henry H. Murray – Need theory
2. Humanistic and Existential psychology
 - (a) Carl R. Rogers – self actualization theory
 - (b) Abraham Maslow - self actualization theory
 - (c) Curt Lewin - Field theory

Section C

1. Learning theories -
 - (a) Pavlov - Classical conditioning
 - (b) B.F. Skinner - Operant Conditioning
 - (c) Bandura – Observation Learning
2. Cognitive and Moral development
 - (a) Jean Piaget – Theory of cognitive development
 - (b) Vygotsky - Socio cultural perspective
 - (c) Bruner – Cognitive psychology, Kohlberg -theory of moral development

References :

Allen, B.P. (2000). *Personality Theories Development Growth and Diversity* (3rd ed.). Boston: Ally & Bacon.

Baldwin, A.L. (1967). *Theories of Child Development*. New York: Willey & Sons.

- Bigge M.L. (2003). *Learning Theories for Teachers*. New York: Harper & Row Publishers.
- Bischof, L.J. (1970). *Interpreting Personality Theories*. New York: Harper and Row Publishers.
- Ewen, R. & Ewen, R.B. (2014). *An Introduction to Theories of Personality (4th ed.)*. New Jersey: Lawrence Erlbaum Associates Publishers.
- Hjelle, L.A. & Ziegler D.J. (1992). *Personality Theories: Basic Assumptions, Research and Application*. Auckland: McGraw Hill, International Book Company.
- Hilgard, E. R. & Bower, G. H. (1966). *Theories of learning*. NJ: Englewood Cliffs.
- Phares, E.J. (2009). *Introduction to Personality*, Boston: Scott Foresman and Company.
- Tarpy, R.M. (1997). *Contemporary Learning Theories and Research (vol.1)*, New York: Mc Graw Hill.

**Advanced Study in Human Development:
Conception to Childhood**

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Gain knowledge of various aspects and concerns of development with special focus from conception to middle childhood stages

Get insight into contemporary issues related to these stages

State various customs and ceremonies in Indian communities related to prenatal, birth and infant care

Analyze and effectively deal with developmental and adjustment issues from conception to childhood stages

Syllabus :

Section A

History of Human Development

Genetic Foundation of Development – Principles of genetics, cross-over and gene – mutation

Hereditary diseases/gene linked syndromes

Genetic counseling – need, essential qualities of genetic counselor.

Assisted reproduction – In vitro fertilization and test tube baby, surrogate mothers – legal & ethical issues

Factors causing infertility

Recapitulation of stages in prenatal development, genetic and environmental factors

Section B

1. Infancy

Early Infancy :

(a) Initial capacities and the process of change

(b) The achievements of the first years

Sensory and perceptual development

Intellectual Development: Piaget's perspective and other recent perspectives

Emotional and social development and concept of attachment

Foundation of language development

2. Early childhood

Transition from infancy to childhood

Social development and development of self concept

Emotional and moral development

Process of language acquisition

Development of cognitive abilities

Section C

1. Middle Childhood

Biological attainments of middle childhood

Social and emotional development; fear, anxiety and stress

Intellectual & Cognitive changes

Development of value system in cultural context

2. Other issues during middle childhood

Health and illnesses during childhood

Child's sexual abuses

Impact of media and school

Development of academic skills

Changing relationship with parents and new sense of self

Reference :

Berk, E.L. (1996). *Child development*. New Delhi: Prentice Hall.

Cole, M. & Cole R. Sheila (1996). *The Development of children* (3rd ed.) NK: W.H. Freeman and Company.

Helen Bee (2000). *Developing Child* (9th ed.). Boston: Allyn & Bacon.

Santrock, J. W. (1998). *Child Development* (8th ed.) NY: McGraw Hill.

Stewart, A.C. & Friedman S. (1987) *Child Development, Infancy through Adolescence*. NJ: Wiley International Education.

**Advanced Study in Human Development:
Conception to Childhood Lab**

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Collecting information regarding birth related customs and ceremonies in different communities
2. Indian practices during pregnancy
3. Care and adjustments (physical, emotional, psychological) during post partum period
4. Perception of different groups/cultures on Infant care and development
5. Compiling 'Norms' of development for Infants and children.
6. Testing and assessment of Infants:
(a) Reflexes (b) Intelligence (c) Attachment (d) Anthropometric measurements
7. Stimulating activities for Infants and children to promote following development -
(a) Physical (b) Motor (c) Socio Emotional (d) Language (e) Cognitive
8. Planning leisure time activities for children

Statistical Methods in Human Development

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Discuss the significance of statistics in the discipline of Human Development

Describe basic concepts of statistical inferences and test of significance

Apply the appropriate statistical technique for analysis and interpretation of data

Syllabus :

Section A

1. Statistics: Meaning, importance, scales of measurement, conceptual understanding of appropriate statistical methods, and limitations of statistics techniques
2. Role of Statistics in Human Development discipline
Classification and tabulation of data, discrete and continuous variables, diagrammatic presentation of data
Frequency distribution, Histogram, frequency Polygon and Ogive (percentiles, quartiles, deciles)
3. Measures of Central tendency – Arithmetic Mean, Weighted Mean, Median, Mode
(Properties, merits, demerits and uses of different central tendency measures)
4. Measures of Variability – Range, Mean Deviation, Quartile, Deviation, Standard Deviation
5. Skewness and Kurtosis

Section B

1. The formal and empirical concepts of Probability
 - Binomial distribution
 - Properties of Normal probability curve and its applications.
2. Concept of Parametric and Non parametric tests
 - Testing hypotheses – One tailed and two tailed tests
 - Type I and Type II errors
 - level of significance, degree of freedom
3. Test of significance of mean and other statistics

Section C

Parametric tests

1. Significance of difference between means – application of student ‘t’ test for small samples, paired ‘t’ test
2. Z test for difference between means (Independent and Correlated groups)
3. Analysis of variance: One way and two way classification
4. Correlation: Product moment and Rank correlation

Non Parametric tests

1. Chi-Square test - Goodness of fit, independence of attributes (contingency tables)
2. Other non parametric test Mann Whitney’s test, Sign test, Kruskal Wallis test

References :

- Garett, H.E. & Woodworth (2004). *Statistics in Psychology & Education* (11th Ed.). Bombay: Vakil, Feffer and Simon.
- Gupta, S.P. (2000). *Statistical Methods*. New Delhi: Sultan Chand & Sons.
- Healey, J. F. (2014). *Statistics: A tool for social Sciences. Descriptive statistics*. New Delhi: Sage Publishers
- Mangal, S.K. (2002). *Statistics in Psychology and Education*, (2nded). New Delhi, India: Prentice Hall.
- Mendenhall Beaver (2013). *Introduction to probability and statistics* (8th Ed). Boston: PWS-Kent, Publishing Company.
- Pagano, Robert. R, (1990). *Understanding Statistics in Behavioral Sciences*. (3rd Ed). New York: West Publishing Company.
- Wright, S.E. (1986). *Social Science Statistics*. Boston: Allyn and Bacon Inc

Early Childhood Care and Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Describe historical development, aims and principles of early childhood care and education

Discuss social issues and need for involvement of parents in ECCE

Identify types of services available related to early childhood care and education in other countries and in India

Plan programmes, design materials and activities for normal as well as special need early childhood children

Implement programmes in mock situations and evaluate them

Syllabus :

Section A

Early child care and education: Nature, needs, aims and objectives

Brief historical background- John Lock, Rousseau, Pestalozzi, Froebel, Maria Montessori, John Dewey, Lev Vygotsky, Rabindranath Tagore, Gandhiji, Giju bhai & Tarabai Modak

Current Issues in early childhood education - popularity, public interest, families & ECE readiness, terminology of ECE

Views about children: Miniature adults, the competent child, child as a sinful, blank tablet, growing plant, property investment in future, children as person with rights, children as potential persons

Contemporary social issues – working parents, rising incomes, single parents families

Paradigm shift in ECE: family centered

Section B

Child care: Meeting the needs of parents & children

Types of child care: Full service, child care family and relatives, family day care, before & after school care, Head start programme, latchkey children

Characteristics of quality child care programme –

Child related characteristic

Provider related characteristic

Facility related

Qualities and characteristics of ECE professionals

Parent involvement in ECCE: Meaning approach, methods and problem

Section C

Play –Types, Importance, play as teaching strategy, Play and creativity, play and disadvantaged, socio – dramatic play, play therapy

a) Indoor & outdoor, play, block play, water play, puzzles, sand toys

Routine and scheduled activities for ECC - goals, significance, objectives, teacher's role related to-

Personal skills - health hygiene, Nutrition & food

Socio-emotional skill – Myself and other people, mannerism

Sensory experiences – Smell, taste, texture, touch, sound and pitch

Planning activity areas

Reference Books:

Brewer, J.A. (1998). *Introduction to Early Childhood Education* (3rd ed.). Boston: Allyn & Bacon.

Grewal, J.S. (1984). *Early Childhood Education*. New York, NY: Macmillan.

Hildebrand, V. (1985). *Guiding Young Children*. New York, NY: Macmillan.

Kaul, V. (1997). *Early Childhood Education Programme*. New Delhi: NCERT.

Morrison, G.S. (1988). *Education and Development of Infants, Toddlers and Preschoolers*. United States, US: Scott Foresman & Co.

Morrison, G.S. (2018). *Early Childhood Education Today* (14th ed.). United Kingdom, UK: Pearson.

Pankajam, G. (1994). *Preschool Education*. Ambala: Indian Pub.

E-Resources:

पाश्चात्य शैक्षिक विचार व विचारक 4MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxQmJYQXJhVkJYW>

अध्यापन—अधिगम तथा मूल्यांकन 2MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxSlg1d2RoafRzYjg>

पाठ्यचर्या तथा अनुदेश 17MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxejNMUFZxbTl6MGc>

अधिगम के लिए मार्गदर्शन 6MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxRXNHR011T3JWaF>

Early childhood development and cognitive development

<https://www.pdfdrive.com/early-childhood-development-and-cognitive-development-e63805631.html>

Early childhood development and cognitive development in developing countries

<https://www.pdfdrive.com/early-childhood-development-and-cognitive-development-in-developing-countries-e124334421.html>

Early Childhood Care and Education Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

Visits of various centers (day care centre, Balwadi, Anganwadi)
Preparing a resource unit file on the basis of play way method
Preparing teaching material kit and presentation in mock set up
 Story
 Types of puppets
 Art and craft portfolio
 Song booklet and low cost musical instruments
 Readiness games and material
 Picture talk object talk
Preparing a programme of activities for children with special abilities
Planning and executing activities in ECCE Centre
Role plays of home visit and conducting a home visit
Planning and conducting a parent teacher meeting

Adolescence and Youth

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain different developmental aspects and characteristic features of adolescence

Get better insight into the specific issues, concerns and problems of adolescents

Plan and design effective programs to help youths in difficult circumstances

Syllabus :

Section A

Understanding Adolescents behaviour and Development

Introduction to adolescence - Different views

Transition from childhood to sexual maturity and psychological impact of transitional events

Physical and sexual development – Puberty, development of primary and secondary sex characteristics, Gender differences, sexuality and sex education

Cognitive development – Formal operational stage of Piaget's theory and Information processing approach

Moral development - Kohlberg's references

Social and emotional development : Interpersonal relation, influences of family & peers, conflict with authority and emotional competence

Section B

Development of the self-different perspectives, construct of self and identity formation

Development of self concept & self esteem.- Impact of family, peer group, school & culture on the development of self

Approaches to self enquiry, role of childhood experiences and memories

Self enhancement techniques

Indian views on adolescents identity

Section – C

Adolescents & Youth at risk -

Vocational aspiration & opportunities, education & career problems

Problem issues - Infatuation, Sex, marriage

Health issues during adolescence

Deviant sexual behaviours and STD's

Fantasies and obsession, depression, suicide, delinquency, violence & aggression, drug abuse

Stress & Strains

Helping youth: Prevention, intervention, rehabilitation and environmental consideration

References:

Balk, D. E. (1995). *Adolescence Development*. New York, N.Y: Brooks/Cole.

Cobb, N. (1998). *Adolescence: continuity, change and diversity*. Houston: Mayfield publishing.

Ingersoll, G. M. (1989). *Adolescents* (2nded.) Englewood Cliffs N.J: Prentice Hall.

Sharma, N. (1999). *Understanding adolescence*. New Delhi: National Book Trust.

Adolescence and Youth Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

Identifying contemporary problems of adolescents

Plan Programmes for identified problems of adolescents

Preparing materials for creating awareness in adolescents for managing their problems

Identification of problems of adolescents & youth; written/oral presentation / role play of solutions of any three problems:

Behavioural changes

Sexuality

Gender differences

Pubertal changes

Personality disorders/problems

Fantasies

Obsessions

Depression

Suicides

Delinquency

5. Planning workshops for adolescents and youth on:

Vocational aspirations and opportunities

Academic problems

Career problems

Health issue

Sex education

Deviant sexual behavior

STD'S and HIV

Contemporary Issues and Concerns in Human Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain the current trends, issues related to various aspects of human development

Interpret the research trends related to various issues and aspects of human development

Identify and reason out contemporary burning issues affecting family

Summarize the role of advocacy in promoting issues and concerns related to human development

Syllabus :

Section A

1. Issues in the studies of Human Development

Cultural variation

Ethical issues

Role of culture : Cultural transmission and intergenerational relations

Cultural differences in parental style

Demographical statistics. Birth and neonate, infancy, early childhood year, adolescence, old age, exceptional children

Section B

2. Research Trends

Current research & trends of last five years: infancy, early childhood years, late childhood, adolescence, adulthood and old age

Gender issues

Section C

3. Contemporary burning issues affecting family

Rising divorce rates

Rising age of marriage and its consequences

Remarriage

Harassment at work place

LGBT Rights

Gender Identity

Reference : Students are expected to refer latest books, current journals, magazines reports and surf websites

Contemporary Issues and Concerns in Human Development Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

Since, the students are expected to get acquainted with various contemporary issues of the society, practicals related to collection of literature, preparation of monographs, writing articles, planning strategies for reduction or alleviation of problems of burning issues will be conducted.

Persons with Special Needs

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Identify special need persons and assess their problem

Identify and classify the needs of special persons

Differentiate causes, effect and special services required for each category

Evaluate programmes, policies, and institutions of special need persons

Section A

Various terminologies related to children with special needs; meaning, definition and significance of the terms

Classification, needs and rights of children with special needs

Special Education for children with special needs—principles, objectives and philosophy of teaching

Integrated v/s. Segregated approach

Concept of rehabilitation and mainstreaming and its need

Guidance of children with special needs

Section B

Visual impairment - various anomalies, characteristics of visually impaired and special education

Hearing impairment – classification, causes and effect on individual, characteristics, special education

Speech and language defects – causes and effects on individual problems and special education

Orthopaedically handicapped – various crippling conditions, causes and effects on children and special education

Section C

Learning disability – causes and effects on individual, types, problems, possible remedies and special education

Intellectual exceptionality

Giftedness – characteristics and special education

Mental retardation – classification, causes and effects on individual, problems in learning, special education

Children with emotional disturbance, social maladjustment and juvenile delinquency

References :

Berdins, W. H. & Blackhorst, A. Ed. (1985). *Introduction to Special Education* (2nd ed.). New York : Harper Collins.

Bullock, Lyndal. M. (1989). *Exceptionalities in children and youth*. Boston : Allyn and Bacon.

Dale, N. (1996). *Working with families of children with special needs*: London.

Heward, W. L. & Orlansky, M. D. (1992). *Exceptional children: An introductory survey of special education*. (4th ed.). New York: Maxwell Macmillan.

Kirk, S. A. & Gallagher, J. J. (2012). *Educating exceptional children* (13th ed.). Boston : Cengage learning

Mangal, S.K. (2009). *Educating Exception Children: An introduction to Special Education*. New Delhi : PHI Learning.

Orlansky, D. & Heward W.L. (1988). *Exceptional children; an introductory survey of special education* (4th ed.). New York: Merrill. Routledge.

Swanson, B. M. & Willis, D. (Eds.). (1979). *Understanding exceptional children and youth*. Chicago: Rand McNally College Publishing Co.

Tinbergen, N. & Tinbergen, E.A. (1983). *Autistic children: new hope for a care*. Boston: Allen.

Weiss, M. A. & Duffy, M. R. (1979). *Oral language disorders in children: Identification and remediation*. Journal of Clinical Child & Adolescent Psychology, 8(3), 206-211.

Persons with Special Needs Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Visit to local educational and rehabilitation institution
2. Critical analysis with specific reference to organization and management of the agency, administrative policies, available infrastructural facilities and programme implementation
Developing proforma to assess the institution functioning
Collecting data
Preparing reports with suitable recommendations
3. Attitudes of society towards children with special needs
4. Techniques of identification and assessment; tools and approaches to assessment
5. Report writing and presentation of a case study
6. Planning need based programme for children with special need
Developing objectives
Planning activities
Developing suitable aids
Execution of prepared programme in mock situation
7. Recent development in welfare programme policies for special children in India & Abroad

Curriculum for Early Years

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Realize the importance of early years and why childhood matters

Prepare strong plan of action to facilitate different developmental aspects of early years; physical, motor, language, cognitive, social, emotional and moral

Plan and prepare models and teaching aids for early year teaching

Syllabus:

Section A

Early childhood matters

Need and importance of curriculum planning in early years

Principles of program planning for early years

Formulation of goals and objectives- long term and short term goals

Weekly and daily plan

Determinants of child survival and development

Ensuring quality and effectiveness in ECD program

Section B

ECCE models and approaches

Theoretical concepts, programme centered learning environment, role of teacher, role of learner and parents

ECCE models

Intervention models

Innovative programmes

Role of parents and community in ECD programmes and curriculum planning

Section C

Curriculum planning :

Activities for ECCE: goals, significance, objectives, criteria & selection of activities, teacher's role related to-

Language art

Concept development

Art and craft activities

Music and dance

Mathematics

Science

Social studies

Reading / writing

Indoor and outdoor play

3. Theme teaching

References :

Aggarwal, J.C. & Gupta, S. (2007). *Early Childhood Care and Education-Principles & Practices*. Shipra Publication.

- Grewal, J.S. (1984). *Early Childhood Education*. New York: Macmillan.
- Hendrick, J. (1988). *The Whole Child- Developmental Education for the Early Years*. Merrill Publishing company.
- Kulkarni, S. (1988). *Parent Education , perspectives and approaches*. Jaipur: Rawat Publication.
- Pankajam, G. (1994). *Preschool Education*. Ambala: Indian Publication.
- Whitebread, D. (2002). *Teaching and Learning in the Early Years*. London: Routledge.

Curriculum for Early Years Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

Observations in various ECCE settings (day care centre, pre-schools, primary schools, anganwadis)

Planning program for various ECCE settings

Implementing program for ECCE settings

Arrangement of stimulating activity areas for various age groups (infants/preschoolers)

Plan socio-dramatic play

Child in the Family

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning outcomes

On successful completion of the course students will be able to::
Understand family as component of social cultural milieu and context
Deal the sensitive issues and crisis situations of family
Understand human rights and duties
Play significant and appropriate role in family and social context

Syllabus:

Section A

1. Family in social context
 - Sociological significance of family
 - Approaches to the study of family: developmental, social, psychological and educational
 - Family: structure, functions, roles and relationships
 - Influence of SES, culture, religion on family
 - Intergenerational conflict within the family
 - Family as an eco system
 - Intrafamilial influences on the personality development – secure and insecure experiences, crisis in the family; death, divorce, alcoholism, illness, and unemployment

Section B

2. Role of the child in the family -
 - Child and family interaction, emotional satisfaction
 - Expansion of family interest
 - Opportunity and insight into the life process
3. Where and how the family helps the individual member through -
 - Shared responsibility
 - Proper use of leisure hours
 - Family customs
 - Family rituals
 - Sacraments
 - Sound sex education
4. Mental health & hygiene: meaning, definition, characteristics of good mental health, role of parents in maintaining positive mental health

Section C

Human Rights:

Classification of human rights- normal, legal, political and civil, social emotional and cultural environment and development rights
Duties of Indian citizens
Child rights:

- Status of Indian children
- Violation of child right and gender disparities

Children in difficult circumstances

Child labour, street children, child prostitutes and children of prostitutes

Remedial measures

Adoption and adopted child

4. Women's Rights:

Status of Indian women

Violation of women rights – violence against women at home, workplace and society

Sexual harassment and rape

Remedial measures

Reference:

Ahuja, R. (2014). *Social problems in India*. Jaipur: Rawat Publications.

Awasthi, P.K. (2014). *Children and Family Relationship*. Delhi: Ancient Publishing House.

Byrne, O. & Dareen, J. (2003). *Human Rights: An Introduction*. New Delhi: Pearson Education.

Carson, D. K., Carson, C. K. and Chowdhary, A. (Eds.) (2007). *Indian Family at the Crossroad*. Delhi: Gyan Publishing House.

D' Souza, C. & Menon, J., *Understanding Human Rights* (series-4) Bombay: Research and Development centre.

Dallos, R. & McLaughlin, E.. (1993). *Social Problems and the Family*. New Delhi: SAGE Publications Ltd.

Desai (1991). *Research on Families with problem in India: Issues and implications*. (Vol. II) Mumbai: M Book Publisher.

Gupta, U.N. (2004). *The Human Rights*. New Delhi: Atlantic Publishers and Distributors.

Lock, S.L. (1992). *Sociology of the Family*. London: Prentice Hall.

Adulthood and Ageing

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Objectives :

- To undertake an advanced study of the stages in human development with specific focus on adulthood and old age.
- To understand the principles and factors influencing human development in these stages.

Section A

- Early adulthood (20-35 years)
 - Physical, intellectual, social and personality development during early adulthood.
 - Transition to adulthood. (life cycle approach) - security, marriage, marital adjustment and parenthood
 - Economic and occupational issues and adjustment
- Middle adulthood (35-50 years)
 - Continuity and change, health and disease, menopause in women, adult sexuality.
 - Intellectual, personality and social development during middle adulthood.
 - Occupational aspect – work and career development.

Section B

- Late Adulthood and Aging (50-60 years)
 - Continuity and change in personality, the family life cycle.
 - Psychological and social adjustment.
 - Planning for retirement – consequences and adjustment.
 - Health and disease.

Section C

- Old age. (65 years)
 - Theoretical perspective on aging process.
 - Physical aspect of aging.
 - Change in personality – social, emotional, cognitive abilities and intellectual aspect.
 - Problems and adjustment during old age.
 - Creative adjustment in aging.
 - Welfare programmes for old age and society's attempt to provide security for the aged with special reference to India.

References :

1. Deats. S.M. & Lenker, L.T. (Eds.) (1991). Aging and Identity Praeger, London
2. Lefrancisiois, G.R. (1996) The Life span, Wordsworth publishers, New York,
3. Rice, F.P. (1992). Human Development, A life span approach, Prentice Hall, New Jersey
4. Santrock, J.W. (1997). Life span development. Brown and Bench Mark, IOWA.
5. Helen Bee: A Journey to adulthood, Allyn and Bacon, Boston.
6. Vikery, F.E., Creative Programming for older Adults, Association Press, Chicago.
7. Kermis The Psychology of Human Aging: Theory, Research & Practice, Allyn & Bacon, London.

Parent and Community Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Appreciate the importance of parent and community involvement for overall development of children

Apply effective methods and techniques for parent and community involvement

Develop appropriate skills to work with parents and the community

Plan programmes of parent education and community mobilization

Syllabus :

Section A

1. Parenthood: meaning and different theoretical views
 - Tasks of 'Parenting' and being a competent parent
 - Changing concept of parenthood and childhood
2. Parent and community education: - concept, principles, objectives and need
3. Parent involvement:
 - In decision and policy development and other activities
 - Involvement of fathers; need and role of fathers in child development
 - Model eg; of (a) Involving fathers in community based ECD programmes (Israel) (b) Empowering fathers in poverty context, involvement in childcare (Montreal, Canada)
4. Recognizing and empowering parents with special needs:
Single parents, working parents, refugee, migrated and language minority parents, parents of disabled children, socially and economically backward parents, parents of adopted children

Section B

1. Techniques of parent and community Education:
Informal meeting, group and individual meetings
Parent and toy library
Parent's corner and workshop/demonstration centers
Open house
Written and printed materials
2. Content of parent and community education:
Development, problems, needs & rights of children
Child rearing and disciplinary techniques, socialization and parental beliefs in various socio-cultural settings
Importance of nutrition, hygiene, health and play for children
Family planning : importance and methods
Local crafts and resources available in community
3. Formulating curricula for parent and community education:
 - a) Parent initiated curricula – need and assessment techniques
 - b) Expert oriented curricula – guidance and action oriented

Section C

1. Contribution of different agencies and community centers in parent and community education

Family planning centers

Hospitals

Maternity and child welfare centers

Schools

PTA

ICDS

WDP

DWACRA

2. Ways of developing human resources and contribution of different professionals in parent and community education
3. Training programmes for young parents : content and need
4. Evaluation of parent and community education programmes

References :

Awasthi, P.K. (2014). *Children and Family Relationship*. Delhi: Ancient Publishing House.

Brophy, T. (1977). *Child Development and socialization*, Chicago: Science Research Association Inc.

Duerback, A. (1967). *Parents Learn Through Discussion*. Minneapolis: Child Study Association of America.

Kulkarni, S. (1988). *Parent Education. Perspectives and Approach*. Jaipur: Rawat Publication.

WHO Planning Cornerstone (2007). *Family Planning a Global Handbook for Providers*.

Parent and Community Education Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Preparation of resource file on parent and community education
2. Explore and evaluate the literature available for parent education
3. Administer a “need assessment checklist’ to 30 parents of various stages of family life cycle of rural/urban/tribal and list topics according to priority felt
4. Assessing knowledge of youth & parent regarding various aspect of family and community life
5. Preparing educational material for community participation
6. Starting short action oriented programmes using various techniques of parents education
7. Implementing educational practices for parents of special need families
8. Development of programme based on identifying needs of parents
9. Executing planned programme and simultaneous monitoring, evaluation of the programme
10. Evaluating effectiveness of two programme each on T.V. and Radio relevant to conducting parent and community education
11. Community support programme for child and family for social, personal, educational and vocational success
12. Survey of common problems of community like child marriage, dowry, child labour, child prostitution etc

Principles and Procedures in Guidance and Counseling

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Get an insight into major theories in the field of guidance and counseling, process involved in different counseling approaches and their application

Apply learned knowledge and skills to plan different therapies required to enhance the quality of life

Syllabus :

Section A

Meaning, concepts and areas of guidance and counseling

The Counselor-

As person and as a professional- personality and training of counselor

Client rights and counselor responsibilities

Therapist competence: ethical and legal aspects

Major theories of counseling –

Person centered

Gestalt

Psychodynamic

Trait factor

Section B

1. Counseling therapies-

Reality therapy

Rational emotive therapy

Cognitive behavior therapy

Play therapy

Psychodrama

Family therapy

Transactional analysis

2. Consultation process-

In school setting

Mental health orientation.

Section C

1. Developing the accountable program for counseling and consultation-

Need assessment

Data analysis and interpretation

Identifying program: priorities and goals

Programs goals

Communication skills for developing the relationship

Skills for ending, evaluating counseling programs

2. Counseling and technology-

Counseling and internet

Distance education

3. Advance action skills: working with dreams, poetry, stories, humour, expressive arts like; dance, music, visual art and sand play

References:

- Barlci, B.C. & Mukopadhyay, B. (1989). *Guidance & Counseling: A Manual*. New Delhi: Stosius Inc./Advent Books Division.
- Dave, I. (1983). *The Basic Essentials of Counseling*. New Delhi: Sterling Publishers Pvt.
- Gummaer, J. (1984). *Counseling and Therapy for Children*. New York: The Free Press.
- Ivey, A.E., Ivey M.B., & Downing, L.S. (1987). *Counseling and Psychotherapy: Interpreting Skills, Theory and Practice*. New Jersey : Prentice Hall.
- Jacoks, E., Robust, .LM. Riley, L., & Harvill (2008). *Group Counseling Strategies and Skills* (6th ed.). USA: Thomson Brooks/Cole.
- Mitehall, M.H. & Gibson, R.L. (2015). *Introduction to Guidance* (7th ed.). New Delhi: Pearson Education Pvt. Ltd.
- Nelson, J.R. (2012). *The Theory and Practice of Counseling Psychology* (5th ed.). South Asia: SAGE.
- Pasricha, P. (1976). *Guidance and Counseling in Indian Education*. New Delhi: NCERT Publication.
- Patterson, L.E. (1999). *The Counseling Process* (5th ed.). USA: Brooks/Cole.

E-resources

दूर शिक्षा

<https://drive.google.com/open?id=0Bwk5FIsI0ctxZnNfeDRtRWFOZUK>
Counseling Psychology

<https://drive.google.com/open?id=0Bwk5FIsI0ctxOGJ0VWF2Y0dJN0U>
Counseling Psychology

<https://drive.google.com/open?id=0Bwk5FIsI0ctxa2h1N25ZbWZRNUE>
Distance Education

<https://drive.google.com/open?id=0Bwk5FIsI0ctxbnE1SGNEN29wR3M>
Psychological Theories and Psychotherapy

<https://drive.google.com/open?id=0Bwk5FIsI0ctxTU90T2toLUxPcEU>
Psychopathology

<https://drive.google.com/open?id=0Bwk5FIsI0ctxS3NqdE5fVEpxN2M>
Psychopathology

<https://drive.google.com/open?id=0Bwk5FIsI0ctxX0QySVFuNllac0E>
Psychotherapeutic Methods

<https://drive.google.com/open?id=0Bwk5FIsI0ctxS3BJWndMMlBpSWc>

Practicing Guidance and Counseling Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On successful completion of the course students will be able to:

An ability to analyze a problem, and to identify and define the counseling requirements appropriate to its solution

An ability to design implement and evaluate counseling solution to meet given set of behavioral problems

An ability to deal with range of clients and communicate effectively

An ability to apply theories in the design, reason about, explain and implementation of counseling programmes

Syllabus :

1. Plan and conduct therapeutic intervention programmers related to the following:
 - i. Psychological first aid, handling specific complaints, motivation for re-organizing ones life
 - ii. Prevention program for community harmony: avoiding riots and violence
 - iii. Crises intervention programmers in school
 - iv. Safety measures for children at home, at school and in the community
2. Conduct classroom debates and discussions on the role of media in crisis situation
3. Plan programmes for mental health in crisis situations (preventive and intervention)
4. Compile the articles and research reviews on various aspects of counseling
5. Interactions with practicing counselors and therapists through visits to schools, clinics, women's centers and hospitals
6. Learn about the counseling process – role play, mock sessions
7. Need assessment of individual counseling by using self structured interview schedule and submitting a report
8. Planning counseling sessions for children with special concerns, children in conflict with self and others
9. Planning counseling for treatment of psycho-social and psycho-emotional problems
10. Arranging counseling activities for elderly (with the help of resource persons.)
11. Visit to HIV counseling center and submitting report

Guidance and Coping in Crisis

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Describe general nature of crisis situation, common reactions and consequences of traumatic events

Classify different problems behavior and difficult circumstances

Analyze causes and effect of different problems behavior

Explore best counseling strategies for different problem behavior

Section A

Nature, concept and understanding of crisis situations-

Events of crises experiences- at home, at school, and community

Effect of crises events on different age groups and role of the family in crisis situation

Normal coping process, common reactions and consequences of traumatic events

Steps in crisis intervention

Skill for managing crisis situation

Special counseling challenges-working with ambivalent indifferent and oppositional clients, older adults, children, mentally ill clients, drugs or alcohol abusing clients, exceptional children, clients from different cultures

Section B

Dealing with problem situations and guidance for vulnerable /special groups-

Marital and sexual relationship concerns

Handling family differences

Divorce families, step families, single – parent homes

Alcoholic families

Violence and abuse, survivals of sexual abuse

Counseling about death and dying

Suicidal behaviors

Latchkey children, homeless children

Section C

Counseling children in difficult circumstances

Emotional problems – frustration, inferiority, actual or imagined limitations, fantasy, frequent sad moods, lack of self confidence, feeling of insecurity, excessive fear anxiety and worrying

Adjustment problems – aggression, poor socialization, difficulty in maintaining friends, feeling of loneliness, excessive shyness and withdrawal

Educational difficulties- school phobia, low achievement, short attention span, truancy, extreme sensitivity

Children in conflict with others- fighting, verbal abusiveness, cruelty, destructiveness, tantrums, swearing, lying, stealing

References :

Barlci, B.C. & Mukopadhyay, B. (1989). *Guidance & Counseling: A Manual*. New Delhi: Stosius Inc./Advent Books Division.

Corey, G. (1981). *Group Counseling*. Brooks/Cole, New Delhi: Engage Leasing India Pvt. Ltd.

Gummaer, J. (1984). *Counseling and Therapy for Children*. New York: The Free Press.

- Hildebrand, V.(1994). *Guiding Young Children*. NY: Mac Millan College Publication Company.
- Hough, M. (2002). *Practical Approach to Counseling*. Harlow: Pearson Education.
- Hutchinson, D. (2007). *The Essential Counselor Process, Skills and Techniques*. Lahaska press, Houston Mifflin Company.
- Jacobs, E.E., Messon, R.L. & Harvill R.L. (2009). *Theory and Practice of Group Counselling*. USA: Cenage Learning.
- Jones, N.R. (2012). *The Theory and Practice of Counseling Psychology* (5th ed.). South Asia: SAGE.
- Kenedy, E. (1947). *One Becoming a Counselor: A Basic Guide for Non-Professional* New Delhi : *Counseling* Gill & Machmillan.
- Mclead, J. (2009). *Counselling Skills*, Indian Reprint, Jaipur :Rawat Publication.
- Thompson, C.L. & Linda B.R. (1992). *Counseling Children* (3rd ed.). California: Brooks /Cole Publishing Company.

Innovative Programmes and Curriculum Planning for ECE Centers

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Discuss the context of innovative approaches towards ECCE centers

Analyze the innovative approaches towards ECCE programmes in international, national and regional context

Apply the innovative techniques in ECE Classrooms

Section A

The context and need for innovative program

Change in orientations towards ECCE centers at international and national level (human rights, child rights, elimination of discrimination, equity and equality)

Policies for ECCE in India

Latest five year plan for ECCE

Special needs of special groups of people (tribal children, children with special need , refugees children , children in urban slums)

Availability of resources

Issues of sustainability and outreach

Section B

Overview of innovative approaches (History, Programme Philosophy and other information

International context – community resource centers for ECE Programme (Australia/ Canada)

Indian context - Kosabad experience , Mobile crèche, New Delhi, URMUL TRUST , CHETNA

Innovative program in regional context – WDP Tilonia Rajasthan. Bodh trust Rajasthan

Section C

Innovative techniques used in ECE classrooms

Smart classroom

Interactive whiteboards

classroom computers /projectors

You Tube videos

Text, Images, Audio, Video, Animation

Role Playing

E-Learning

STEM for beginners

Engagement in Purposeful Play

Library in ECE classroom

References :

ECCE Experiences in India: GOI Report.

ICDS (1996), New Delhi: Department of Women and Child Development, Ministry of HRD. GOI.

National Policy of Children, 1986. National Program of Action,1992, New Delhi. Department of Education, Ministry of Human Resource. GOI.

Report of the Expert group on ECCE 175 GW RE by 2022- Niti Aayog. India: GOI.

5. Sub Group Report –ECE in the 12th Five Year Plan(2012-2017). New Delhi: Ministry of Women and Child Development.

6. The State of World's Children: 2006, New York , UNICEF.

ECE Centers Organization, Administration and Management

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Gain knowledge for planning, organizing and managing different ECE centers

Describe the roles and responsibilities of in charge of ECE center

Classify different ECE centers on the basis of administrative and managerial strategies

Learn organizational and administration skills for managing ECE centers

Get insight into problems and issues of legal and ethical nature

Section A

Administration and organization of ECE centers :

Meaning, responsibilities of the incharge of ECE centers

Types of schools

Opening a new school

Beginning the school session

Staff selection – qualification, recruiting sources, selection process, notification

Personnel practices

Supervision of staff

Developing staff skills

Section B

Management of ECE centers:

The budget: services, programmes, goals, start up budget, operating budget

Food services – plan, purchase and services

Equipment and materials – planning the physical environment

Maintaining the physical environment

Section C

Building plan

Health & social services

Licensing

Volunteers, resource persons, special visitors

Student teacher

Parents and community

Interpreting the schools to the public

Legal issues pertaining to opening a new school

References :

Decker, C.A. & Decker J.R. (1997). *Planning and Administering Early Childhood Programme* (6th ed.). NJ: Prentice Hall Inc.

Katherine, H. R. (1971). *The Nursery School: A human Relationship Laboratory* (5th ed.). Philadelphia: W B Saunders Company.

Kaul, V. (1997). *Early childhood education programme*. New Delhi: NCERT.

- Kimberly, A. & Gordon, B. et.al. (2014). *Early childhood education: becoming a professional*. Los Angeles: Sage Publication.
- Morrison, G.S. (1988). *Education and development of infant, Toddlers and preschoolers*. Glenview I L, Scott.
- Murlidharan, R. & Bangerji, U. (1991). *A guide for nursery school teacher*. New Delhi : NCERT.
- Pankajam, G. (2015). *Pre primary Education Philosophy and Practice*. New Delhi: Concept Publishing Company.
- Perry, R. (2004). *Teaching Practing of Early Childhood: A guide for students*. NY: Routledger Palmer.
- Phyllis, C. (1999). *Administration of School for Young Children*. Delmar Publishers.

Management and Innovations in Early Childhood Education Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

Plan, implement, supervise, participate, monitor and evaluate different ECCE programmes

Acquire skills for organization and management of ECE centers

Design ECE center lay outs for varied groups

Plan, set up and develop their own ECE center

Syllabus :

1. Orientation to selected innovative programmes that may be in the vicinity
 - Observational visits
 - Discussions in community
 - Video films on programmes, followed by group discussion
2. Survey of various ECE centres to observe
 - Physical facilities: equipments, staff; age and procedure of admission, budget, conduct of programme, records, PTA
3. Planning & executing activities & programmes for EC Centers (Participation in ECE Centers)
4. Evaluation: self assessment and other participants assessment
5. Organize, supervise & monitor – field trip, picnic
6. Project method of conducting nursery school activities
7. Conduct PTM & one home visit

Research Methods in Human Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain the significance of research methodology in human development

Distinguish between different types of tools and methods of research

Analyze a research problem and design research proposals and prepare research report

Syllabus :

Section A

Research – Meaning, objectives and importance

Nature and Areas of research in Home-Science with special reference to Human Development

Types of Research

Basic, Applied and Action research

Historical research

Descriptive Research Methods –

Survey, case study, correlational study, causal comparative.

d) Analytic studies – Pre-experimental, experimental and quasi experimental research

4. Qualitative research methods

1. Theory and design of qualitative research

2. Definition and types of qualitative methods:

Informal group discussion

Interview : Key informant, indepth study

Observation

Social mapping

Participatory Rapid Assessment

Participatory Learning Assessment

Case study

Section B

Definition and Identification of research problem – selection, justification, sources, basic assumptions, limitation and delimitations of the problems.

Review of literature: Importance, sources of literature collection and presentation

Variables & their types

Objectives and assumptions

Hypothesis – meaning, importance and ways of stating hypothesis

Sampling – meaning, importance, sampling techniques, sources of bias and methods of reducing bias

Basic principles of Research Design

Purpose of Research design

Design for different types of research

Section C

Sources of primary and secondary data collection

Psychometrics : Meaning, characteristics of a good test, determination of reliability, validity, discrimination power

Data Analysis: classification, coding and analysis, interpretation of data

Research Report :-

General structure of reporting

Formal style of writing

- Acknowledgements
- Tables & Figures
- Footnotes, Quotations
- Appendices, Bibliography

References :

Agarwal, J.C (1966). *Educational Research. An Introduction*. New Delhi : Arya Book Depot.

Banclarkar, P.L. and Wilkinson, T.S. (2000). *Methodology and Techniques of Social Research*. Mumbai: Himalaya Publishing House.

Best, J.W. (1977). *Research in Education*. New Delhi: Prentice Hall of India.

Bhatnagar, G.L. (1990). *Research Methods and measurement in Behavioural and Social Sciences*, New Delhi Agri: Coll Publishing Academy.

Chandra, S.S. & Sharma, R.K. (2004). *Research in Education*. New Delhi : Atlantis Publishers.

Kaul, Lokesh (2006). *Research in Education and Psychology*. New Delhi: Vikas Publishers.

Nachman's, D. & Chava, N. (2008). *Research methods in Social Sciences* (2nd Ed.). New Delhi: St Martin's Press.

E-Resources:

Research methodology, methods and techniques, CR Kothari

<http://www.modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf>

Research hypothesis – Slide share

<https://www.slideshare.net/drjayeshpatidar/research-hypothesis-20719840>

Research Methods in Food Science and Nutrition

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain the significance of research methodology in Food Science and Nutrition

Distinguish between different types of tools and methods of research

Analyze a research problem and design research proposals and prepare research report

Syllabus :

Section A

1. Scientific method and research
 - meaning
 - importance
 - critical features of research
2. Selection and formulation of a research proposal
 - selection of problem area
 - review of literature
 - functions
 - sources
 - c) statement of problem
 - d) hypothesis
 - characteristics
 - formulation
 - e) defining concepts
3. Research types – An overview of
 - Basic, Applied and Action research
 - Quantitative and Qualitative research
 - Descriptive, Analytical and Experimental Research
 - Rapid Assessment – Participatory Research (PRA and PLA in brief)

Section B

1. Research design
 - characteristics of good research design
 - phases in research design
2. Design strategies in-
 - co relational studies
 - case studies
 - cross sectional surveys
 - observational studies
 - case control studies
 - cohort studies
 - retrospective
 - prospective
 - g) intervention trials

- h) animal studies
- 3. Ethical considerations in intervention and animal studies

Section C

1. Sampling and measurement –
 - sample size and power
 - types of sampling
 - sampling and non sampling errors
 - dependent and independent variables
 - scaling techniques
 - nominal
 - ordinal
 - interval
 - ratio scales
- f) measurement
 - validity
 - reliability
2. Principle steps of a sample survey with special reference to Food Science and Nutrition.
3. Methods of data collection
 - a) Primary data
 - Observation
 - Questionnaire and interview techniques
 - Objective tests and scales
 - Secondary data

References :

- Agarwal, J.C (1966). *Educational Research. An Introduction*. New Delhi : Arya Book Depot .
- Banclarkar, P.L. and Wilkinson T.S. (2000). *Methodology and Techniques of Social Research* . Mumbai: Himalaya Publishing House
- Best, J.W. (1977). *Research in Education*. New Delhi: Prentice Hall of India.
- Bhatnagar, G.L. (1990). *Research Methods and measurement in Behavioural and Social Sciences*, New Delhi Agri: Coll Publishing Academy.
- Chandra, S.S. & Sharma, R.K. (2004). *Research in Education*. New Delhi: Atlantis Publishers.
- Kaul, L. (2006). *Research in Education and Psychology*. New Delhi: Vikas Publishers .
- Mienert, C. L. (1986). *Clinical trials: Design, Conduct and analysis*. New York : Oxford University Press.
- Nachman's, D. & Chava N. (2008). *Research methods in Social Sciences* (2nd Ed.). New Delhi: St Martin's Press.
- Scrimshaw, N. S. & Gleason, G. (1992). *Rapid Assessment Procedures. Quantitative Methodologies for planning and evaluation of health related programmes*. Boston, USA: International nutrition foundation for developing countries.

E-Resources:

- Research methodology, methods and techniques, CR Kothari
<http://www.modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf>
Research hypothesis – Slide share

<https://www.slideshare.net/drjayeshpatidar/research-hypothesis-20719840>

Advanced Food Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Apply and incorporate the principles of Food Science in practical, real-world situations and problems

Explain the basic principles of sensory analysis and other analytical techniques associated with food

impart awareness on the concept of 'new food product development' and current topics of importance to the Food industry

Apply the various techniques in the quality evaluation of foods and demonstrate practical proficiency in a food analysis laboratory

Syllabus :

Section A

1. Colloidal chemistry as related to foods. Food emulsions and foams
2. Carbohydrates in food
 - a) Sugar: Manufacturing process of sugar, stages of sugar cookery, sugar products
 - b) Polysaccharides
 - i. Starch : Structure, gelatinization, retrogradation, syneresis, gelation, modified food starches, dextrinization
 - ii. Non Starch Polysaccharides: Cellulose, hemicellulose and pectins – sources, characteristics in foods
 - c) Cereals – Structure and composition of wheat and rice
 - i. Flours and flour quality
 - ii. Breakfast cereals

Section B

1. Protein in Foods:
 - a) Plant foods – pulses, nuts and oilseeds; composition. Antinutritional factors. Fermentation and germination in legumes. Cooking quality
 - b) Animal foods –
 - i. Milk – Composition, spoilage and care. Physical and chemical properties
 - ii. Meat, fish and poultry – Structure and composition, Evaluation of egg quality and grading. Use of egg in cookery Postmortem changes in meat
2. Fats and Oils:
 - a) Physical and chemical properties
 - b) Rancidity changes
 - c) Antioxidants and synergists
 - d) Changes during frying and storage

Section C

1. Fruits and Vegetables – Classification and composition.
 - Effect of heat on vegetables.
 - Preservation of vegetables and fruits.
 - Food Pigments.
 - Browning Reactions.
2. Food Additives: Definition, importance, classification and uses.
3. Leavening Agents : Importance, classification, nature and use.
4. New Food Product Development: Definition, factors shaping new product development – Social concerns, health concerns, impact of technology and market place influence

5. Sensory Evaluation

- a) (i) Selection of panel of judges
- (ii) Types of tests (an overview)
- (iii) Judging
- b) Objective methods for measurement of:
 - (i) Colour
 - (ii) Texture

References :

- Belitz, H.D. & Grosch, W. (1999). *Food Chemistry*. (2nd ed.) New York: Springer.
- Charley, H. (1982). *Food Science* (2nd ed.) New York: John Wiley and Sons.
- Manay, N.S. & Shadarssharaswamy, M. (1987). *Foods, Facts and Principles*. New Delhi: Wiley Eastern Ltd.
- Meyer, L.H. (1978). *Food Chemistry*. New York: Reinhold Book Corporation.
- Potter, N. & Hotchkins, J.H. (1996). *Food Science* (5th ed.). New Delhi: CBS Publishers and distributors.
- Srilakshmi, B. (2001). *Food Science* (2nd ed). New Delhi : New Age International Pvt. Ltd.

E –Resources:

- <https://opened.uoguelph.ca/student-resources/food-science-certificate-> Food Science Certificate
- [https://www.academiccourses.com/Courses/Food-Sciences/Distance-learning/-](https://www.academiccourses.com/Courses/Food-Sciences/Distance-learning/)

Advanced Food Science Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Analysis of ash, moisture, crude, fibre and fat content of wheat flour
2. Analysis of milk for total solids, acidity, ash, lactose, specific gravity, fat and protein
3. Determination of protein content of the given sample of wheat flour
4. Determination of Iodine Value, Saponification Value, Acid Value and Peroxide Value of groundnut oil or hydrogenated fat
5. Microscopic structure of raw and cooked starch granules of wheat, maize and potato
6. Gelatinization in various starches – Effect of temperature, acid, sugar and dextrinization
7. Effect of temperature, concentration and acid on crystallization of sugar
8. Sensory Evaluation of food by subjective methods
 - (i) Preparing samples
 - (ii) Using reference samples
 - (iii) Product oriented tests
 - (iv) Consumer oriented tests
 - (v) Reducing panel response error
 - (vi) Collecting and analyzing survey data

Human Physiology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Describe the anatomy and physiology of various organs to understand the integrated functioning of all systems in human body

Relate the dysfunction of organ and occurrence of disease in relation to different internal and external physiological, pathological and environmental conditions

Analyze blood and urine samples for various parameters

Syllabus :

Section A

1. Definition of anatomy and physiology. Importance of the study of physiology. Brief overview of the cellular and tissue levels of structural organization
Cell structure and function: Various sub cellular organelles and their functions. Transport across cell membrane and primary cellular communication
Brief overview of the various types of elementary tissues and their general characteristics
2. Fundamental aspects of the Nervous System –
 - Structure and functions of brain and spinal cord and reflex action, conduction of nerve impulse, synaptic transmission and role of neurotransmitters
3. Endocrine System: Main structural features and functions of endocrine glands:- Hypo-thalamus, pituitary, thyroid, parathyroid, adrenals, ovary, testis, α and β endocrine cells of the pancreas

Section B

1. Gastrointestinal Physiology: Secretory, digestive and absorptive functions of the organs of gastrointestinal tract. Roles of liver, pancreas and gall bladder and their dysfunctions. Brief overview of absorption and transport of macronutrients: carbohydrate, fat, protein and micronutrients; calcium, iron and zinc
2. Circulatory System
Blood – Physical characteristics, general functions, components and their brief description, Blood coagulation, blood groups. Brief overview of anaemia and its types
Structure and function of heart, blood vessels, regulation of cardiac output, blood pressure and its significance, hypertension
3. Excretory System:- Structure and function of kidney, nephron. Process of urine formation, role of kidney in maintaining blood pH, acid base, electrolyte and water balance

Section C

1. Homeostasis and its regulation under different conditions by the nervous and endocrine system
2. Musculo- Skeletal System:- Brief overview of structure and function of muscles. Types of muscles. Fundamental points of muscle contraction, metabolism and fatigue
3. Immune System:
Cell mediated and humoral immunity, defensive properties of neutrophils and macrophages, phagocytosis and inflammation allergy
4. Sense organs: Brief overview of the structure of skin, eye, ear, nose and tongue and their role in the perception of stimuli

References :

Chatterjee, C. (1992). *Human Physiology*, (Vol I & II). Calcutta: Medical Allied Agency,

Sanghani, P. B. (2012). *Human Anatomy and Physiology with health education*. New Delhi: Tata Mc Graw Hill Education Private Limited.

Sharma, S. (1993). *Practical Biochemistry*, Jaipur: Classic Pub. House.

Tortora, G. J. & Derrickson, B. (2006). *Principles of Anatomy and Physiology*. USA: John Wiley & Sons. Inc.

Waugh, A. & Grant, A. (2014). *Ross & Wilson Anatomy and Physiology in Health and Illness* (12th ed.). New York; Churchill Livingstone, Elsevier.

E- Resources:

Diagram of human body organs -

<https://in.pinterest.com/pin/429390145695727907/>

The human body: Anatomy ,facts and functions

<https://www.livescience.com/37009-human-body.html>

Human Physiology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

- Determination of blood groups and clotting time
- Estimation of haemoglobin by cyan methemoglobin method.
- Examination of urine : Physical examination, specific gravity, pH, Abnormal (Pathological) constituents: protein, glucose, ketone bodies, bile salts and bile pigments
- Measurement of blood pressure
- Microscopic examination of cells and tissue

Scientific Writing and Nutrition Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Understand the structure of various scientific documents

Write correct in text citations and complete references in approved style(s)

Comprehend the barriers that lead to ineffective communication

Apply their minds to come up with the optimal combination of media for nutrition related behaviour change

Conceive and write short radio programmes, newspaper articles on nutrition

Syllabus :

Section A

1. Scientific writing as a means of communication
Different forms of scientific writing.
Articles in journals, research notes and reports, review articles, dissertation, bibliography.
2. Drafting titles, subtitles, tables, illustrations.
Presenting data in rows and columns
Formating tables.
Presenting data in figures.
Formating figures.
Appendices : information to be given and guidelines for writing.
3. The writing process

Section B

4. Parts of dissertation/research report/article.
Introduction
Review of literature
Method
Result and discussion
5. Communication
Concept
Elements
Models
Barriers

Section C

6. IEC (Information, Education and Communication)
Introduction and Importance
Relevance to Programmes
7. Different Media, their characteristics and use -
- Audio visual aids
8. IEC – methods, techniques and tools
9. Planning effective IEC programmes
10. IEC for different large groups-
Community

Grass root functionaries

Donor agencies

Policy makers

References :

1. Dodd, J. S. (Ed.) (1997). The ACS style guide. A Manual for Authors and Editors Washington DC: American Chemical Society.
2. Peat J., Elliott, E., Baur, L. & Keena, V. (2004). *Scientific writing: Easy when you know how*. New Delhi: Byword Viva Publishers Private Limited.

Scientific Writing and Nutrition Communication Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

Preparation of tables and illustrations.

Writing a term paper

Writing an article for journal (using M.Sc. Project reports)

Writing project proposal for grants

Preparation of IEC material

Chart

Poster

Power point slides

Radio talk

TV show (an outline)

6. Preparation of IEC material on a specific topic for

One to one

Group

Mass communication

Statistical Methods in Food Science and Nutrition

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Discuss the significance of statistics in the discipline of Food Science and Nutrition

Describe basic concepts of statistical inferences and test of significance

Apply the appropriate statistical technique for analysis and interpretation of data

Syllabus :

Section A

1. Scope and role of statistics in Food Science & Nutrition
2. Treatment of data – collection of primary and secondary data
3. Representation of data: Tabular, diagrammatic and graphical methods. Frequency distribution, histograms, frequency polygons, ogives.
4. Measurement of central tendency – Arithmetic mean, Median, Mode. Selection of appropriate measures of central tendency
5. Measures of Dispersion – Range, Quartile and Interquartile deviation, Mean deviation, Standard deviation, Coefficient of variation.

Section B

Correlation : Pearsons' coefficient of correlation, Rank correlation.

Regression, Odds Ratio

Sampling: Types, sample survey versus census survey, sample size, probability & non probability sampling techniques

Normal Distribution with its application

Testing of hypothesis – Meaning and need, one tail and two tail tests, large and small sample tests, type I and type II errors, degree of freedom

Section C

Parametric test of significance for large and small samples – Mean, variance, proportion and correlation coefficient.

ANOVA – one way and two way.

Non parametric tests

Chi square test and goodness of fit.

Kruskal Wallis test

Mann Whitney U Test

Sign Test

Design of experiment – layout and analysis of completely randomized design (CRD) and randomized block design (RBD)

Vital statistics : Introduction and its application.

References :

Garett, H.E. & Woodworth (2004). *Statistics in Psychology & Education* (11th Ed.), Bombay, Vakil, Feffer and Simon.

Gupta, S.P. (2000). *Statistical Methods*. New Delhi: Sultan Chand & Sons.

Healey, J. F. (2014). *Statistics: A tool for social Sciences. Descriptive statistics*. New Delhi : Sage Publishers

Mangal, S.K. (2002). *Statistics in Psychology and Education*, (2nd Ed). New Delhi, India : Prentice Hall .

Mendenhall, B. (2013). *Introduction to probability and statistics* (8th Ed). Boston: PWS-Kent, Publishing Company.

Pagano, Robert. R, (1990). *Understanding Statistics in Behavioral Sciences*. (3rd Ed).New York: West Publishing Company.

Wright, S.E., (1986). *Social Science Statistics*. Boston: Allyn and Bacon Inc

Statistical Methods in Clothing and Textiles

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Gain knowledge and understanding of various statistical methods for analysis and interpretation of qualitative and quantitative data in clothing and textile field

Critically analyze the rationale used in parametric and non-parametric tests and apply them to draw inferences

Syllabus :

Section A

1. Statistics: Meaning, importance, limitations. Conceptual understanding of statistical measures, classification and tabulation of data, discrete and continuous variables. Frequency distribution, diagrammatic & graphical presentation of data
2. (i) Measures of central tendency – Arithmetic and Weighted Mean, median, mode, properties, merits, demerits, common uses in research of above measures
(ii) Measures of variability – range, mean deviation, quartile deviation, standard deviation, coefficient of variation

Section B

1. The formal and empirical concepts of Probability and the binomial distribution. Properties of Normal Probability Curve and its applications
2. Correlation: Pearson's Coefficient of correlation, rank correlation
3. a) Sampling distribution & the standard error
b) Parametric & non parametric tests
c) Elements of testing statistical hypothesis
d) Formulation of the problem, definition of Type I and Type II errors, levels of significance, degree of freedom
e) Test of Significance of mean, standard deviation and correlation

Section C

Application of students' t' test for single mean and difference between the means, paired t test.

Analysis of variance – One way classification. Two way classification

Chi squares – for testing independence of attributes

Other non parametric test: Mann Whitney's U test

References:

- Garett, H.E. & Woodworth (2004). *Statistics in Psychology & Education* (11th ed.). Bombay. India: Vakil, Feffer and Simon.
- Gupta, S.P. (2000). *Statistical Methods*. New Delhi: Sultan Chand & Sons.
- Mangal, S.K (2002). *Statistics in Psychology and Education*, (2nd ed.). New Delhi: Prentice Hall of India.
- Pagano, R. R. (1990). *Understanding Statistics in Behavioral Sciences*, (3rd ed.). New York: West Publishing Company.
- Wright, S.E. (1986). *Social Science Statistics*. Boston: Allyn and Bacon Inc.

Nutritional Epidemiology Paediatric and Geriatric Nutrition Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

1. To plan an epidemiological study
2. To plan and prepare nutrient dense, complementary foods for 6-12 month old infants.
3. To plan and prepare dietary schedule for infants
4. To plan and prepare diet to promote catch up growth after acute diarrhea/infection
5. To plan and prepare diet for elderly in health
6. To plan and prepare dental soft diet for elderly
7. To plan and prepare diet for elderly during ill health

Biochemistry - I : Biomolecules and Energetics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain the biochemical basis of not only macro and micro nutrients but also of the various body processes like digestion, gaseous transport, muscle contraction and the like

Explain the biochemical basis of food energy production and energy transfer in human beings

Understand process of detoxication of harmful foreign and endogenous substances by the body tissues

Carry out biochemical estimations in food composition, analysis and nutritional assessment

Standardize methods for different estimations

Syllabus :

Section A

An introduction to Biochemistry as a science and an overview of its goals

Carbohydrates: Sources, chemistry and functions of mono, oligo and polysaccharides. Dietary fibre and its functions, simple chemical reactions of carbohydrates

Lipids : General characteristics and classification, chemistry and sources: Saponification, Iodine, Acid, Reichert Miesel, Peroxide and Acetyl Numbers of fat. Main biological functions of lipids. Rancidity of fat

Minerals: Sources, absorption, transport, utilization and functions of Magnesium, Calcium, Phosphorus, Iron, Iodine, Copper and Zinc

Section B

Proteins: Amino acids as the structural monomers for proteins, structure and simple chemical reactions of amino acids. Levels of structural organization of proteins. Protein classification and biological functions. Plasma proteins and their functions

Enzymes : Historical perspective, enzymes as biological catalysts, introductory account of IUB system of enzyme classification, concept of active site, specific activity, turnover number, units of enzyme activity. Effect of substrate concentration on the velocity of single substrate enzyme catalyzed reactions. Michaelis constant (K_m) and Maximal Velocity (V_{max}). Graphic Method of K_m evaluation. Line Weaver Burk Plott. Effect of pH and temperature on enzyme catalyzed reactions, various types of enzymes inhibition, iso enzymes

Nucleic Acids : Components of nucleic acids, structure of nucleic acids. Significance of DNA as genetic material

Section C

Vitamins: Sources, absorption and biochemical role of Vitamin A,D,E, K; Thiamine, Riboflavin, Niacin, Pyridoxin, Biotin, Folic Acid, Cyanocobalamin and L Ascorbic Acid

Biologic Oxidation: Enzymes of biologic oxidation, Redox potential, Respiratory chain

Oxidative phosphorylation, Mitchell's chemiosmotic hypothesis. Inhibitors of respiratory chain and oxidative phosphorylation

Detoxication of foreign compounds. Various reactions of detoxication. Role of liver in detoxication. Role of hepatic microsomal enzyme in detoxication

References:

Deb, A.C. (1997). *Fundamentals of Biochemistry*. Kolkata: New Central Book Agency.

Murray, R.K., Granner, D.K., Mayes, D.A. & Rodwell, V.W. (2000). *Harpers Biochemistry* (25th ed.). New York:Macmillan Publishers.

Nelson, D.C. & Cox, M. (2000). *Lehninger's Principles of Biochemistry* (3rd ed.). New York: Macmillan Publishers.

Rama, R. AVSS (2010). *A Text book of Biochemistry*. Tahuku (AP): L.K. and S. Publishers.

Sharma, S. (2000). *Human Nutrition and Meal Planning*. New Delhi. Jnanda Prakashan .

Talwar, G.P. : *A Text Book of Biochemistry and Human Biology*. New Delhi: Prentice Hall of India.

Biochemistry - I : Biomolecules and Energetics Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. pH determination by pH papers and pH meter
2. Extraction and estimation of total lipid content of wheat grain or any other food stuff
3. Standardization of a method of blood glucose estimation
4. Estimation of blood glucose of a normal and diabetic person by the method standardized
5. Titrametric estimation of vitamin C in lemon juice or any other fresh food stuff
6. Standardization of methods for serum total protein and albumin
7. Estimation of total protein and albumin by the method standardized for a well nourished and a protein malnourished person
8. Formal titration of amino acid.
9. Standardization of a method for the determination of reducing sugars

Problems in Human Nutrition Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

A. Planning, preparation, serving of diet for following disorders:

Protein – energy malnutrition
Vitamin A deficiency
Nutritional anaemia
Osteoporosis
Obesity
Diabetes mellitus
Hypertension and
Atherosclerosis

B. Nutritional counselling for following disorders

Protein – energy malnutrition,
Vitamin A deficiency,
Nutritional anaemia
Osteoporosis
Obesity
Diabetes mellitus,
Hypertension and
Atherosclerosis.

Food Microbiology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Identify the important pathogens and spoilage microorganisms in foods and the conditions under which they grow

Utilize laboratory techniques to identify microorganisms in food

Describe role and significance of microbial inactivation, adaptation and environmental factors on growth and response of microorganisms in various environments

Identify the conditions under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods

Recognize the elements of the Hazard Analysis Critical Control Point (HACCP) system

Define "food borne disease outbreak", and design a good food borne disease surveillance program

Syllabus :

Section A

1. Microorganisms of importance in food : Their primary sources in foods. Morphology; cultural characteristics and biochemical activities.
2. Main characteristics of microbial growth
3. Factors affecting their growth in food. Intrinsic and Extrinsic parameters that affect microbial growth and their relevance to food spoilage and preservation.

Section B

1. Spoilage of different groups of food: Cereal and cereal products, vegetables and fruits, meat and meat products, eggs and poultry, milk and milk products, canned foods.
2. Food Preservation:
Physical methods – Drying, cold storage, heat treatments, irradiation.
Chemical preservatives and natural antimicrobial compounds.
Biologically based preservation systems and probiotic bacteria.
3. Microorganisms in food enzyme and technology:
Food Fermentation – An introduction.
Enzyme and food production
Micro-organisms as food.

Section C

1. Food borne diseases : Foods involved, the disease, conditions necessary for an outbreak, prevention of outbreaks for –
Food borne intoxication: Botulism and staphylococcal intoxication.
Food borne infections – Salmonellosis, Clostridium perfringens illness, Bacillus cereus gastroenteritis.
Investigation of food borne disease outbreak.
2. The HACCP system and food safety used in controlling microbiological hazards.

References :

- Adams, M.R. & Moss M.G. (2008). *Food Microbiology* (1st ed.). New Delhi: New Age International (P) Ltd.
- Atlas, M. R. (1995). *Principles of Microbiology*. Missouri, U.S.A.: Mosby – Year Book, Inc.
- Banwart, G.(2004). *Basic Food Microbiology* (2nd ed). New Delhi: CBS Publishers.
- Frazier, W.C. & Westhoff D. C. (2014) *Food Microbiology*. New York: Mc Graw Hill Inc.

Jay, J.M. (2005). *Food Microbiology* (6thed.). Maryland: Aspen Publishers, Inc.

Pelczar, M.I. & Reid, R.D. (1998). *Microbiology*. New York: McGraw Hill Book Company.

E-Resources:

Microbiology and Food Safety

<https://swayam.gov.in/courses/5147-food-microbiology-and-food-safety-Food>

Food and dairy Microbiology

<https://swayam.gov.in/courses/4626-environmental-food-and-dairy-microbiology-Environmental>

Microbiology learning and education online

<https://jcm.asm.org/content/54/5/1203-Microbiology>

<https://microbiologyonline.org/-MicrobiologyOnline>

3. β – oxidation pathway of fatty acid catabolism

Role of carnitine in beta oxidation of fatty acids, De novo synthesis and chain elongation of saturated fatty acids , Metabolism of ketone bodies, Metabolism of cholesterol, Lipoprotein metabolism in brief and its relationship with lipid transport and atherosclerosis

Section B

1. General reactions of protein metabolism : Synthesis of Urea – the urea cycle (Krebs's Henseleit cycle), Biosynthesis of proteins, Basic aspects of Metabolism of Uric Acid and its nutritional implications
2. General hierarchical organization of mammalian endocrine system – mode of action of insulin, glucagon, epinephrine, thyroid and steroid hormones

Section C

1. Collection and preservation of biological fluids- Patterns of functional and non functional enzymes of blood plasma in health and diseases with specific mention to serum lipase, amylase, cholinesterase , alkaline and acid phosphatases, serum transaminases, lactate dehydrogenase (LDH) and creatine phosphokinase(CPK)
2. Introduction to the functional biochemistry of liver – A brief description of liver function tests

References :

Deb, A.C. (2008). *A Text book of Biochemistry* . Kolkata : New Central Book Agency.

Murray, R.K, Granner, D.K., Mayes, D.A. and Radwell V.W. (2000). *Harpers Biochemistry* (25th ed.). New York : Macmillan Publishers.

Nelson, D.C. and Cox, M.M.(2000). *Lehningers Principles of Biochemistry* (3rd ed). New York : Macmillan Publishers.

Rama Rao, A.V.S.S. (2007). *Text book of Biochemistry*. Tahuka, (AP) : L.K. and publishers.

Sharma, S. (2007). *Experiments and Techniques in Biochemistry*. New Delhi : Galgotia Publishers .

Sharma, S.(2000). *Human Nutrition and Meal Planning*. New Delhi: Nanda Prakashan.

Talwar, G.P.(2005). *A Text book of biochemistry and Human Biology*. New Delhi : Prentice Hall of India.

Biochemistry II: Metabolism and Diagnostic Biochemistry (Th)

Contact hrs.4/wk

Max. Marks - 60

Exam. Duration - 3 Hrs.

CA 20 SA 40

Objectives :

- Enabling the students to understand the biochemical basis of nutrition and health.
- Determining certain biochemical indices in quantitative terms in the laboratory to assess nutritional status and diagnosis of certain diseases.

Section A

- 1 Glycolysis , alcoholic fermentation as a variant of glycolytic pathway. Direct oxidation (HMP shunt) pathway of glucose metabolism. Gluconeogenesis. All aspects of the regulation of blood glucose level. TCA (Krebs) cycle and its significance as amphibiotic pathway.
- 3 β – oxidation pathway of fatty acid catabolism.
Role of carnitine in beta oxidation of fatty acids. De novo synthesis and chain elongation of saturated fatty acids. Metabolism of ketone bodies. Metabolism of cholesterol. Lipoprotein metabolism in brief and its relationship with lipid transport and atherosclerosis.

Section B

1. General reactions of protein metabolism. Synthesis of Urea – the urea cycle (Krebs-Hanseliet cycle). Biosynthesis of proteins. Basic aspects of Metabolism of Uric Acid and its nutritional implications.
2. General hierarchical organization of mammalian endocrine system – mode of action of insulin, glucagon, epinephrine, thyroid and steroid hormones.

Section C

1. Collection and preservation of biological fluids. Patterns of functional and non functional enzymes of blood plasma in health and diseases with specific mention to serum lipase, amylase, cholinesterase , alkaline and acid phosphatases, serum transaminases, lactate dehydrogenase (LDH) and creatine phosphokinase (CPK).
2. Introduction to the functional biochemistry of liver – A brief description of liver function tests.

References:

1. Deb A.C. A Text book of Biochemistry, New Central Book Agency, Kolkata.
2. Talwar, G.P. A Text book of biochemistry and Human Biology, Prentice Hall of India, New Delhi
3. Murray R.K., Granner D.K., Mayes, D.A. and Radwell V.W. (2000) : 25th edition Harpers Biochemistry, Macmillan Publishers.
4. Nelson D.C. and Cox, M.M. (2000): 3rd Ed Lehningers Principles of Biochemistry Macmillan Publishers.
5. Rama Rao, A.V.S.S. Text book of Biochemistry. L.K. and publishers.
6. Sharma S. (2000). Human Nutrition and Meal Planning , Nanda Prakashan (P&D) New Delhi;
7. Sharma Sheel (2007) Experiments and Techniques in Biochemistry –Galgotia Publishers New Delhi.
8. Sharma S. (1993), Practical Biochemistry, Classic Publishers, Jaipur.

Practical

Contact hrs.4/wk

Max. Marks - 30

Exam. Duration - 4rs.

CA 10SA 20

- (1) Estimation of total, free and conjugated, bilirubin in blood serum
- (2) Estimation of total and lipoprotein cholesterol in blood serum.
- (3) Estimation of triglycerides in blood serum.
- (4) Assay of alkaline phosphatase activity in serum.
- (5) Assay of the activity of transaminases (SGOT, SGPT) in serum.
- (6) Assay of the trypsin activity inhibition by some legume antinutritional factors

Metabolism and Diagnostic Biochemistry Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

Estimation of total, free and conjugated, bilirubin in blood serum

Estimation of total and lipoprotein cholesterol in blood serum.

Estimation of triglycerides in blood serum.

Assay of alkaline phosphatase activity in serum.

Assay of the activity of transaminases (SGOT, SGPT) in serum.

Assay of the trypsin activity inhibition by some legume antinutritional factors

Advanced Nutrition

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Apply various methods of estimation of body composition

estimate protein quality of food stuffs

estimate nutritional requirements of different groups and make recommendations through life cycle

conduct laboratory and anthropometric methods of assessment of nutritional status

Section A

1. Development of Nutrition as a science, metamorphosis of the science of nutrition in historical perspective
2. Body Composition: Concept of body composition biochemical composition, Nutritional anthropometry, Skin fold thickness, measurement and calculation of body density using Archimedes' principle and hydrometry. Calculation of percent body water and body fat from body density. Dilution techniques and calculation of indices of body composition. Lean body weight and fat free body weight. Concept of body cell mass and its determination by isotopic measurement. Application of body composition data
3. Evaluation of protein quality :In vitro evaluation- Chemical score, Protein digestibility coefficient, PDCAAS
In vivo evaluation- Biological value (BV), Net protein utilization (NPU), Protein efficiency ratio (PER), NDP caloric percent.

Section B

1. Concepts of energy expenditures and their application. Units of energy, measurement of energy expenditure by direct and indirect calorimetry. Calculation of non protein respiratory quotient and its conversion to quantity of carbohydrate and fat (in grams) metabolized. Determination of amount of protein metabolized and calculation of total heat production of the diet, basal metabolism, BMR and its measurement. Calculation of surface area from equations and monograms, SDA of food and its interpretation, calculation of energy expenditure of an average reference man and woman, regulation of energy balance
2. Perspectives in human nutritional requirements. Different methods of estimating nutritional requirements and their critical evaluation. Estimation of Energy, Protein, Fat, Iron, Calcium, vitamin A and vitamin C requirements
3. Regulation of food intake: Hunger and appetite, gastrointestinal factors in the regulation. Role of hypothalamus, glucose utilization in the body and fat stored in the body as regulators of food intake, regulation of body weight

Section C

1. Nutrition, immunity and infection. Innate and adaptive immunity. Primary and secondary lymphoid organs. Cell mediated and humoral immunity. T and B lymphocytes, antibody response, primary and secondary infection . Role of nutrition in immune functions, Immune aberrations – AIDS
2. Nutrition and stress - Stress types, Body's response (endocrine and metabolic) to short term and long term stress. Role of nutrition in stress coping
3. Non nutritive food components with potential health effects- polyphenols, tannins, phytates, phytoestrogens

References :

Annual Reviews of Nutrition(1981). California USA : Annual review INC

Bamji M.S., Krishnaswamy, K., Brahman G. N. V. (2017). *Text Book of Human Nutrition* 4th Ed.. New Delhi : Oxford and IBH publishing Co Pvt. Ltd..

Davidson, S. S., Passmore, L., Eastwood, M. A. (1986). Davidson and Passmore *Human Nutrition and Dietetics*. Churchill Livingstone

Pike, R. L., Brown, M. L. (1984) *Nutrition – An integrated approach*. Canada : John Wiley and Sons.
Sharma S., (2000). *Human Nutrition and Meal Planning*, Delhi : Jnanda prakashan.

E-reference :

Nutrient Requirements and Recommended Dietary Allowances for Indian

A Report of expert group of ICMR 2009

<http://www.scribd.com/document>

Advanced Nutrition Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

1. Determination of vitamin C status of the subject.
2. Detection of inherited disorders
 - a) Alkaptonuria
 - b) Fructosuria
 - c) Tyrosinosis
3. To practice the technique of anthropometry
4. Biochemical parameters and their relevance to the assessment of nutritional status.
5. Determination of basal metabolic rate
6. Acquainting the students with the methods of estimating nutrition requirements.
7. Orienting the students towards planning diets for metabolic disorders.

Applied and Community Nutrition

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Understand the applications of nutrition in public health

Comprehend the determinants of food and nutrition security

Work and collect data pertaining to nutrition and health in the field situation

Design strategies to facilitate community participation

State the strengths and weaknesses of the ongoing nutrition programmes

Section A

Introduction to Community Nutrition:

1. Definition of important concepts , community nutrition goals, skills and strategies made for their achievements
2. Formulation of food production targets, Food security, Food safety, Nutrition security, National Nutrition Policy

Section B

Nutrition Programme Management:

1. Introduction to Management – Definition , objectives and components of -
 - a. Planning
 - b. Implementation
 - c. Evaluation
2. Types of Supervision- relevance of supervision in nutrition programme management
3. Monitoring and Evaluation (Process and Impact,) National Nutrition Monitoring Bureau (NNMB)
4. The art and Science of field work.
5. Operations research – Definition and its application in nutrition programme management. An overview of response surface methodology (RSM) as a technique of process optimization
6. Community Participation – concepts and approaches

Section C

Other Measures to combat under nutrition :

1. Nutrition in primary health care and family welfare programmes
2. Nutritional Surveillance
3. Nutritional Rehabilitation for PEM in children, severe anaemia

Critique and Review of :

1. Integrated Child Development services
2. Mid Day Meal Programme
3. Anaemia Prophylaxis and Vitamin A Prophylaxis Programmes
4. Iodine Deficiency Disorders Control Programme

References :

Dahama, O.P. & Bhatnagar O.P. (1991). *Education and Communication for Development*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

Gopaldas, T. & Seshadri S. (Ed.).(1987). *Nutrition- Monitoring and Assessment*. New Delhi : Oxford University Press.

Park, K. (2007). *Park's Textbook of Preventive and Social Medicine*. Jabalpur: Banarasidas Bhanot Publishers.

THCU. (2001). Introduction to Health Promotion Program Planning (Version 3.0). The Health Communication Unit, Centre for Health Promotion, University of Toronto.

Wadhwa, A. & Sharma S. (2006). *Nutrition in the Community- A Text Book*. New Delhi: Elite Publishing House Pvt. Ltd.

Applied and Community Nutrition Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

1. Planning and conducting nutrition education projects for a community using different extension methods and audio visual aids.
 - Study of existing diet and nutrition practices
 - Planning
 - Conducting survey and imparting education
 - Analyzing data
 - Writing report
2. Visit to the ongoing national nutrition programmes

Nutrition in Diseases and Disorders

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Find out causes, clinical manifestation, preventive and therapeutic measure of disabling diseases, malabsorption syndrome and genetic defects

explain the role of probiotics, prebiotics, functional and nano food for maintaining health

Counsel patients to take therapeutic measure and diet modifications

Syllabus :

Section A

1. Nutrition in Cancer
 - Introduction
 - Dietary components associated with cancer
 - Nutritional care
2. Nutrition in AIDS
 - Introduction
 - Signs and symptoms
 - Transmittal routes
 - Nutritional care
3. Nutritional support in Disabling Disease
 - Rheumatoid arthritis
 - Osteo arthrits

Section B

1. Inborn Errors of Metabolism
 - Metabolic defect, clinical symptoms and management of -
 - Phenylketonuria
 - Galactosemia
 - Maple syrup urine disease
 - Homocysteineuria
 - Familial hypercholesterolemia
2. Nutritional management of malabsorption syndrome, food intolerance and allergy
3. Metabolism of alcohol, nutritional effects metabolism of alcohol and nutritional therapy in chronic alcoholism

Section C

Prebiotics, probiotics and symbiotics – Probiotics : Definition, types and relevance; Usefulness in gastro intestinal health and other health benefits; development of probiotic products; Prebiotics: Prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes; health benefits of prebiotics; symbiotics.

Development of functional foods, use of bioactive compounds in appropriate form with protective substances and activators; Research frontiers in functional foods; delivery of immunomodulators / vaccines through functional foods. Nutrigenomics- concept of personalized diet. Use of nanotechnology in functional food industry.

References :

Antia , F.P. and Abraham, P. (1997). *Clinical Dietetics and Nutrition (4th ed.)*. Delhi : Oxford university press.

Bamji , M.S. Rao, P.N. and Reddy, V. (1996). *Text Book of Human Nutrition*, New Delhi : Oxford & IBH Publishing Co, Pvt. Ltd.

Davidson , S.R., Pabsamore, J.E. and Truswell, A.S. (1984). *Human Nutrition and Dietetics*. Edinburgh : English Language Book Society and Churchill livingston.

Lutz Carroll A , Mazur Erin E. & Litch Nancy A. (1997). *Nutrition and Diet Therapy*, (6th ed.). Philadelphia : F.A. Davis Company.

Robinson, C.H.(1986). *Normal and Therapeutic Nutrition* (17th ed.). NY: McMillan publishing Company.

Sharma, S. (2000). *Human nutrition and Meal planning*. New Delhi : Nanda Prakashan.

Shils, M.E., Olson, J.A. Shike. and Ross, A.C. (1999). *Modern Nutrition in Health and Disease*, (9th ed.). Maryland : Williams & Wilkins.

Wardlaw, C. M. and Insel, P.M. (1993) .*Perspectives in Nutrition*. (2nd ed.) St. Louis US : Mosby College Publishing.

Williams, S.R. (1989). *Nutrition and Diet Therapy*. (6th ed.). St. Louis US : Time Mirror / Mosby College Publishing.

E- resources :

History, Nutraceuticals, Mechanism, products and application
<https://www.slideshare.net/drswaroopsoumya/prebiotics-and-probiotics-40275016>

Different kinds of probiotics, sources and side effects

<https://www.slideshare.net/151212345/prebiotic-and-probiotic>

Inborn errors of metabolism

<https://www.slideshare.net/Sreevarshinim/inborn-errors-of-metabolism-ppt>

Nutrition in Diseases and Disorders Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

1. Dietary management in AIDS and Cancer
2. Dietary management of metabolic disorders and food allergies
3. Dietary management in arthritis
4. Dietary management of inborn errors of metabolism

Techniques and Instrumentation in Nutrition Research

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Familiarized with instruments and techniques used in Food Science and Nutrition Research

Skilled to analyze macro and micro nutrients of food stuffs with precision and accuracy

Syllabus :

Section A

1. Electrolytic dissociation in acids, bases and salts, Buffers used in nutritional and biochemical analysis, Concept of buffer action, Henderson – Hasselbech equation and its application in buffer preparation, Theory of indicators and principle of measurement of pH by indicators /pH papers
2. Physico-chemical principles involved in visible and UV spectrophotometry, Construction and working of colourimeter and UV spectrophotometer
3. Physico- chemical principles involved in atomic absorptiometry, fluorimetry, flame photometry and pH measurement, construction and working of these instruments. Application of these techniques

Section C

1. Principles and brief description of the working and applications of radio immuno assay (RIA) and enzyme linked immuno sorbent assay (ELISA) techniques
2. Overview of the principles and applications of biological and microbiological assays.
3. Animal experimentation : Albino rats as experimental animals, their nutritional/dietary requirements , housing and care, formulation of diets, Feeding practices, Anaesthesia, Blood sampling techniques, Euthanasia and organ sampling, Designing animal experiments

References :

Keith Wilson and John Walker(Ed.). (2005). *Practical Biochemistry Principles and Techniques*. New Delhi : Cambridge low priced edition.

Lab Manual in Biochemistry (2012). New Jersey : Wiley Eastern limited.

Raghuramulu et al (2010). *A Manual of Laboratory Techniques*. Hyderabad : National Institute of Nutrition.

Sharma S. (2007). *Experimental Techniques in Biochemistry*. Delhi : Galgotia publishers.

Techniques and Instrumentation in Nutrition Research Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

Standardization of a colourimetric and spectrophotometric method and working on this instrument

Standardization of a fluorimetric method and working on this instrument

Semi automatic protein estimation by Kjehldal nitrogen quantitation

Separation of the various components of a mixture using a suitable chromatographic method

Dietary fibre estimation by Pelican semi automatic apparatus

Nutrition for Health and Fitness

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain the components of health and fitness and the role of nutrition

Explain the role of sports nutrition for the enhancement of performance

evaluate and make recommendations to maintain the fitness and well being of an individual

Syllabus :

Section A

1. Introduction to fitness, wellness and lifestyle management. Basic principles of physical fitness. Definition, components and assessment criteria of age – specific fitness and health.
2. Holistic approach to the management of fitness and health:
 - Energy input and out put
 - Diet and Exercise
 - Effect of specific nutrients on work performance and physical fitness.
3. Nutrition, exercise, physical fitness and health inter-relationship

Section B

Dietary supplements and ergogenic aids

1. Nutrition in sports: Sports specific requirements Diet manipulation pre and post game meal. Diet for person with high energy requirements, stress, fracture and injury.
2. Water and electrolyte balance: Loss and their replenishment during exercise, effect of dehydration, sports drinks.
3. Effect of work environment on health, safety, and performance adaptive responses
 - (i) Physical factors-heat, cold, noise, vibration and light.
 - (ii) Nutritional factors (water, electrolyte, energy, foods, protein, vitamin, essential trace minerals),
 - (iii) Environmental contaminates (dust, gases, fumes, chemical)

Section C

1. Significance of physical fitness and nutrition in the prevention and management of -
 - Weight
 - Diabetes mellitus
 - Cardiovascular disorders
2. Nutrition and exercise regimes for pre and post natal fitness
3. Alternative systems for health and fitness like ayurveda, yoga, meditation, vegetarianism and traditional diets

References:

- Wolinsky Ira (Ed.)(1997). *Nutrition in Exercise and sports*(3rd ed.). Florida : CRC Press
- Mahan, L.K. & Eccohstum P.S. (2000). *Krause's Food , Nutrition and Diet therapy* (10th ed.). W.B. Saunders Ltd.
- MCArkle, W. Katch . F. and Katch, V. (2014). *Exercise Physiology Energy, Nutrition and Human Performance* (8th ed.). Philadelphia : Williams and Wilkins.
- Parizkova, J.(Ed.). (2017). *Nutrition, Physical Activity and Health in Early Life*. Florida : CRC Press.
- Ross, A.C., Caballero,B., Cousins,R J, ,Tucker K L, and Ziegler T. R. (2014).*Modern Nutrition in Health and Disease* (11th ed.) . Philadelphia : Williams and Wilkins.

Sizer F. and Whitney , E. (2000). *Nutrition – concepts and controversies (8th ed.)*. Belmont, CA: Wadsworth, Thomson Learning.

Whitney E.N. & Rolfes S.R. (1999). *Understanding Nutrition (8th ed.)*. Belmont, CA: Wadsworth, Thomson Learning.

Journals :

1. *Medicine and Science in sports and Exercise*
2. *International Journal of Sport Nutrition*

E- resources :

Carbohydrate loading, fueling exercise, Pre and post workout meal, hydration

www.slideshare.net/MUSWellness/sports-exercise-nutrition

Benefits, Principles, Pre and post workout meals

<https://www.slideshare.net/fitnesslex/sports-nutrition-38663048>

Nutrients in sports nutrition

<https://www.slideshare.net/BODYFUELZBIO/basics-on-sports-nutrition>

Nutrition for Health and Fitness Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

Assessment of nutritional status and Physical fitness

Height, weight, BMI

Mid Upper arm circumference

Skin fold thicknesses

WHR

2. Diet survey and diet calculations

Techniques and Instrumentation in Nutrition Research

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Familiarized with instruments and techniques used in Food Science and Nutrition Research

Skilled to analyze macro and micro nutrients of food stuffs with precision and accuracy

Syllabus :

Section A

1. Electrolytic dissociation in acids, bases and salts, Buffers used in nutritional and biochemical analysis, Concept of buffer action, Henderson – Hasselbech equation and its application in buffer preparation, Theory of indicators and principle of measurement of pH by indicators /pH papers
2. Physico-chemical principles involved in visible and UV spectrophotometry, Construction and working of colourimeter and UV spectrophotometer
3. Physico- chemical principles involved in atomic absorptiometry, fluorimetry, flame photometry and pH measurement, construction and working of these instruments. Application of these techniques

Section C

1. Principles and brief description of the working and applications of radio immuno assay (RIA) and enzyme linked immuno sorbent assay (ELISA) techniques
2. Overview of the principles and applications of biological and microbiological assays.
3. Animal experimentation : Albino rats as experimental animals, their nutritional/dietary requirements , housing and care, formulation of diets, Feeding practices, Anaesthesia, Blood sampling techniques, Euthanasia and organ sampling, Designing animal experiments

References :

Keith Wilson and John Walker(Ed.). (2005). *Practical Biochemistry Principles and Techniques*. New Delhi : Cambridge low priced edition.

Lab Manual in Biochemistry (2012). New Jersey : Wiley Eastern limited.

Raghuramulu et al (2010). *A Manual of Laboratory Techniques*. Hyderabad : National Institute of Nutrition.

Sharma S. (2007). *Experimental Techniques in Biochemistry*. Delhi : Galgotia publishers.

Food Processing and Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Describe the source and variability of raw food material and their impact on food processing operations

Explain the principles and current practices of processing techniques and the effects of processing parameters on product quality

Describe the unit operations required to produce a given food product

Explain the properties and uses of various packaging materials

Describe the transport processes and the unit operations in food processing as demonstrated both conceptually and in practical laboratory settings

Syllabus :

Section A

1. Principles underlying food preservation operations
 - (i) Thermal
 - (ii) Refrigeration and freezing
 - (iii) Dehydration
 - (iv) Radiation
2. Processing Technology of foods:
 - (i) Cereals: Wheat milling process, baking technology, production of bread, barley malting. Rice processing, fractionation, Parboiled Rice
 - (ii) Beverages: Manufacturing process of Beer, Wines, Liquors and high fructose corn syrup.

Section B

1. Nuts and oilseeds: Pressing, Solvent Extraction, Purification (degumming, refining, bleaching, deodorization), hydrogenation, plasticizing and tempering.
2.
 - a) Fruits and vegetables: changes during ripening.
 - b) Canning process of fruits and vegetables.
3.
 - a) Milk and Milk products: Milk processing, separation and standardization, pasteurization, homogenization, ultra high sterile milk.
 - b) Milk products: Skimmed milk, Fortified milk, Butter, Cheese, dehydrated milk products.

Section C

1. Meat and Fish Processing
 - Rigor Mortis and its role
 - Ageing
 - Tenderizing
 - Curing
 - Smoking
 - Salting
 - Pickling
 - Storage of Egg, meat and Fish
2. Fortification Technology:

- Objectives
 - Nutritional significance
 - Selection of vehicle
 - Fortification of salt, Cereal products and dairy products.
3. Extruded food: An Introduction to Extrusion Technology
 4. An Introduction to packaging Technology
 - objectives
 - Basic Packaging Materials and their protective qualities
 - Effect of packaging on the nutritive value of foods

References :

- Dey, S.(1996). *Outlines of Dairy Technology*, Delhi : Oxford University Press,
- Desrosier,N.W(1977). *Elements of Food Technology*. Connecticut: USA :AVI publishing Co.
- Fellows,P.J(2008).*Food Processing Technology: Principles and practice (2nd ed.)*. Cambridge : CRC Woodhead publishing LTd,
- Gould, G.W.(1994). *New Methods of Food Preservation* . London: Blackie Academic and Professional.
- Matz, S.A.(1970). *Cereal Technology*. Connecticut, USA: AVI Publishing Co.
- Tressler, D. K. & Joslyn, M. A.(1961). *Fruit and Vegetable Juice Production*. Connecticut, USA: AVI Publishing Co.

E resources

Food processing and technology

<https://www.acs.edu.au/courses/food-processing-and-technology-721.aspx>

Food Science knowledge into Food Chain

<https://www.iseki-food.net/training/e-learning-Integrating>

FAO

<http://www.fao.org/elearning/#/elc/en/home>

Food Product Development Safety and Quality Control

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Describe the various aspects of product development

Apply the knowledge of quality assurance in food industries

Explore sensory and nutritional attributes of new product

Syllabus :

Section A

1. New food products
 - Definition, classification, characterization, factors shaping new product development
 - Social concerns, health concerns, impact of technology and market place influence
2. A brief introduction to phases in Food Product Development- (with appropriate examples of each phase)
 - Idea generation
 - Screening (feasibility, consumer studies, financial review)
 - Development, production, consumer trials and test market

Section B

3. Refining the screening procedures for the product
 - Sensory Evaluation
 - Shelf life testing
 - Product integrity and conformation to standards and their specialization for
 - (i) Preservatives
 - (ii) Colouring matter
 - (iii) Emulsifying agents
 - (iv) Current concepts of quality control
4. Quality assurance programme
 - Quality assessment plan
 - Documentation of records, product's standards
 - Product and purchase specification
 - Process control and HACCP

Section C

5. Product Evaluation
 - Sampling for product evaluation and line control
 - Statistical quality and process control
 - Sample preparation
 - Reporting results and reliability of analysis
 - Grading and marketing of finished products
6. Tests for specific raw food ingredients and processed products
 - a) Proximate analysis
 - b) Specific Nutrient analysis

References :

Early, R. (1995): *Guide to Quality Management Systems for the Food Industry*. London: Blackie. Academic and Professional.

Food and Agriculture Organization. (1980). *Manuals of Food Quality Control to Additives Contaminants Techniques*. Rome.

Fuller, G.W. (1994). *New Food Product Development from Concepts to Market Place*. New York ,NY: CRC Press

Man, C.M.D., & James, A.A. (1994). *Shelf Life Evaluation of Foods*. London: Blackie. Academy and Professional.

Nelson, S.S. (1994). *Introduction to Chemical Analysis of Food*. Boston: Jones and Bartlett Publishers.

Ranganna, S.S. (1994): *Handbook of Analysis and Quality Control for Fruits and Vegetable Products*. New Delhi: Tata McGraw Hill Publishing Co Ltd.

E - Resources:

Sensory evaluation in food industry

http://eta.bibl.u-szeged.hu/731/1/sensory_evaluation_in_food_teljes.pdf

Quality Control A Model Program for the Food Industry

<https://athenaeum.libs.uga.edu/bitstream/handle/10724/12251/B997.pdf?sequence=1>

Food Quality Assurance

<http://www.thanut-swu.com/images/BOT331/food%20quality%20assurance.pdf>

Food Processing and Quality Assurance Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On successful completion of the course students will be able to:

Design and develop new food products for human consumption

Evaluate sensory and nutritional attributes of new product

Appreciate the effect of processing upon the nutritional properties of foodstuffs

Syllabus :

1. To study the time and water required for sprouting whole pulses and legumes.
2. To prepare Amylase rich Foods (ARF) from cereals and to develop energy dense food products from it.
3. To demonstrate the method of preparing Peanut Butter.
4. To test the Acceptability of texturized food products as an alternative to meat.
5. To prepare simple Extruded food products.
6. Quality Assurance ,testing of wheat flour.
 - Alcohol acidity
 - Gluten.
7. Quality Assurance of Bread
 - pH of Bread extract
 - Acid insoluble ash
 - Crude fibre
 - Total solid content.
8. To improvise products by evolving on the traditional ones and their sensory evaluation.
9. Qualitative evaluation of some common food additives.
 - Sulphur dioxide
 - sodium benzoate
 - Colours Extraction
 - Identification of food colours (annatto, Chlorophyll, caramel, turmeric)

Nutrition and Critical Care

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:
understand the nuances of nutrition care process in ICUs
deeply know the "Medical nutrition therapy" (MNT) for life threatening prevalent diseases and disorders
use evidence based practice in hospital settings
Skilled to plan therapeutic diet for different types of diseases

Syllabus :

Section A

Definition and process of nutritional care, nutritional screening and counseling.
Enteral Nutrition – Introduction, advantages of enteral feeding, indication and selection of enteral feeding, Enteral feeding methods (gastric or transpyloric tube feeding), Techniques of tube placements: complication of tube feeding, measures of monitoring of EN.
Parenteral Nutrition- Introduction, indications of Parenteral Nutrition, components and requirements for PN solution , delivery and monitoring for PN, complications of PN (technical, metabolic and infective)
Hospice Nutrition

Section B

Role of immuno-enhancer, immune suppressants and special diet in critical care
Diet related ethical issues in the terminally ill
Diet and metabolic aspects and special nutritional requirement in ESRD and multiple organ dysfunction syndrome

Section C

Clinical and metabolic aspects and special nutritional requirements in following conditions -
Stress, trauma, sepsis, burns
C.V. complication and surgery
Kidney transplant, dialysis
Hepatic failure and transplant
GI tract surgery
Diabetic complications
Neurosurgery

References :

Ghai, O.P and Gupta P. (1994). *Essential Preventive medicine; Clinical and applied orientation*. NOIDA (UP) : Vikas Publishing House Pvt.Ltd.
Gupte S. (Ed.). (2006). *Textbook of Pediatric Nutrition*. Delhi: Peepee Publishers and Distributors (P) Ltd.
Mahan L.K. and Escott Stump S. (Eds.) (2000). *Krause's Food, Nutrition & Diet Therapy*.USA: Saunders.
Phillips, G.D. & lodgers. C.L. (1986) *Parenteral and Enteral Nutrition A Practical guide*. London : Churchill, Livingstone
Shils, M.E. , Oslan, J.A., Shike, M. & Ross, A.C. (1999): *Modern Nutrition in Health and Disease (9th ed.)*. Philadelphia: William and Wilkins.

Srilakshmi B. (2011). *Dietetics*. New Delhi: New Age International (P) Limited, Publishers.

Williams S.R. (2007). *Nutrition and Diet Therapy*. St. Louis: Times Mirror/Mosby College Publishing.

Zaloga, G.P (1994) *Nutrition in critical care*. T St. Louis: imes Mirror/ Mosby.

Clinical Nutrition and Dietetics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Skilled in the methods of assessment of nutritional status of the patients

Able to be employed as dietician in hospitals and other health organizations

Able to conduct the researchers in the field of therapeutic nutrition

Prepared to work as independent dietician and dietary counselors

Ready to run therapeutic kitchens and increases their employability in such kitchens

Syllabus :

Section A

1. Nutritional assessment of hospital patients
 - Methods based on single index
 - Prognostic nutritional index
 - Mini nutritional assessment
 - Nutritional risk index
 - Hospital prognostic index
 - Cluster analysis
 - Subjective global assessment
2. Drug nutrient interaction
 - Drug effect on food and nutrition
 - Food and nutrient effect on drugs

Section B

Recent advances in the dietary management of –

1. Gastro intestinal diseases
 - Peptic ulcer
 - Ulcerative colitis
 - Diarrhoea
 - Dysentery
2. Liver disorders
 - Viral hepatitis
 - Cirrhosis
 - Hepatic coma
3. Gall bladder and pancreatic disorders
 - Cholelithiasis
 - Pancreatitis

Section C

Recent advances in the dietary management of –

1. Renal disorders
Acute nephritis
Nephrotic syndrome
2. Eating disorders
Anorexia nervosa
Bulimia nervosa
4. Infection

References :

- Bendich, A., Deckelbaum, R.J.(Eds.) (2001). *Primary and Secondary Preventive Nutrition*. Totowa NJ : Humana Press.
- Mahan, K. L., Escott–Stumps, S. (2000). *Krause’s Food, Nutrition and Diet Therapy*. Philadelphia USA : W. B. Saunders.
- Shils, M.E., Olson, J. A., Shike, M., Ross, A. C.(1999). *Modern Nutrition in Health and Disease*. Bombay: KM Varghese Company.
- Williams, S.R. (1997). *Nutrition and Diet Therapy*. St. Louis: Times Mirror/ Mosby Publishing

Therapeutic Nutrition Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On successful completion of the course students will be able to:

Prepare a safe and nutritious general (house) tube feed for home based patients

Plan and to prepare therapeutic diet for different types of diseases

Suggest suitable nutritional supplements for specific health conditions

Syllabus :

1. Planning of diets using exchange list for -
 - Peptic ulcer
 - Ulcerative colitis
 - Viral hepatitis
 - Cirrhosis
 - Cholelithiasis
 - Acute nephritis
 - Nephritic syndrome
 - Infection (acute fever)
2. Preparation and service of these diets
3. Preparation of aids for dietary counseling
4. Market survey of commercial nutritional supplements
 - a) Collection of information on commercial food formula available in the market and their evaluation
 - b) Intravenous nutrition supplement (TPN)- (cost, composition, dosage, indications and contra – indications)
5. Preparation of blenderised formulae for enteral feeding – Standard tube feed formula, High calorie high protein tube feed formula, Diabetic feeds, Renal feeds, Hepatic feed

Research Methods in Clothing and Textile

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain meaning , importance, types of research and methods of data collection

Outline research proposal

Write research report

Syllabus :

Section A

1. Research - meaning and importance, nature and areas of research in clothing and textiles.
2. Types of Research
 - Pure, applied and action
 - Longitudinal vs cross sectional approach
 - Quantitative - descriptive, correlational, causal comparative, experimental research
 - Qualitative - historical, explanatory
3. Planning Research Design
 - Meaning, functions, characteristics of good research design.
 - Phases in research designs
 - Design for different types of research
 - Outlining a research proposal - Introduction, review of literature, significance of study, operational definition of terms and concepts, delimitations of study, basic assumptions/hypothesis Sampling tools and procedure for collecting data, bibliography, time and budget schedule

Section B

1. Research problem:- sources, criteria, statement and operational definition
2. Review of literature – Importance, sources of literature collection and presentation
3. Variables & their types, formulating objectives
4. Hypothesis – meaning, importance, ways of stating
5. Sampling – meaning, importance, sampling techniques, sources of bias and methods of reducing bias

Section C

Methods & devices of data collection :

1. a) Survey, observation, interview, questionnaire, case study, check list, rating scale, field studies.
b) Psychometrics : meaning & characteristics of a good test, determination of reliability, validity, discrimination power
2. Data Analysis:- Classification, coding and analysis, interpretation of data.
3. Research Report :
 - (i) General structure of reporting.
 - (ii) Formal style of writing
 - Acknowledgement
 - Tables & figures
 - Footnotes, Quotations
 - Appendices, Bibliography

- Writing for publication

References:

Agarwal, J.C. (1966). *Educational Research. An Introduction*. New Delhi: Arya Book Depot.

Bhatnagar, G.L. (1990). *Research Methods and Measurement in Behavioural and Social Sciences*. New Delhi: Coll Publishing Academy.

Ghosh, B.N. (1986). *Dictionary of Research Methods*. Delhi: Arnol Heinmann.

Kothari, C.R. (2004). *Research Methodology: Methods and Techniques*. New Delhi: New age International.

Nachmias, D. & Nachmias, C. (1981). *Research methods in Social Sciences* (2nd ed.). New York: St Martin's Press.

E-Resources:

Research methodology, methods and techniques, CR Kothari

<http://www.modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf>

Research hypothesis – Slide share

<https://www.slideshare.net/drjayeshpatidar/research-hypothesis-20719840>

Apparel Pattern Making

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Acquire basic skills and knowledge to make paper patterns by different methods

Develop an understanding of sizing systems and pattern grading techniques used in garment industry

Create designs for apparels using construction details applying elements of arts and principles of designs

Produce paper patterns of different designs in different sizes

Syllabus:

Section – A

1. Methods of pattern making
(a) Drafting (b) Flat Pattern (c) Draping
Their principles, applications and limitations in clothing construction
2. Types of block patterns – standard, simplified, tailored, trade, primary and secondary blocks, blocks for knitted fabric, commercial pattern

Section – B

Anthropometric measurements and their values

Body proportion, figure types and sizes

Measurement for men's tailored garments, method of measuring female figure for different garments

Techniques of grading block

Pattern envelope – front, back, pattern marking, pattern guide sheet

Clothing terminology

Section – C

Scope of dress and apparel design

Roles and responsibilities of designer

Types of design – structural and decorative

Use of construction features in design – seams, tucks, pleat, gather, neckline, hem opening, fasteners, sleeve, collar, wristband, cuff

Elements of arts and principles of design and their application on apparel

Design & fabric selection in relation to figure, fashion, climate, occasion, complexion

References :

Erwin, and Kinchen (1979). *Clothing for Modern*. New York: MacMillan and Co.

Kallal (1995). *Clothing Construction*. New York: Macmillan Publishing Company.

Reader's Digest complete Guide to Sewing. (1979). London: The Readers Digest Association Ltd.

Winfred, A. (1996). *Fabric Form and Flat Pattern Cutting*. New Delhi: Om Books Service.

Apparel Pattern Making Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

Designing through flat pattern

 Dart Manipulation in bodice

 Dart Manipulation in skirt

Development of variation in

 Basic sleeves

 Collars

 Neckline

 Opening

Textile Testing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain and use methods and techniques to analyze textile fiber, yarn and fabric properties for end use performance

Use different testing equipments, their underlying principles, the international accepted standards, test methods and the language of measurement

Analyze the discriminatory selection of textiles for specific end uses

Syllabus:

Section A

Objectives and importance of textile testing, importance of standards, different types of standards based on established science, introduction to national and international bodies – BIS, ASTM, BS, ISO, AATCC

Selection of samples for testing – Random sampling procedures for determination of properties of fibers, yarns and fabrics

Standard atmospheric test conditions, various methods to measure relative humidity, moisture content and moisture regain of textiles

Section B

Fiber testing - definition, objectives and method of testing staple length, effective length, short fiber percentage, fineness, maturity, strength

Yarn Testing – definition, objectives and method of testing count, twist, diameter, crimp, tensile strength and elongation at break, stress- strain curve, elastic recovery, yarn appearance, evenness

Section C

Fabric Testing – definition, objectives and method of testing length, width, bow, thread count, weight, thickness, breaking strength, tear strength, bursting strength, abrasion resistance, pilling, shrinkage, stiffness, drapability, crease recovery

Colorfastness test – colorfastness to washing, sunlight, crocking, perspiration, dry-cleaning, ironing

Thermal properties of textile fabric

References:

Booth, J.E. (1976). *Principles of Textile Testing*. London: Newness Butterworths.

Grover and Hamby (1960). *Hand book of Textile Testing and Quality Control*. New Delhi: Wiley Eastern Ltd.

Trotman, E.R. (1975). *Dyeing and Chemical Technology of Textile Fibers*. London: Charles Griffin and Company Ltd.

E-Resources:

AATCC TEST Methods, technical manual and standards

Textile standards

<https://www.astm.org/Standards/textile-standards.html>

Textile research associations

http://texmin.nic.in/pdf/ar02_c13.pdf <https://www.aatcc.org/test/methods/>

Textile Chemistry Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Identification tests for blends
2. Desizing, scouring and bleaching of textile material
3. Determination of strength of bleach liquor
4. Determination of hardness of water
5. Softening of water with various methods
6. Determination of alkalinity in soap solution
7. Determination of effectiveness of soaps and detergents
8. Formation and detection of oxycellulose, copper number of oxidized cotton

Fashion Business and Communication

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explore dynamics of fashion , its development and role of fashion designers

Gain understanding of fashion business fashion communication

Describe managerial aspects of fashion retailing

Illustrate fashion figures, garment details, accessories and theme rendering

Develop fashion line using elements of art and design

Syllabus :

Section A

The Dynamics of fashion; an overview

1. Fashion terminology, fashion cycle, principles of fashion adoption, theories of fashion adoption, psychology of fashion, factors affecting fashion and its changes. History of fashion
2. Fashion forecasting, sources of fashion information. The role of designers in merchandising
3. Components of fashion: silhouette, detail, texture, color, fabric, seams and trims
4. Research and design development: An advance approach
Elements & principle of art & design
Interpreting theme /trend
Scope of line
Line portfolio
Designers case study (National & International)

Section B

Fashion Retailing & Business:

1. The definition and concept of retailing, role of retailing in merchandising, retail environment, types of retail stores, expansion of retailing in 20th century
2. The retail mix, planning and budgeting for a retail store, maintenance and ordering of stocks, preparation of sales reports
3. Segments /categories of fashion Industry – An overview
Primary level
Secondary level

Section C

Fashion communication:

1. Need for promotion of fashion, need for the communication process, and communication through media
2. Brief overview about written communication, fashion shows in practice or choreography of fashion events
3. Visual communication:
Plans and schedule – seasons, holding promotion, sales themes / ideas
Types of displays – Window display, Interior displays
Elements of display – The merchandise, the backdrop, wall & shelves, mannequins and forms, signage
lightings – illuminance levels, relation to colors

References:

- Abling, B. (1993). *Fashion Sketchbook*. New York: Fairchild publication.
- Abling, B. (2017). *Fashion Flats and Technical Drawing*. New York: Bloomsbury Publication.
- Aldrich, W. (1966). *Fabric form and flat pattern cutting*. London: Blackwell.
- Castelino, M. (1994). *Fashion Kaleidoscope*. Calcutta: Rupa and co.
- Clark, J. (2015). *Fashion Merchandising: Theory and Practice*. London: Palgrave.
- Frings, G. S. (1999). *Fashion from Concept to Consumer*. New Jersey: Prentic Hall
- Ireland, P.J. (2005). *Figure Templates for Fashion Illustration*, Singapore: Page One Publishing Pvt.Ltd.
- Leach, R. (2012). *The Fashion Resource Book: Research for Design*. London: Thames and Hudson
- Seivewright, S. (2017). *Research and Design for Fashion*. London: Bloomsbury Publication
- Stone, E. (2004). *The Dynamics of Fashion*. New York: McGraw Hill Book Company

E-Resources:

Fashion cycle, adoption of fashion – slide share

<https://www.slideshare.net/Tamilselvan245/fashion-cycle-adaption-of-fashion>

Innovative approaches in fashion retailing,

https://www.researchgate.net/publication/322291991_Innovative_Approaches_In_Fashion_Retailing

Fashion Business and Communication Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Fashion figure proportion:
 - a) Sketching of different croqui (front, back & side view) for child, male & female
 - b) Basic figure forms; drawing legs, arms, feet, hand in different form and motion
 - c) Fashion heads; drawing head in different angle & sketching features, sketching hair style
 - d) Model drawing: gesture components & sketching different poses
2. Sketching garment & garment details using gravity, angles, & perspective
neckline, collars, sleeve details, skirts, Pants, blouse, blazer, jacket, coats, ruffles, cascades, cowls, smocking and shirring & draping details
3. Sketching Accessories:
hats, headgear, footwear, sunglasses, bags & purses, jewellery
4. Basic rendering techniques:
 - a) Color matching using different media
 - b) Pattern and texture – checks, stripes, plaids & gingham, fabric prints
 - c) Reducing the print
5. Development fashion line / range of garment (with accessory) using elements of art & design. texture color, details, shape & structure
6. Theme Rendering
Casual wear
Sports wear
Executive wear/ Formal wear
Night wear
Bridal wear
Beach wear
Traditional wear/ Ethnic wear
Party wear

Historic Textiles

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Summarize the differences in regional embroideries, resist dyed textiles and handloom weaving of India

Classify a specific embroidery style; block printed textiles and hand-woven textile of India and other countries on the basis of colors, motifs, patterns and layout

Describe the influencing factors for the evolution and development of different Indian traditional textiles

Develop portfolios of designs of different types of traditional textiles

Prepare embroidery articles

Syllabus:

Section A

Brief history and development of woven, embroidered and printed textiles in India

An overview of shawls, carpets, tapestry, brocades, baluchar butidar, himru, mushru, dacca mulmul, chanderi and Indian ikats

Section B

An overview of painted and mordant dyed textiles – picchwai, pattchitra, madhubani and kalamkari. Block and resist printed textiles of Rajasthan, Gujarat and M.P.

An overview of traditional embroideries of India – phulkari, chikankari, kantha, gujarati, kashmiri, kasuti, chamba rumal and manipuri embroidery

Section C

History of textile fibres, colors and motifs in India, China, Egypt, Peru, Greece, Crete and Mesopotamia

References:

Chattopadhyay, K. (1975). *Handicrafts of India*, New Delhi: Indian Council for Cultural Relations.

Ghosh, G.K. & Ghose, S. (2000). *Indian Textiles*. New Delhi: APH Publishing Corporation.

Ghosh, G.K. & Ghose, S. (2000). *Ikat Textiles of India*. New Delhi: APH Publishing Corporation.

Gillow, J. (1991). *Traditional Indian Textiles*, London: Thames and Hudson Ltd.

Kothari, G. (1995). *Colorful Textiles of Rajasthan*. Jaipur: Jaipur Printers Pvt. Ltd.

Mehta, R.J. (1970). *Masterpieces of Indian Textiles*, D.B. Bombay: Taraporewala Sons and Co. Pvt. Ltd.

Naik, S.D. (1996). *Traditional Embroideries of India*. New Delhi: APH Publishing Corporation,

Sharma, V. (2002). *Fabric treasures of Andhra Pradesh*. New Delhi: Bhartiya Kala Prakashan.

Historic Textiles Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Preparation of portfolio of designs of different textiles- printed woven and embroidered
2. Preparation of samples of traditional Indian embroideries
3. Preparation of any one embroidery article

Garment Production Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain functions of different sections of garment production unit

Define and explain the principles and methods of making and joining various garment parts

Extend and expand ideas about materials and technologies available for apparel industry so as to further develop their creativity and critical thinking

Examine and evaluate the quality of apparels during production

Syllabus:

Section A

Introduction to the background and structure of the garment industry

The organization of a garment factory – various departments like design, marketing, finance, purchasing, production and operation

Review of fundamental aspects of garment designing (Pattern making)

Section B

Manufacturing technology -

Cutting and cutting room

Fusing technology

Sewing technology

Pressing technology

Production technology

Warehousing

Section C

Quality assurance in garment manufacturing - inspection and its significance, Raw material inspection, In process inspection, Final Inspection and A QL, Statistical Quality Control

References :-

Carr, H. & Latham, B. (1994). *The Technology of Clothing Manufacture* (2nd ed.). Oxford, UK: Blackwell Science Ltd.

Cooklin, G. (1991). *Introduction to Clothing Manufacture*. Oxford, UK: Blackwell Science Ltd.

Cooklin, G. (1997). *Garment Technology for Fashion Designers*. Oxford, UK: Blackwell Science Ltd.

Glock, R. E. & Kunz, G. I. (2005). *Apparel manufacturing: sewn product analysis*. New Delhi, India: Pearson Education, Inc.

Naseer, M. (2007). *Pocket Apparel expert: a practical handbook on garment manufacturing*. Lahore, Pakistan: Irfan Ahmed Shaikh.

Rosenau, J. A. & Wilson, D. L. (2014). *Apparel merchandising: the line starts here* (3rd ed.). New York, NY: Fairchild books.

E-Resources:

Fabric cutting Knives

<https://www.textileschool.com/464/fabric-cutting-techniques/>

An overview of quality in textile industry

<http://textilelearner.blogspot.com/2013/05/an-overview-of-quality-and-quality.html>

Garment manufacturing quality control

<https://www.scribd.com/doc/134452607/Assignment-on-Garment-Manufacturing-Quality-Control-pdf>

Quality control system in garment

<https://textilelearner.blogspot.com/2014/11/quality-control-system-for-apparel.html>

In line inspection

<http://www.authorstream.com/Presentation/sanjitsingh58-1520805-line-inspection/>

Textile Testing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain and use methods and techniques to analyze textile fiber, yarn and fabric properties for end use performance

Use different testing equipments, their underlying principles, the international accepted standards, test methods and the language of measurement

Analyze the discriminatory selection of textiles for specific end uses

Syllabus:

Section A

Objectives and importance of textile testing, importance of standards, different types of standards based on established science, introduction to national and international bodies – BIS, ASTM, BS, ISO, AATCC

Selection of samples for testing – Random sampling procedures for determination of properties of fibers, yarns and fabrics

Standard atmospheric test conditions, various methods to measure relative humidity, moisture content and moisture regain of textiles

Section B

Fiber testing - definition, objectives and method of testing staple length, effective length, short fiber percentage, fineness, maturity, strength

Yarn Testing – definition, objectives and method of testing count, twist, diameter, crimp, tensile strength and elongation at break, stress- strain curve, elastic recovery, yarn appearance, evenness

Section C

Fabric Testing – definition, objectives and method of testing length, width, bow, thread count, weight, thickness, breaking strength, tear strength, bursting strength, abrasion resistance, pilling, shrinkage, stiffness, drapability, crease recovery

Colorfastness test – colorfastness to washing, sunlight, crocking, perspiration, dry-cleaning, ironing

Thermal properties of textile fabric

References:

Booth, J.E. (1976). *Principles of Textile Testing*. London: Newness Butterworths.

Grover and Hamby (1960). *Hand book of Textile Testing and Quality Control*. New Delhi: Wiley Eastern Ltd.

Trotman, E.R. (1975). *Dyeing and Chemical Technology of Textile Fibers*. London: Charles Griffin and Company Ltd.

E-Resources:

AATCC TEST Methods, technical manual and standards

Textile standards

<https://www.astm.org/Standards/textile-standards.html>

Textile research associations

http://texmin.nic.in/pdf/ar02_c13.pdf <https://www.aatcc.org/test/methods/>

Textile Testing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Moisture relations – use of oven and hygrometer
2. Physical testing of fiber, yarn and fabric
3. Testing of dyed materials colorfastness tests

Work Experience/Internship

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Practical experience in different units of clothing and textile industry is of great relevance and significance. Students will undergo internship training in a textile designing unit apparel manufacturing unit/ textile dyeing and printing unit / apparel export unit/ boutiques/ fashion houses etc. so that they get to understand the existing working practices, conditions and acquire an indepth technical knowhow. Since 'seeing is believing and doing is understanding', the experience would be more sound and meaningful.

There will be work experience/Internship of 4-6 weeks of duration during summer vacations after second semester examination.

Every student has to make presentation and submit a report at the beginning of III Semester.

Three components of evaluation

- (i) Appraisal Report by competent authority of the organization in which student completed training (based on regularity, punctuality, ability to work in the team, ability to be sensitive to the client, initiative to organize specific programme). - 30 Marks
 - (ii) Report submitted by the student - 30 Marks
 - (iii) Oral presentation - 40 Marks
- (evaluated by all the staff members and averaged)

Dyeing and Printing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Thoroughly comprehend the theories of dyeing, the laws of dyeing kinetics, the manufacturing principles of dyeing machinery and the preparation of various classes of dyes

Apply procedures and control of production, analyze structures, processes and techniques for optimization and quality assurance of dyeing

Describe the different methods of printing styles and machines used at industrial level.

Evaluate the technical advantages of each style of printing

Use the technical competency in dyeing and printing with different dyes on different fabrics

Find many research possibilities by getting in-depth technical knowledge of dyeing and printing practices at industrial level

Syllabus:

Section A

Classification, definition and chemical composition of textile dyes. C.I. constitution number and C.I. generic number

Dyeing with natural dyes, synthetic dyes and pigment dyes

Dyeing machine for fiber, yarn and fabric

Industrial dyeing practices

Dyeing auxiliaries and their use

Dyeing of blends

Section B

Introduction of printing. Historical development of printing method

Printing paste – thickening agents and auxiliaries for printing and their suitability to various classes of dyes and fibers

Preparation of printing paste for different dyes and different fibers

Section C

Styles of printing – direct, dyed, resist, discharge and raised styles

Methods of Printing - block, screen, stencil, roller, tie & dye and batik

Special printing procedures – polychromatic dyeing, transfer printing, carpet printing

Finishing and after treatment of printed goods at cottage and industrial level

References:

Clark, W. (1971). *Introduction to Printing*. London: Newness Butterworth.

Marsh, J.T. (1979). *Textile Science*. Mumbai: Sevak publications.

Shehnai, V.A. (1995). *Technology of Dyeing*. Mumbai: Sevak publications

Shehnai, V.A. (1995). *Chemistry of Dyes and Principles of Dyeing*. Mumbai: Sevak publications.

Trotman, E.R. (1964). *Dyeing and Chemical Technology of Textile Fibres*. England: Charles Griffin and Co. Ltd.

Dyeing and Printing Lab

Max. Marks : 100

L	T	P	C

Syllabus:

1. Dyeing of cotton, silk, wool, nylon, polyester, acrylic with corresponding dyes
Dyeing of cotton with direct, reactive and vat dyes by exhaust method
Dyeing of polyester with a disperse dye in HTHP dyeing machine.
Dyeing of wool and nylon with an acid dye by exhaust method
Dyeing of acrylic and silk with a basic cationic dye by exhaust method
2. Textile Designing
 - I Sources of design
Nature - flora and fauna
Architecture
Traditional arts and crafts
Religion and mythology
 - II Process of designing
Motif development – geometrical, simplified, naturalized, stylized and abstract
Growth of motif – entering and reducing
Colour application – colour harmonies and colour ways
Placement and repeats – sequel arrangement of units: spot, border, overall, line designs (horizontal, vertical, diagonal)
Types of pattern – centerline, continuous, flowing, (geometrical, abstract , decorative with fruits, flowers, foliage, birds, animals)
 - III. Design application
Designing for blocks, stencil, screen printing
Design suitability for different fabrics and for special articles of clothing and household use
Preparation of stencil and screen for printing
Printing suitable fabrics using direct, acid, azo, disperse and reactive dyes
Special printing effects on fabric-crepe, burntout, discharge

Advanced Apparel Designing and Construction

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Learning Outcomes:

On successful completion of the course students will be able to:

Create designs and layout for special fabrics

Handle different types of fabrics which will improve their sewing skill levels

Gain knowledge about different aspects of fit and apply them to create correct fit in the garment

Develop an understanding of quality standards for different components of garment

Develop patterns for complex designs and tailored garments and, construct them

Syllabus :

Section A

Special considerations in designing and layout of the garment for prints, stripes, checks, pile fabric etc

Handling of special fabric while cutting and stitching (deep pile, lace, velvet, chiffon, knits, leather)

Supporting fabrics: lining, interlining, interfacing, underlining, their functions and application

Section B

Fitting

Factors affecting good fit

Fitting shell, master pattern and the test garment

Basic pattern alterations in length, width, waist, hipline etc

Common problems encountered in fitting, remedies of fitting defects

Section C

Evaluating the quality of apparel - Identifying the components of apparel - fiber content, shaping device, pockets, neckline, hem treatment, decorative details

References:

Aldrich, W. (1996). *Fabric Form and Flat Pattern Cutting*. New Delhi: Om Books Service.

Bray, N. (1986). *More Dress Pattern Designing*. Oxford: Blackwell Science Ltd.

Bray, N. (1986). *Dress Fitting*. Oxford: Blackwell Science Ltd.

Jaffe. (1993). *Draping for Fashion Design*. London: Prentice Hall Ltd.

Kallal. (1995). *Clothing Construction*. New York: Macmillan Publishing Company.

Lenker, S. (1984). *Vogue Fitting*. New York: Harper and Row Publishers.

Reader's Digest complete Guide to Sewing. (1979). London: The Readers Digest Association Ltd.

Slambler, Sharp and Donnell. (1983). *Evaluating Apparel Quality*. New York: Fairchild Publications.

Advanced Apparel Designing and Construction Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Designing through draping :
 - Basic Bodice (Front and Back)
 - Basic Skirt (Front and Back)
 - Princess Line
 - Cowl Neck
 - Halter
 - Yokes (bodice & skirt)
 - Shift dress
2. Raglan and kimono blocks and interpretation of various styles using these blocks, types of gusset
3. Neckline and collars – coat collar, gent's collar and shawl collar
4. Stitching of garment using different fabric, texture and design
5. Stitching shorts/ trouser/Bermuda, coat/ classic jacket.

Fabric Manufacture

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Explain and create basic weaves on handloom

Interpret methods of developing fabric using fibre, yarn and different fabric making techniques.

Analyze the discriminatory selection of textiles for specific end uses.

Create new research ideas and free, creative, inductive thinking

Syllabus :

Section A

1. General principles of yarn manufacture:
 - Yarn processing for staple fibers by conventional spinning system
 - Alternate spun yarn process
 - Open end spinning – rotor, vortex, friction, electrostatic and air jet
 - Twist-less spinning
 - Self twist spinning
2. General principles of man-made fiber spinning
 - Fiber spinning methods: wet spinning, melt spinning, dry spinning and solvent spinning
3. Blended yarn, Bicomponent yarn, Film yarn and Multicomponent yarn
4. Textured yarn technology -
 - Texture and its purpose
 - Types and texturing method
 - Process variables in texturing
5. Structural geometry of yarns and their relationship to fabric properties

Section B

1. Principles of fabric manufacture – basic principles, characteristics and significance of different processes- woven, knitted, non-woven, laces and braids
2. Knitting technology – weft or filling knitting
 - Single , double knit, knitted pile
 - Warp knitting – tricot, raschel, milanese, simplex
 - Knitting machines – flat bed, circular
3. Non – woven technology: non-woven, felts (construction and types)

Section C

1. Weaving Technology:
 - Sequence of operation in warp and weft preparation
 - Parts of the handloom, motion in weaving
 - Types of looms and loom development
2. Types of weaves - basic and decorative
 - Plain weave and derivatives, twill and satin

Honey comb, huck a back, pique, leno, pile, surface figure weaves with extra weft and extra warp yarn, dobby and jacquard

3. Elements of colour and design in weaving

References:

Ajgaonkar, D. W. (1998). *Knitting Technology*. Mumbai: Universal Publishing Corporation.

Blinov, I & Belay, S. (1988). *Design of Woven fabrics*. Moscow: Mir Publisher.

Goswami, M. & Scardino (1977). *Textile Yarns Technology, Structure and Applications*. New York: John Wiley and sons.

Grosicki, I.J. (1989). *Watson's Advanced Textile Design*. London: Newness Butterworths.

Hollen, N. & Seddler (1964). *Textile*. (5th ed). New York: Macmillan Publishing.

Kadolph, S. J. & Langford, A. L. (1988). *Textiles*, (8th Ed.). New Delhi: Prentice Hall of India Pvt.

Nisbet, H. (1994). *Grammer of Textile Design*. Mumbai: D.B. Taraporvala Sons. & Co. Pvt. Ltd.

E-Resources:

Air Texturizing

<http://textilelibrary.weebly.com/air-texturizing-process.html>

Colour and weave relationship in woven fabric

<https://www.intechopen.com/books/advances-in-modern-woven-fabrics-technology/color-and-weave-relationship-in-woven-fabrics>

Cotton yarn spinning system

<http://textilelearner.blogspot.com/2013/08/cotton-yarn-spinning-process.html>

Manufacture of filament yarns and their texturing

http://content.inflibnet.ac.in/data-server/eacharya-documents/53e0c6cbe413016f234436ed_INFIEP_8/5/ET/8_ENG-5-ET-V1-S1__lesson.pdf

New Spinning Systems

<http://14.139.172.204/nptel/CSE/Web/116102038/new%20spinning%20systems/open-end%20spinning.htm>

Textile innovation knowledge platform: weaving process

<http://www.tikp.co.uk/knowledge/technology/warping-and-weaving/weaving-process/>

Fabric Manufacture Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Collection of samples of woven fabrics, identification of weaves by visual examination using magnifying glass
2. Drafting and lifting plan of different weaves on graph paper
3. Weaving –
 - a) Setting up of a simple loom
 - b) Sample preparation of following weaves on handloom – plain, twill, rib, satin, basket, pile, stripe and checks
4. Knitting –
 - a) Setting the machine for basic knitting
 - b) Control of design elements
5. Fabric construction through a non – conventional method

Textile Merchandising

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Critically analyze the multifaceted profile of textile industry of India

Learn how to market and sell their own textile products

Understand the types of retail environments and merchandising strategies

Pursue themselves in the field of retail management in boutiques, importers, designers and manufacturers as fashion advertising agents, store managers, fashion product developers, fashion retailers, window dressers, and fashion promotion specialists

Syllabus :

Section A

1. History, development, present status, problems, and export – import trends in cotton, wool, silk, jute and man made textile industries
2. Policies for import and export market, organizations for promoting export in textile and garment industries

Section B

1. Price determination: pricing policies, factors affecting price determination, causes of price fluctuation, methods of pricing
 2. Distribution: channels of distribution for consumer and industrial product, classification of middlemen
 3. Retailing and merchandising: terminology, concept & principal, factors affecting merchandising, role and responsibilities of a merchandiser
- Marketing trends: assessment of market trends, forecasting and significance in product planning. Merchandising for domestic market (buying houses, department store) and export market

Section C

1. Sales promotion: advertising, personal selling, publicity, display
2. Labelling: Importance, classification, problems, regulation, care labelling, certification labels – eco labels, wool mark, ISI mark
3. Branding: need, function, types of brands, brand names and their selection

References:

- Bajaj, C., Tile, R. & Srivastav, V.N. (2011). *Retail Management. Element impression*. Delhi: Oxford University press.
- Costaintion, M. *Fashion Marketing*. London: PR Batsford LTD.
- Diamond, J., Diamond, E. & Diamond, S. (2015). *Fashion Retailing – A multi channel approach*. London: Pearson.
- Donnellan, J. (2015). *Merchandise Buying and Management (4th ed.)*. NY: Fairchild Books.
- Fringes, G. S. (1999). *Fashion from Concept to Consumer* (6th ed.). New Jersey: Prentice Hall.
- Gerald, J.S. & Sar, P. (2014). *The Real World Guide to Fashion Selling and Management (2nd ed.)*. New York: Fairchild Books.
- Gupta, S.L. (2005). *Brand Management*. Mumbai: Himalaya Publishing House.
- Jackson, T. & Shaw, D. (2006). *The Fashion Handbook*. New York: Routledge – Taylor & Francis Group.

Stone, E. & Sampler, J.A. (1985). *Fashion Merchandising*. New York: McGraw Hill Book Co.

Technical Textiles and Textile Ecology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Understand meaning, classification and application of technical textiles

Explain effect of industrial pollution on health and environment

Know red listed chemicals, allergic dyes, carcinogenic amines and harmful dyes

Describe eco parameters and eco friendly textiles

Understand treatment and disposal of textiles effluent and dyes

Syllabus :

Section A

Technical textiles – meaning, classification, application of technical textiles, manufacturing techniques, future scenario

Medical textiles, agro textiles, geo textiles, industrial textiles automotive textiles, phase change materials, shape memory materials, smart textiles

Section B

1. Effect of industrial pollution on health and environment, allergic dyes, carcinogenic amines, harmful dyes, red listed chemicals as per eco classification
2. German ban, Indian ban, banned dyes
3. Eco-parameters, eco-friendly textiles
4. International legislation and environmental standards, eco-mark and eco-label

Section C

1. Treatment and disposal of textiles effluent and dyes
2. Ecofriendly production and processing of textiles
3. Testing of textiles and auxiliaries, testing facilities, Govt. and private labs

References:

Horrocks, A.R. (2008). *Handbook of Technical Textiles*. Florida: CRC Press.

Mirraftab, M. and Horrocks, A.R. (2007). *Eco-textiles: The way forward for sustainable development in textiles*. Florida: CRC Press.

Slater, K. (2003). *Environment Impact of Textiles: Production, Process and Protection*. Florida: CRC Press.

E-Resources:

Classification and application of technical textiles,

<http://textilelearner.blogspot.com/2012/09/classification-and-applications-of.html>

Properties, application and uses of technical textiles,

http://www.t-pot.eu/docs/Workshops/LEITAT_5_Technical_Textiles_1.pdf

Textile effluent treatment- slide share,

<https://www.slideshare.net/GranchBerheTseghai/textile-effluent-treatment>

Textile Finishes

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Know importance and objectives of textile finishes

Understand various finishes for different fabrics

Classify synthetic resins and understand their chemical structure and application

Discriminate microscopic structure and determination of gelatinization temperature of different starches

Understand and apply special purpose finishes

Determine crease recovery, stiffness of fabrics treated with different finishes

Syllabus :

Section A

Importance , objectives and classification of the finishes

Different methods of finishing – padding, foam and spray

Finishing for wool – carbonizing, decatizing, crabbing and milling

Finishes applied on worsted fabrics, pilefabrics, hosiery and lace

Section B

Calendering – treatment and types, swizzing, chasing, friction, embossing, moireing and schreinerising

Finishes involving chemical reaction with textiles – mercerising, parchmentising, chlorination and permanent setting of wools

Use of enzymes for special finishing

Section C

Synthetic resins - classification, chemical structure and application

Application of resin for wash ‘n’ wear and durable press finishes

Special purpose finishes – water proof ,water repellent, flame retardant, antistatic, stain and soil resistant , moth proofing, softening finish, absorbent finish and shrinkage control

References :

Gohl, E.P.G. & Vilensky, L.D. (1983). *Textile science*. Australia: Longman Cheshire.

Marsh, J. T. (1979). *An Introduction to Textile Finishing*. Mumbai: B.I. Publications.

Marsh, J. T. (1979). *Textile Science: An Introductory Manual*. Mumbai: B.I. Publications.

Shenai, V.A. *Technology of Textile Finishing*. Mumbai: Sevak Publications.

Tortora, P.G. (1978). *Understanding Textiles*. New York: McMillan Publishing co.

E-Resources:

Textile finishes,

<http://download.nos.org/srsec321newE/321-E-Lesson-25.pdf>

Textile finishes – slide share,

<https://www.slideshare.net/RuchiSardana1/textile-finishes-38312735>

Textile Finishes Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Microscopic structure of different starches. Determination of gelatinisation temperature of different starches
2. Application of starches and synthetic resin
3. Pick-up and add-on determination. Determination of solid content of resin
4. Determinations of crease recovery, Stiffness of textile fabrics treated with various finishing agents
5. Mercerization of yarn / fabric
6. Application of waterproof, water-repellent, flame retardant, soil resistant & shrinkage control finish

Knitting Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:
gain experience in hand knitting and machine knitting
have knowledge about Indian knitting industry
understand the various knitting structure

Section A

Introduction to knitting – definition of knitting, basic structural terms and principle of knitting technology.
Difference between knits and woven
Development of knitting from hand knitting to machine knitting and further developments
Indian Knitting industry – past, present and future
Basic mechanical principles of knitting technology, elements of knitted loop structure, four primary base structures (plain, rib, interlock, purl)

Section B

Weft knitting and warp knitting – terms and definition used related and warp knitting comparison of weft and warp knotting, classification of weft knitting machines and warp knitting machines
Weft knitting – Basic structure, stitches, designing of weft- knit structures, needle and yarn selection of r weft knitting. Quality control of weft knit fabrics, general calculation for weft knits

Section C

Warp knitting- development of warp knitting machines, basic warp knit structures and their representation, patterning mechanisms for warp knit designs, yarns for warp knits, general calculations for warp knits. Tricot and Raschel knits – principle, machines and production methods
The structure of a flat knitting machine
Manual operation of flat knitting machine and circular knitting machine
Knitted structures, structured knits, Jacquard knitting, intarsia knitting – Basic principle a stitches and their application
Electronics in knitting

References

1. Ajgonkar, D.B. Knitting Technology, University Publishing Co-operation, Bombay.
2. Spencer, D.J. Knitting Technology, Pergeman Press, U.K.

Commercial Clothing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

On successful completion of the course students will be able to:

Gain an understanding of process and procedure for establishing an enterprise

Learn about govt. support and scheme of assistance for entrepreneur

Acquire knowledge of management skills needed to run an enterprise

Gain experiential learning to run micro commercial unit

Syllabus:

Section A

1. Business environment for the entrepreneur, government of India's policy towards promotion of entrepreneurship, reservation and sanction for small scale sector
2. Establishing an enterprise-problems, information, source/scheme of assistance

Section B

1. Managing boutique, Management technique – planning, organizing, appointing staff, executing, controlling
2. Financial Management – Financial planning, source of finance, institution finance to entrepreneur, working capital management
3. Purchasing – objectives, responsibilities of purchase manager, purchasing policies, purchasing procedure, organization for purchasing, relationship of purchasing with other departments

Section C

1. Human resource management-manpower planning, job requirement, recruitment and selection, training and development, remuneration and benefits
2. Marketing management– problems of marketing, market segmentation, marketing mix, an overview of distribution channel
3. Costing
4. Production management- Investment analysis, plant location

References:

- Cherunilam, F. (1994). *Business Environment*. New Delhi: Himalayan Publishing House.
- Gupta and Srinivasan (1997). *Entrepreneurship Development in India*. New Delhi: Sultan Chand and Company
- Jain, P.C. (1998). *Handbook for New Entrepreneurs*. New Delhi: Oxford University Press.
- Khanka, S.S. (2012). *Entrepreneurial Development*. New Delhi: Sultan Chand and Company.
- Sudha, G. S. (2006). *Fundamental of Entrepreneurship*. Jaipur: Ramesh Book Depot.
- Tripathi and Reddy. (2012). *Principles of Business Management*. New Delhi: Tata McGraw Hill.

Commercial Clothing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Syllabus :

Styling and construction of garment for a particular age group
Knitting of three articles- cardigan /pullover, baba suit, half sweater
Fixing of price by keeping profit margin on each garment
Organizing exhibition and display cum sale
Visit to boutique to understand their set up and functioning

CAD in Textile and Garment Designing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
2	0	0	2

Learning Outcomes:

On successful completion of the course students will be able to:

Make use of computer technologies in garment and textile designing

Utilize each aspect of 'Computer Added Designing' (CAD) thoroughly

Apply appropriate CAD systems in 'fashion designing units'

Understand the use of CAD in different sections of textile industry, especially in the field of fashion designing, textile merchandising, textile designing and pattern making

Syllabus :

Section A

RGB colour model

Brief overview of CMYK model

Monitor Resolution

Image file formats-

 Pixels

 Bitmap

 Monochrome bitmap image

 Grayscale bitmap image

 24 bit colour image

 16 bit colour image

 8 bit colour image

Standard system independent formats- GIF, JPEG , TIFF

Section B

Scope and importance of CAD in industry

Use of CAD in textile industry- Weaving, printing, knitting, embroidery, fashion designing, pattern making, grading and marker making

Hardware for CAD- Computer: overview of system devices, memory and storage devices, input device, output devices, communication devices, Printer, Scanner

Basics of software- Overview of system software, application software

CAD modules: Draw, Edit, Data output, System control, Data storage

Types of CAD software: generic vs dedicated, 2D, 3 D, Wireframe etc

Factors to be considered while selecting CAD software

Creating a basic prototype drawing, Drawing drape on figure, Basic Commands and its application, Creating and storing slopers in CAD

Theories of drawing figures

Section C

Creation of a new pattern from a spec sheet

Digitizing of basic pattern

Grading of Patterns

Marker function, making marker interactively, making markers automatically

Plotters and their function

References:

Aldrich, W. (Ed.) (1994). *CAD in clothing and textiles* (2nd ed.). Oxford, UK: Blackwell Science Ltd.

Beazley, A & Bond, T. (2003). *Computer aided pattern design and product development*. Oxford, UK: Blackwell Science Ltd.

Gray, S. (1998), *CAD/CAM in Clothing and Textiles*. London, UK: Design Council/Gower.

Smith, S. S. (2013). *CAD for fashion design and merchandising*. New York, NY: Fairchild Books.

Groover, M. P. & Zimmers, Jr. E. W. (2008). *CAD/CAM: Computer-aided design and manufacturing*. New Delhi: Pearson Education, Inc.

E-Resources:

A beginners guide to Bitmaps

<http://paulbourke.net/dataformats/bitmaps/>

Advanced Cad/cam systems for garment design and simulation

https://www.researchgate.net/publication/271216884_Advanced_CADCAM_systems_for_garment_design_and_simulation

Application of Cad/cam in textile Industry

<http://textilelearner.blogspot.com/2012/03/computer-application-areas-in-textile.html>

Cad/cam technology: a boon to apparel industry

www.researchgate.net/publication/303844333_CADCAM_TECHNOLOGY_A_BOON_TO_APPAREL_INDUSTRY

Computer application in textile

<https://www.scribd.com/document/35173915/Computer-Application-in-Textiles-1-vignesh-dhanabalan-pavitra>

Image file formats

<http://eye-pix.com/image-file-formats/>

Plotter

<https://www.scribd.com/doc/54972334/Plotters>

CAD in Textile and Garment Designing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	8	4

Syllabus :

1. Colour shade cards of Munsell and CIE colour system
2. Repeat pattern: all types with various motifs Natural, stylized, geometrical, ethnic, connectional using coral draw
3. Making and innovating new motifs on coral draw and designing article (textiles)
4. Making croquis (men and women) and draping garment
5. Editing and creating photos in Photoshop using all tools at least 20
6. Converting coral drawing pages in to Page Maker
7. Creating and designing patterns
8. Using CAM for basic pattern digitization, creating new patterns, pattern modification and grading, making marker automatically
9. Visit to the industry

Introduction to Human Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Discuss concept and various aspects of Human Development

Explain growth and development of children

Appraise concern and issues related to parenting and development aspects

Relate theories to developmental aspects

Syllabus :

Unit-I Orientation to Human Development

- Concept, scope and significance of human development
- Human Development as multi disciplinary science
- Objectives of studying children, major approaches and methods of child study.

Unit-II Orientation to Growth and Development

- Understanding growth and development (definitions)
- General principles of development
- Constraints and facilitators in growth and development (influences of heredity and environment)
Genetic inheritance: (i) fertilization (ii) number of chromosomes, (iii) the unique third pair determines sex, sex chromosomes (iv) genotype and phenotype, (v) sex linked genetic effects.
Environmental pre-requisites: (i) Nutrition, (ii) opportunities
Interaction between environment and inheritance: (i) genes provide the predisposition, range and direction of development, (ii) environment determines the extent or limit
- Maturation and learning (with reference to Gessell's maturational point of view and Watson and skinner's behaviorist point of view).

Unit-III

- Fundamental needs of children.
- Child rearing practices, disciplinary practices and their impact on children.
- Importance of early years of life.

Unit-IV Dimensions of Development

- Physical and Motor development - factors influencing physical and motor development
- Language development - functions, factors influencing
- Moral development - meaning, factors influencing development (with special reference to Kohlberg's theory)

Unit-V Dimensions of Development

- Cognitive development across the life span (with brief introduction to Piaget's theory)
- Emotional development - development of different emotions, factors predisposing to emotional development, characteristics of children's emotions.
- Social Development - Importance, factors influencing social development, agents of socialization.

References:

Gupt, Ram Babu (1996). *Vikasatmak Monovigyan*. Agra: Ratan Prakashan Mandir

Hurlock, Elizabeth B. (1984). *Bal Manovigyan* (6th ed.). New Delhi : Tata Mc Graw Hill.

Hurlock, Elizabeth B. (1978). *Child Development* (6th ed.). New Delhi: Mc Graw Hill Publishers Ltd.

Mussen, P., Conger J.J., Kagan J. and Haston AC (1990). *Child Development and Personality*. New York: Harper & Raw.

Fundamentals of Bio-Chemistry and Microbiology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Analyze principles of Biochemistry (as applicable to human nutrition)

Explain chemistry and functions of major nutrients in human body

Discuss nature and role of microbiology

Apply and practice learned information in qualitative analysis of major nutrients, micro organisms in food

Syllabus :

Unit –I

Introduction of Biochemistry

Introduction to organic functional groups with examples from biochemistry – alcohol, aldehyde, ether, esters, amine and carboxylic groups

Carbohydrate: Classification and nomenclature, chemical structure and functions of mono, di & polysaccharides

Carbohydrates as sweeteners

Lipids : Chemical structures and functions of lipids

Unit II

Amino Acids : Classification, structure and functions of Essential Amino Acids

Proteins : Classification, structure and functions

Unit III

Vitamins and Minerals: Chemical names and functions of Fat soluble and Water soluble vitamins - A, D, E and K, Vitamin B Complex (Thiamin , Riboflavin, Niacin, Pyridoxine, Biotin, Folic Acid, Vitamin B₁₂) and vitamin C (only Basic information)

Minerals and trace elements (Macro and Micro Minerals) : Calcium, Phosphorus, Magnesium, Sodium, Chloride, Iron, Iodine, Zinc and Selenium

Unit IV

Introduction to Microorganisms: Basic structure of bacteria, virus and fungi (only elementary idea) and general characteristics

Benefits and hazards of Microorganisms

Introduction to Microorganisms found in air and water

Unit V

Concept of infectious diseases and their mode of transfer

Resistance – Natural resistance (the first line of defense and second line of defense)

Immunity - Definitions of innate , acquired, active and passive immunity

Concept of immunization

Immunization schedule for children

Importance of cold chain vaccine management

References:

Deb, C. (1997). *Fundamentals of Biochemistry*. Kolkata: New Central Book Agency.

Rama, Rao (1983). *Text book of Bio-chemistry (5th ed.)*, Tahuker: L.K & S. Publishers.

Sharma, S. (1993). *Practical Biochemistry*. Jaipur: Classic Publishing House.

Sharma, S. (2007). *Experiments and Techniques in Biochemistry*. New Delhi: Galgotia Publications Pvt. Ltd.

Singh, R.P. and Kamal (1989). *An Introduction to Microbiology*. Allahabad: Central Book depot.

Volk, W.A. and Wheeler M. F(1998). *Brave Microbiology (5th ed.)*. New York: Haeper and Row Publishers.

Fundamentals of Bio-Chemistry and Microbiology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus:

1. Qualitative analysis of carbohydrates
2. Qualitative analysis of fats and proteins
3. Acid - Alkali titrations and determination of PH by indicator paper
4. Examination of permanent slides of pathogenic microorganisms
5. Bacterial staining - gram staining
6. Bacterial cultivation - Preparation and sterilization of media- Nutrient Agar- Inoculation and Incubation

Elementary Human Physiology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Describe the functioning of various body organs and integrated functioning of all systems in human body

Examine some basic parameters of human fitness

Apply the knowledge of First Aid in different situations

Syllabus:

Unit I

Animal Cell Structure– Basic structure and function of sub cellular organelles

Tissues- Basic structure and functions of various types of tissues

Unit II

Digestive system- Organs of digestive system and their physiology; Role of enzymes in digestion of carbohydrate, protein and fat

Excretory System- Organs of excretory system, formation of urine and its composition

Unit III

Reproductive system- Structure of internal reproductive organs (male and female). Menstrual cycle (in brief)
Physiology of conception, parturition, lactation and contraception

Endocrine system- Functions of hypothalamus, pituitary, gonads, adrenal glands, Pancreas, Thyroid and Parathyroid gland

Unit IV

Circulatory System- Structure and functions of heart; Composition and functions of blood and lymph

Respiratory System- Organs of respiratory system. Process of respiration, transport and exchange of oxygen and carbon dioxide in the body

Unit V

Central nervous system (CNS) - Structure of nerve cell, Physiology of nerve transmission, Functions of spinal cord, medulla oblongata, cerebrum and cerebellum

Elementary idea about five sense organs with details of the following: Physiology of vision and hearing

References :

Ross & Wilson (1996). *Foundations of Anatomy and Physiology* (8th ed.). New York: Churchill Livingstone, Elsevier

Sanghani, P. B. (2012). *Human Anatomy and Physiology with health education*. New Delhi: Tata Mc Graw Hill Education Private Limited.

Sears, W.G. & Winwood, R.S. (1982). *Anatomy and Physiology for Nurses*, London: Edwards Arnold Publishing Co.Ltd.

Tortora, G. J. & Derrickson, B. (2006). *Principles of Anatomy and Physiology*. USA: John Wiley & Sons. Inc.

Waugh, A. & Grant, A. (2014). *Anatomy and Physiology in Health and Illness* (12th ed.). New York; Churchill Livingstone, Elsevier.

E-Resources:

Diagram of human body organs -

<https://in.pinterest.com/pin/429390145695727907/>

The human body: Anatomy ,facts and functions

<https://www.livescience.com/37009-human-body.html>

Elementary Human Physiology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus:

1. Identification of Elementary tissues
2. Determination of Hemoglobin
3. Determination of Blood groups
4. Recording of pulse rate and Blood Pressure
5. Tying Bandages - Triangular and roller
6. First Aid in wounds, shock, burn, heat stroke and frost bite, Road accident. Artificial respiration, Bed making for the patient

Introduction to Home Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Discuss concept, , historical background and relationship between Home Science with foundation and supportive courses

Explain the scope of different areas of Home Science

Utilize information in designing and developing skills needed for further specialization and entrepreneurship

Syllabus:

Unit-I

Definition, Philosophy and Objectives of Home Science

Historical development of the field of Home Science in India (in brief)

Role of Home Science for empowering women (through enhancing communication skills, presentation skills, personal skills and preparation for placement)

Scope of Home Science - Educational and Vocational

Unit –II

Foundation Courses: Importance and their relationship with Home Science

Supportive Courses: Importance and their relationship with Home Science

(Physics, Chemistry, Biology, Education, Agriculture, Dairy Science, Philosophy and Computer Application)

Disciplinary Courses: Five Major Areas- basic concepts, courses and significance

Unit-III

Social Sciences and Home Science

Basic concepts of Sociology - Society, culture, primary and secondary groups, Social Change

Basic concepts of economics- goods, utility, price, wealth, demand and supply Laws of utility, laws of demand and supply

Market-Definition and classification

Unit –IV

Psychology and Home Science

Definition and scope of Psychology, Areas of Psychology (Developmental, Experimental, Comparative, Clinical, Social, Abnormal and Educational)

Psychological Needs

Learning-Meaning and Importance of learning theories

Memory, Sensation, perception, Thinking (in brief)

Unit-V

Entrepreneurship Development and Home Science

Concept, definition and significance

Entrepreneur- characteristics, challenges faced by Women Entrepreneur

Formalities in Enterprise Setting –

Preparation of project proposals

Availing of licenses, quotas, finance, subsidies

Insurance, security, guarantee

Registration

References:

Aggarwal, J. C. (2004). *Educational Psychology*. New Delhi: Vikas Publishing House Pvt. Ltd.

Bansal, I.& Kumari, C. (2009). *Home Science: An Introduction*. Banasthali: Navjeevan Press.

Bhushan, B. & Sachdeva, R. (1983). *Sociology*. , Allahabad: Kitab Mehal.

Chandra, A. (1978). *Introduction to Home Science*. New Delhi: Metropolitan Book Company, Ltd.

Chauhan, S.S. (1983). *Advanced Educational Psychology*. (5th ed.). Agra: Vikas Publishing House, Pvt. Ltd.

Devdas, R.P. (1978). *Methods of Teaching Home Science*. New Delhi: NCERT.

Devdas, R.P. (1978). *The meaning of Home science*. New Delhi: NCERT.

Khanka, S.S.(1999). *Entrepreneurial Development*. New Delhi: S. Chand and Company, Ltd.

Sharma, K.R. (2007). *Fundamental of Sociology* .Chennai: Atlantic Publishers.

Verma, S. & Deshpandey, A. (1997). *Parivarik Vitt*. Shri Saraswati Sadan Mansuri, New Delhi: Hindi Granth Academy.

Vidyalankar, S. (1976). *Samajshastra*. Jaipur: Hindi Granth Academy.

Textiles and Their Care

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to

Select and evaluate textile material critically for the specific end use.

Differentiate among various types of fiber, yarns and fabrics that would meet the requirement of garment and textile industries.

Use various types of materials, reagents, equipments and processes involved in care of textiles.

Demonstrate good base knowledge for higher degree program

Syllabus

Unit I

Importance of studying textiles

Essential properties of textile fibers, classification of fibers

Origin, production method, properties and uses of natural fibers: cotton, flax, wool, silk and jute

Unit II

Manufacturing process, properties, importance and uses of rayon, acetate, nylon, polyester, acrylic and modacrylic Minor fibers: Ramie, Sisal, Pine and Asbestos

Unit III

- a) Yarn Manufacturing- Mechanical and Chemical spinning method. Mechanical Method- Conventional ring spinning method, Chemical Method- Wet, dry and Melt.
- b) Different types and characteristics of simple and complex yarn
- c) Fabric Construction techniques- Basic loom parts and operation, Types of basic weaves and other fabric construction methods- knitting, felting and non woven

Unit IV

Laundry Agents- water, soap, detergent, Blueing agents and stain removers, stiffening agents.

Washing equipments, washing principles, washing methods- friction, kneading and squeezing etc.

Unit V

Stain Removal- methods, principles of stain removal.

Drycleaning. Care of different fiber fabrics (Washing, Ironing, Storage): cotton, wool, silk and man made.

References :

- Corbman, B.P. (1983). *Textiles: Fiber to Fabric* (6th ed.). New York: McGraw Hill Publication.
- Dantyagi, S. (2006). *Fundamentals of Textiles and their Care* (5th ed.). Delhi: Orient Longman private ltd.
- Deulkar, D. (1982). *Household textiles and Laundry Work*. Delhi: Atma ram and Sons.
- Gohl, E. P. G. & Vilensky, L. D. (1981). *Textiles-for modern living*. Melbourne: Longman Cheshire.
- Hollen, N. & Saddler, J. (1979). *Textiles* (5th ed.). New York: MacMillan Publishing Co.
- Joseph, M. L. (1986). *Introductory Textile Science*. New York: Holt, Rinehart and Winston.
- Tortora, G. P. (1978). *Understanding Textiles*. New York: MacMillan publishing Co.

E-Resources:

Textile fibers classification

<https://www.textileschool.com/2782/comprehensive-list-of-textile-fibers/>

Fancy yarns

<https://nptel.ac.in/courses/116102038/42>

Handbook of textile fibers

<https://www.scribd.com/doc/23984852/Handbook-of-Textil-Fibers>

Textile fibers: Classification and properties pdf

<http://bieap.gov.in/Pdf/CGTPaperII.pdf>

Textile science book

http://cbseacademic.nic.in/web_material/Curriculum/Vocational/2018/Textile%20DesignT&P_XI_829.pdf

Textile fibers, dyes, finishes and processes

<https://www.scribd.com/document/25717442/Textile-Fibers-Dyes-Finishes-and-Processes>

Textiles and Their Care Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Identification of fibers- Cotton, Silk, Wool, Nylon, Polyester and Rayon
2. Identification of yarns- simple, ply, cord, novelty
3. Identification of fabric- woven, knitted, lace and nonwovens
4. Preparation of basic weaves- plain, twill, satin and sateen
5. Washing, Stiffening and Ironing of different fiber fabrics
6. Stain Removal

Introduction to Extension Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Understand meaning, philosophy and principles of Extension Education and its role in national development

Explain Extension models in practice and their scope in facilitating development

Design plan of work for need based program

Ready to be part of various developmental programs

Syllabus :

Unit I Concept of Extension

Meaning of Extension

Principles of Extension

Philosophy of Extension

Objectives of Extension

National Extension Service

Non Formal Education

Role of Extension Education in National Development

Unit II Extension Models

Technology - Innovation- Transfer Model

Social Education Model

Indigenization Model

Social Action Model

Empowerment/Participation Model

Unit III Motivation & Learning in Extension

Definition, Principles of Learning

Definition of Motivation & Motives

Types of Motives

Factors influencing learning

Cone of Experience

Unit IV Programme Planning & Adoption Process

Definition, steps in Planning

Plan of work

Evaluation of a Programme

Stages in Adoption Process

Types of Adopters

Unit V Plans & Programmes

Five year plans

Community Development Programme

Panchayati Raj System

References:

Chauhan, J. (1996). *Prasar Shiksha Aur Soochana Tantra*. Agra: Isha Publication.

Dahama, O.P., & Bhatnagar, O.P. (2010). *Education and Communication for Development*. New Delhi: Oxford and I BH Publishing Co., Pvt. Ltd.

Dubey, V.K., & Bishnoi, I. (2008). *Extension Education and Communication*. New Delhi: New age International Publishers.

Jalihal, K. (2007). *Fundamentals of Extension Education and Management in Education*. New Delhi: Concept Publishing Company

Kalla, P.N., & Gakkhar, A. (2005). *Prasar Shiksha Ke Naye Ayam*. Jaipur: Hindi Granth Akadami.

Kalla, P.N., & Gakkhar, A. (2010). *New Dimension of Extension and Communication*. Jaipur: University Book House.

Maximun, N. (2006). *Understanding Extension Education*. New Delhi: Gyan Publishing House

Mohanty, S.R. (2017). *Home Science Extension Education and Rural Development*. Germany: Anchor Academic Publishing.

Rajsingh, A., & Saxena, A. (2008). *Prasar Siksha me Sampreshan va Nirdesh Takneek*. Jaipur: University Book House, Pvt. Ltd.

Sandhu, A.S. (1993). *Text book on Agricultural Communication : Process and Methods*. Calcutta: Oxford and IBH Publishing Co. Pvt. Ltd.

Sharma, O.P. (2013). *Programme Planning and Participatory approaches in Extension*. Udaipur: Agrotech Publishing Academy.

Singh, U., & Nayak, A. (2007). *Extension Education*. , New Delhi: Commonwealth Publishers. ISBN 817169442.

Supe, S.V. (2005). *An Introduction to Extension Education*. Oxford & IBH Publishing Co. Pvt. Ltd.

Vaghmare, S.K.(1980). *Teaching Extension Education*. Vallabhvidyanagar Gujarat: Prashant Publishers.

Elements of Food Science

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Explain the chemistry underlying the properties of various food components

Explain functions of food and identify good sources of nutrients

Know the basic concept of food science

Apply the various methods of cooking in daily life

To make informed judgments in use of different commodities in various food preparations

Syllabus:

Unit I

Basic Physico- chemical properties in food system

Hydrogen ion concentration (pH).

Surface tension

Plasticity

Colloidal properties

Iso- electric point of proteins

Functions of food.

Food as a source of nutrients

Five food groups.

Merits and demerits of methods of food preparation

- Boiling, Pressure cooking, Steaming, Sautéing, Roasting, Stewing, Simmering

Unit II

Cereals - general composition and structure

Wheat - composition, structure, milling, gelatinization,

Rice - composition, parboiling

Starch - granular structure, gelatinization, dextrinization, gel formation, retrogradation

Sugar - types, manufacturing process of white and refined sugar, effects of heat on sugar, crystallization and caramelization

Unit III

Milk - Composition, processing pasteurization, homogenization, sterilization, types of milk.

Milk products - Manufacturing and composition of cheese, milk powder, cream, butter ghee, yoghurt.

Pulses and legumes- composition, processing, anti nutritional factors affecting cooking quality.

Egg. - structure, composition, quality, coagulation and denaturation of egg protein, uses in cooking.

Meat, fish and poultry – nutrition aspect, post mortem changes in meat.

Unit IV

Vegetables and fruits - composition and nutrient content processing, enzymatic browning, pectic substances, processed products.

Food adjuncts - spices, condiments, herbs, extracts, concentrates, essence.

Salt - types and uses.

Unit V

Convenience food - role, types, advantages, contribution to diet

Leavening agents - biological chemical constituents used in cooking and bakery.

Beverages - tea, coffee, cocoa: Nutritional aspects.

References :

Mudambi, S., Shalini R.S. & Raw, M. (2007). *Food Science*, New Delhi: Wiley East limited,

Shadak, S.M. & Manay, N.S. (1996). *Food Facts & Principles*. New Delhi : Wiley Eastern Ltd.

Srilakshmi, B. (1996) .*Food Science*. New Delhi: New age international Pvt. Ltd.

Swaminathan, M. (1987). *Food Science Chemistry and Experimental Foods*. Bangalore : The Bangalore Printing and publishing Co. ltd.

Elements of Food Science Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

Kitchen equipments - uses and care

Weights & measures

Cooking methods

Cereal cookery emphasizing- dextrinization, gelatinization, identification of grains, Effect of treatments on identity of grains and functions of starch

Sugar cookery

Milk & milk products cookery

Vegetables cookery emphasizing effect of acid and alkali on pigments

Use of fruits in food preparation

Preparation from nuts and oils seeds

Life Span Development - I **(Prenatal to Early Childhood years)**

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Understand various aspects of development from prenatal to early childhood years

Assess the issues faced and adjustments required during these years

Syllabus:

Unit I Pregnancy -

- a) Human Reproductive System
- b) Conception, signs and symptoms of pregnancy
- c) Common discomforts of pregnancy
- d) Complications during Pregnancy
- e) Care during Pregnancy

Unit II Prenatal Development -

- a) Course of prenatal development
- b) Conditions effecting prenatal development
- c) Overview of birth process and complications
- d) Types of Delivery
- e) Hazards during prenatal development

Unit III Infancy-

- a) Characteristics of Neonate (0-4 weeks) - physical description, sensory capacities and reflexes, becoming coordinated - Feeding, sleeping, crying
- b) Developmental tasks, milestones of development during Infancy
- c) Physical, Motor, social, emotional, cognitive and language development of child from 4 weeks to 2 years

Unit IV Early Childhood-

- a) Definition, overview of early childhood years - highlights, developmental tasks and milestones
- b) Physical, motor, moral, cognitive and language development during early childhood years
- c) Social and emotional development during early childhood years

Unit V

- a) Role of preschool education during childhood years
- b) Importance of play and creative activities during childhood
- c) Need for ECCE programme to provide quality care
- d) Available child care practices and services

References :

- Berk, L.E. (1996). *Child Development*. New Delhi: Prentice Hall.
- Cole, M., & Cole, S. (1995). *The Development of Children*. NY: Freeman & Co.
- Hurlock, E.B. (1978). *Child Development* (6th ed.). New York: Tata McGraw Hill Publishing Company Limited.
- Hurlock, E.B. (1980). *Developmental Psychology - A Life Span Approach* (5th ed.). New York: Tata McGraw Hill Publishing Company Limited.
- Rice, F.P. (1965). *Human Development – A Life Span Approach*. New Jersey, NJ: Prentice Hall.
- Santrock, J.W. (2008). *Life Span Development*. New Delhi: Tata McGraw Hill Companies Pvt. Ltd.

E-Resources:

Early childhood development and cognitive development

<https://www.pdfdrive.com/early-childhood-development-and-cognitive-development-e63805631.html>

Early childhood development and cognitive development in developing countries

<https://www.pdfdrive.com/early-childhood-development-and-cognitive-development-in-developing-countries-e124334421.html>

Effects of Prenatal Stress and Poverty on Fetal Growth

<https://www.pdfdrive.com/effects-of-prenatal-stress-and-poverty-on-fetal-growth-e21046301.html>

Influence of prenatal stress and postnatal maternal behaviour on child temperament and coping with stress

<https://www.pdfdrive.com/influence-of-prenatal-stress-and-postnatal-maternal-behaviour-on-child-temperament-and-coping-d57252917.html>

Prenatal Book

<https://www.pdfdrive.com/prenatal-book-e35457151.html>

Prenatal maternal stress and child motor development

<https://www.pdfdrive.com/prenatal-maternal-stress-and-child-motor-development-1-understanding-the-d53948640.html>

Prenatal, Perinatal & Postnatal Aspects

<https://www.pdfdrive.com/prenatal-perinatal-postnatal-aspects-e54138046.html>

Interior Designing and Decoration

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Compare and relate objects in terms of their aesthetic potentials

Analyze factors that create beauty and eloquence in different types of interiors

Synthesize elements of art based on principles of design in order to achieve the objectives of design and decoration

Syllabus:

Unit-I a) Objectives of Interior Designing and Decoration

b) Meaning and Importance of Art.

c) Creative Process (i) Pre requisites of Creativity (ii) Steps in Creative process

Unit-II Elements of Art/Design

a) Line- types, emotional effect, combinations.

b) Form or Volume-importance, relationship with objects.

c) Color-Theories, Dimensions, Harmonies/schemes, Psychology of color, classification

d) Texture-Types, characteristics, Importance in interiors

e) Pattern-Types of motifs

f) Light-Types of lighting, luminaires, Illumination required in interiors

g) Space-characteristics, importance in creating mood and character

Unit-III Principles of design

a) Proportion - Concept of golden oblong and golden spiral, methods of achieving units of measurement, law of margins.

b) Balance - Symmetrical, Occult, Radial and Crystallographic

c) Rhythm - Methods of achieving rhythm

d) Harmony - Meaning, aspects of harmony

e) Emphasis - Methods to create emphasis

Unit-IV Space Planning

Types of space plans - Floor plan, Elevation, Site Plan,

Perspective view, Landscape plan

b) Building standards - structural, functional, aesthetic

c) Introduction to Vaastu Shastra & Feng Shui

Unit-V Implications of elements and Principles of design

a) Creating illusions with the help of color and light

b) Principles of furniture arrangement

c) Window Treatment

References:

- Faulkner and Faulkner (1977). *Inside Today's Home*. (4th ed.). New York: Reinhart & Winston
- Kurtz, D. (1987). *Visual imagination: An introduction to Art*. New Jersey: Prentice Hall Inc. Engle Wood Cliffs
- Sardana, S.C. (2001). *Vaastu Shastra*. New Delhi: New Allied Publishers
- Sutton & Whelan (2004). *The Complete Color Harmony*. USA: Rockport Publishers Inc.

E-Resources:

Elements and Principles of Art Design

<https://study.com/academy/lesson/elements-and-principles-of-art-design.html>

Basic Elements of Design

<https://creativemarket.com/blog/10-basic-elements-of-design>

Using Illusions in Interior Designing

<http://www.hamstech.com/blog/using-illusions-in-interior-designing>

Vaastu

<http://www.vaastuinternational.com>

Interior Designing and Decoration Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

1. Drawing Floor plans to scale (with engineering scales)
2. Obtaining standard colors (Munsell system of color notation)
4. Obtaining value chart
5. Development of color harmonies
6. Identification of advancing and receding colors
7. Methods of obtaining units of measurement
8. Window Treatments - Types of curtains & draperies, Blinds and Shades
9. Furniture arrangement with cut-outs
10. Development of textures in interior

Fabric Construction

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion the course, students will be able to:

Know different yarn manufacturing process and their effect on properties

Understand and relate various fabric construction methods with properties and end use

Describe preparatory processes for weaving and develop concept of color and weave effects

Explain different simple and compound weaves

Syllabus :

Unit I Fabric construction methods - Classification

A brief introduction of non woven and other fabric construction methods-knits, film, foam, lace, braids, woven composites, multicomponent fabric and laminated

Unit II Yarn manufacturing process

Objectives and principles of spinning

Conventional and non-conventional yarn manufacturing method:-

Conventional - ring spinning

Non conventional (for natural-open end, rotor, twist less and air jet spinning; for manmade-dry, wet, melt, emulsion and solution

Classification of yarn - simple, complex and textured, Yarn diameter and Yarn count

Unit III History and development of loom, parts and functions of loom, Basic operations and mechanism of weaving, Intersection theory of weaving

Unit IV Preparatory process for weaving

Winding, warping and sizing of yarn, colour warp preparation, Colour and weave effects - harmony of colour, plaid, stripes and other moire effects

Unit V Weave and their different types, Basic weaves - Plain and its derivatives, twill and satin

Introduction to fancy weaves - Pile, leno, crepe, pique, huckaback, honeycomb, double cloth, dobby and jacquard

References:

Blinov, I. and Belay, S. (1988): *Design of Woven Fabrics*. Moscow: Mir Publishers

Corbman, B. P. (1985). *Textile Fibres to Fabric*. New Delhi: Gregg Division - Mc. Graw Hill Inc.

Grosicki, Z. J. and Watson. (1988). *Textile Design and Colour*, London: Newness, Butterworth

Hall, A. J. (1975). *The Standard Hand Book of Textiles*. London: Newness, Butterworth

Hollen, N. and Saddler, J. (1964). *Textile*. 5th ed. New York, Mc. Millan Publishing Co.

Kadolph, S. J. and Langbord, A. L. (2014). *Textiles*, 11th ed. New Jersey: Prentice - Hall Inc.

Tortora, P.G., (1978). *Understanding Textiles*, New York: Macmillan Publishing Company

E-Resources:

Fabric Construction

<http://download.nos.org/srsec321newE/321-E-Lesson-24.pdf>

Yarn and classification

<http://cms.gcg11.ac.in/attachments/article/87/CLASSIFICATION%20OF%20YARN.pdf>

Food Preservation and Protection

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Identify and describe causes, principles and methods of food preservation

Describe personal hygiene requirements for food handlers for preparing food safely.

Know the principles and objectives of various food laws, standards and authority required for safe food marketing.

Syllabus:

Unit I Food Spoilage-

Causes of food spoilage- Perishable, semi perishable and non perishable food

Factors affecting the growth of micro- organisms in the food

Intrinsic Parameters and Extrinsic

Unit II Food Preservation

Importance and Principles of Food Preservation

Methods of Food Preservation and preparation of Jam, Jelly, pickles, Squash, syrup and Murabba

Use of Low Temperature (Refrigeration and freezing)

Use of High Temperature (Pasteurization and sterilization)

Use of preservatives.

Drying

Radiation

Unit III Food Fermentation- An Introduction

Microorganisms as food – SCP (Single cell Protein).

Introduction to food adulteration and house hold methods of detection

Unit IV Food Additives

Definition

Classification

General principles for the use of food additives issued by FAO/ WHO Codex. Ailments commission

Brief explanation of natural and synthetic Preservatives

Introduction to Genetically Modified (G.M.) Foods

Unit V Food Laws and standards

Objectives of food Laws, responsible agencies for safe food

Present Regulations / Orders / Standards related to foods

Main objectives of food Laws

i) PFA ii) MFPO

- iii) FPO iv) Milk and Milk Product orders
- d) Regulatory authorities of food laws and orders

References :

Desrosier, N.W.(1977). *Elements of food Technology*. Connecticut USA: AVI Publishing Co.

Frazier, W.C., Westhoff D.C.(2014). *Food Microbiology*. New York :Mc Graw Hill Book Company.

Gould, G.W.(1994). *New Methods of food Preservation*. London : Black lie Academic and Professional.

Swaminathan, M. (1987) *Food Science Chemistry and experimental foods*. Bangalore : The Bangalore Printing and Publishing Co. Ltd.

Human Nutrition and Meal Planning

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

To describe the functions and sources of nutrients

Assess the dietary requirement of various nutrients and effects of deficiencies and excesses.

Apply the knowledge in planning and preparation of meals of improved nutritional quality for different groups

Evaluate acceptability and serving of food.

Syllabus :

Unit I: Nutrition Health relationship. Energy- (unit of energy,) measurement of energy in foods, energy requirement of individuals, factors affecting the energy requirement Basal Metabolic Rate (BMR), factors affecting the Respiratory Quotient, Specific Dynamic Action of food

Water- Introduction, Source, functions, requirement and electrolyte balance

Unit II: Carbohydrate – classification, sources, functions, digestion, absorption and utilization, role of dietary fiber in diet, effect of carbohydrate deficiency

Lipid – classification, sources, functions, digestion absorption and utilization, essential fatty acids and their functions, effect of lipid deficiency

Unit III Proteins- nutritional classification of food proteins, functions, sources, digestion, absorption and utilization, classification of amino acids and quality of protein , protein requirements and factors affecting the needs

PEM - classification, etiology, signs and symptoms, prevention and treatment

Unit IV Vitamins- history, definition, Sources, requirements, functions and deficiency

Fat soluble vitamin (A,D,E and K), Water soluble vitamins (Thiamine, Riboflavin ,Niacin, Folic acid, Biotin, vitamin B12 and vitamin C)

Minerals – source, requirement, function and deficiency of Calcium, Phosphorous Sodium, Potassium, Magnesium, Copper, Iodine, Fluoride and Iron

Unit V Objectives and importance of meal planning, important considerations for meal planning, balance diet, five basic food groups, recommended dietary allowances (RDA), factors affecting the RDA

Methods of securing meal – traditional and western

Fundamental of sensory evaluation

References:

Khanna, K, Gupta S, Mahna R, Puri S, Seth R. and Passi S.J.(1997). *Text book of Nutrition & Dietetics*. New Delhi: Phoenix Publishing House Pvt. Ltd.

Mudambi, S.R. (2007). *Fundamental of foods , Nutrition and Diet Therapy*. Delhi: New age international (P) Ltd..

Robinson, C.H. (1986). *Normal and Therapeutic Nutrition(17th ed.)*. New York: McMillan Publishing Company.

Sharma, S. (2000). *Human Nutrition and Meal Planning*. New Delhi : Jnanda Publishers.

Srilakshmi , B. (2004). *Nutrition Science*. New Delhi : New Age, International (P) Limited.

E-Resources:

Classification of food, balanced diet

<https://www.slideshare.net/JasminaSangani/meal-planning>

Types of food services and their advantage

<https://www.slideshare.net/iamrealmelissa/food-service-67652942>

Dietary requirement for various age groups

<https://www.slideshare.net/aneeshajaiswal/dietary-guidelines> 11405034

Human Nutrition and Meal Planning Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

Preparation of nutrient rich dishes such as:

Protein, Vitamin A, Thiamine, Riboflavin, Niacin, Ascorbic acid, Calcium and Iron

Preparation of food products for the use of PEM children

Planning and preparing (in groups) balanced diet for different activity levels.

Meal serving practice

Table setting – Modern and traditional

Introduction to Resource Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

- Upon completion of the course students will be able to:
- Describe the concepts of management
- Differentiate between various approaches to management
- Understand process and techniques of decision making

Syllabus :

Unit I Management

- Management: concept and importance
- Systems approach to management
- Family resource management as a system

Unit II Philosophy of management

- Resources- meaning, importance, types and characteristics, Guidelines to increase utility of resources
- Philosophy of management
 - Values- origin and classification
 - Goals- characteristics and types
 - Standards- characteristics and types

Unit III Approaches to management

- Schools of management
 - Scientific school
 - Classical organization theory
 - Behavioral school
- Levels of management and managerial skills

Unit IV Management Process

- Planning- The Planning System, Dimensions of Plans
- Controlling- Energizing, Facilitating, Checking, Adjusting
- Evaluation- types, Feedback

Unit V Decision making- Process & Techniques

- Definition and Concept of Decision Making
- Tools and Techniques for Decision Making
- Steps in decision making process
- Classification of Decisions
- Decision Tree and Cost Benefit Analysis

References:

- Armstrong, M. (2010). *A Handbook of Management Techniques*. (Revised 3rd ed.). London : Kogan Page Publishers.
- Daecon R.E.& Firebaugh F.M. (1975). *Context and concepts of Management* USA : Houghton Mifflin Company.
- Gross I.H. & Crandall, E.W. (1980). *Management for modern families* (3rd ed.) . New Jersey : Prentice Hall Inc. Engle Wood Cliffs.
- Luthans F.(1998). *Organizational Behavior*. (8th ed.). New York : Ervin-McGraw Hill.
- Robbins S.P., Decenzo D.A. (2009). *Fundamentals of Management*. (6th ed.). New Jersey : Pearson Prentice Hall.
- Robbins, S. & Judge, T.A. (2013). *Organizational Behavior* (15th ed.). US : Prentice Hall.
- Stoner, J., Freeman R. & Gilbert D. (1995). *Management*. (6th ed.). New Delhi: Prentice Hall of India Pvt. Ltd..

E-Resources:

Management Theory

<http://www.technofunc.com/index.php/leadership-skills-2/leadership-a-management/item/> management-theories

Motivation Theories

https://www.tankonyvtar.hu/hu/tartalom/tamop412A/2011-0023_Psychology /030300.scorml

Fundamentals of Clothing Construction

L P T C
4 0 0 4
Max. Marks : 100
(CA: 40 + ESA: 60)

Objectives:

- To familiarize the students with the essentials of clothing construction.
- To acquaint students with the various steps involved in the apparel making system and to gain skills in making garment.

Note: The paper will contain ten questions having at least two questions from each unit. Candidates are required to attempt five questions in all taking at least one question from each unit.

Unit I (a) Fundamentals of clothing construction- its importance, terms used in clothing construction
(b) Equipments- measuring, marking, cutting, stitching,
(c) Sewing machine- types, parts, care, handling and problems.

Unit II (a) Principles and elements of art in clothing design
(b) Factors affecting selection of fabric, age, sex, occupation, figure, garment style, fashion, etc.

Unit III (a) Body measurements and proportion, figures, types and problems, garment designing according to figure
(b) Preparation of fabric for garment cutting

Unit IV (a) Patterns- types and preparation methods
(b) Layout types and cutting of the fabric
(c) Calculation of material for different garments

Unit V (a) Hand knitting- abbreviations, types and selection of needles and yarn, knitting patterns.
(b) Machine knitting- Simple hand knitting machine, its parts and operations.
(c) Mending and Renovation.

References:

1. Reader's Digest (1995), "Complete Guide to Sewing". The Reader's Digest association (Canada) Ltd. Montreal
2. Sew Simple "A step by step guide to dress making" (1980), English sewing Ltd, Hutchinson.
3. Doongaji (2002) "Basic Processes of Clothing Construction" Raaj Prakashan, Delhi.
4. Mc-call's (1963) "Sewing Book" Random House, Inc. New York.

Fundamentals of Clothing Construction Lab

L P T C
0 0 4 2

Max. Marks : 100
(CA: 40 + ESA: 60)

- Hand and Machine stitches, Basic embroidery stitches, seams and seam finishes, Disposal of fullness, Plackets and fasteners, Yokes, Sleeves, Pockets, Trimmings, Knitting Patterns.
- Stitching of Apron, Sari Petticoat, Sari blouse
- Collars, Baby Layette, Romper.
- Mending.

Life Span Development - II (Middle Childhood to Old age)

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Acquire knowledge related to various aspects of development in different stages of life span.

Understand adjustment issues and requirements of different stages from middle childhood to old age.

Syllabus :

Unit-I Middle Childhood (6 to 12 yrs)

Definition, developmental tasks, milestones.

Physical, motor, social, cognitive and emotional development.

Role of family and peer group

Importance of schooling

Effects of success and failure

Unit-II Adolescence (13 to 18 yrs)

Definitions, developmental tasks.

Puberty, growth spurt

Physical, Social, Moral, Cognitive and Emotional development during Adolescence

Choosing a career

Peers and heterosexual relationship, importance of friendship

Heightened emotionality: meaning, causes, conflict with authority

Problems: Drug and alcohol abuse, psychological breakdown, STDs and HIV/AIDS, pregnancy

Unit-III Young Adulthood (19 to 40 yrs)

Definitions, need to study

Development tasks of young adulthood

Responsibilities and adjustments with new family, work place, parenthood, financial matters.

Sex role issues and implications for young adults.

Different developmental aspects during young adulthood.

Unit-IV Middle Adulthood: (41 to 60 yrs)

Definition- physical & psychological changes (senses, diseases)

Menopause and other health issues.

Stress in middle age, coping with stress at family and workplace

Job satisfaction

Pre-retirement- preparation and effect

Unit-V Old Age

Definition, physiological and psychological changes.

Health problems during old age

Cognitive and memory status and changes

Retirement- effect of retirement on self, family, society

Attitudes towards aging

Interests during old age

Issues- old age homes, loneliness, coping with complications, prolonged illness

Death: preparation and coping strategies

References:

Berk, L.E. (1996). *Child Development*, New Delhi: Prentice Hall.

Cole, M. & Cole, S. (1995). *The Development of Children*. New York, NY: Freeman & Co.

Craig, G. (1999). *Human Development*. New Jersey, NJ: Prentice Hall.

Gardiner, H.W., Mutter, J.D., & Kosmitzki. (1998). *Lives Across Cultures*. Boston: Allyn & Bacon.

Gupta, R. (1998). *Matra Kala Shishu Palan avm Bal Vikas*. Agra: Ratan Prakashan Mandir.

Hurlock, E.B. (1980). *Development Psychology: A Life Span Approach* (5th ed.). New York: Tata McGraw Hill Publishing Co. Ltd.

Hurlock, E.B. (1990). *Vikas Manovigyan*. Pratham Khand/Dutiya Khand, Hindi Madhyam Karyanvai Nideshalaya, Delhi University Dwara Prakashit.

Rice, F.P. (1965). *Human Development : A life Span Approach*. New Jersey, NJ: Prentice Hall.

Santrock, J.W. (2008). *Life Span Development*. New York: Tata McGraw Hill Companies, Inc.

E-Resources:

Ageing and old age as a task

<https://www.pdfdrive.com/ageing-and-old-age-as-a-task-e38334984.html>

Aging, Economic Growth, and Old-Age Security in Asia

<https://www.pdfdrive.com/aging-economic-growth-and-old-age-security-in-asia-e34443523.html>

Chapter 16 Middle Adulthood: Emotional and Social Development

<https://www.pdfdrive.com/chapter-16-middle-adulthood-emotional-and-social-development-e7909382.html>

Factors contributing to life satisfaction in early and middle adulthood

<https://www.pdfdrive.com/factors-contributing-to-life-satisfaction-in-early-and-middle-adulthood-e32013339.html>

Physical and Cognitive Development in Middle Adulthood

<https://www.pdfdrive.com/physical-and-cognitive-development-in-middle-adulthood-e59558323.html>

Nutrition for Vulnerable Groups

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Have sufficient content – related knowledge base of nutritional requirements of vulnerable groups of society

Apply the knowledge to design , implement and evaluate solutions to meet requirements of given set of vulnerable groups with available range of food sources

Syllabus :

Unit I a) Nutritional Education

Definition and concept; guide to good eating food and health, cooking and processing of food, feeding of girls and women and different phases (adolescence, pregnancy and lactation)

b) Nutrition during pregnancy

Normal growth and developmental stages of pregnancy

Physiological, biochemical and hormonal changes during pregnancy

Nutritional risk factors in Pregnancy

Nutritional needs and RDA during Pregnancy

Complications of pregnancy and their dietary implications

Unit II Nutrition during lactation

Physiology of lactation: Pro-lactin and let down reflex

Nutritional requirements and RDA during lactation

Factors affecting the needs and diet and feeding pattern

Nutritional problem/ complications in lactation

Unit III Nutrition during infancy and for low birth weight infants

Normal growth and development

Growth chart

Nutritional requirements

Feeding and weaning practices; breast v/s artificial feeding

Unit IV Nutrition during childhood and adolescence

Growth and development

Nutrient needs and RDA

Diet and feeding pattern

Nutritional problems

Unit V Nutrition during old age

Physiological changes during ageing

Changes associated with ageing

Nutrition related problems among the elderly

Nutrition needs and dietary planning

References:

- Gupta, S. (2006). *Text Book of Pediatric Nutrition*. New Delhi : Peepee Publishers and Distribution P. Ltd. Ed.
- Khanna, K. Gupta, S. Mahna, R, Puri, S. Seth, R. and Passi, SJ.(1997).*Text book of Nutrition & Dietetics*. New Delhi: Phoenix Publishing House Pvt. Ltd..
- Robinson, CH. and Lawler, MR. (1994). *Normal and Therapeutic Nutrition*. New York: Macmillan

Communication Process

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

- Upon completion of the course students will be able to:
- Explain concept and different types of communication
- Distinguish different approaches of communication
- Create effective messages to relevant audiences
- Use appropriate media in different approaches of communication

Syllabus :

Unit-I Concept of communication

Meaning and importance of communication, key elements of communication with special reference of Leagan's model, The purpose of communication, Factors affecting / helping communication

Unit-II Communication process

Types of communication - One way, two way or interactive communication, verbal and non verbal, intrapersonal and inter personal, formal and informal

Importance of two way communication

Gaps in Communication and their causes,

Unit-III Approaches of communication

Selection and effective use of following methods and materials

Individual – Home / farm visits, telephone calls, personal letters

Group - lecture, group discussions, meetings, role plays, demonstrations, work- shops, camps

Mass approach- electronic and print media

Unit-IV Basic concepts related to information dissemination, education and

propaganda

Modern technology: Basics and effective use

Satellite communication, Videoconferencing, Teleconferencing, Fax, Internet, E-mail , E-page , Cyber Café, Cellular phone

Unit-V Media for communication

Folk Media - songs, stories, street theater, puppet play, phad, kavad

Importance of Folk Media

Print media- posters, charts, leaflets, books, articles/stories, cartoons

Audio- Visual aids- meaning, classification, merits and limitations

References:

Chauhan, J. (1996). *Prasar Shiksha Aur Soochana Tantra*. Agra, Isha Publication.

Dahama, O.P., & Bhatnagar, O.P. (2010). *Education and Communication for Development*. New Delhi, Oxford and I BH Publishing Co., Pvt. Ltd.

- Harpalani, B.D. (1994). *Grih Vigyan Mein Prasar Shiksha*, Agra, Star Publication.
- Joseph, M.K. (1996). *Modern Media and communication, Sociology and Communication Revolution*. (Vol.- 1), New Delhi, Anmol Publication Pvt. Ltd.
- Joshi, U.J. (2000). *Textbook of Mass Communication*. New Delhi, Anmol Publishers.
- Kalla, P. N., & Gakkhar, A. (2010). *New Dimension of Extension and Communication*. Jaipur, University Book House.
- Malhan, P.N. (1992). *Communication Media Yesterday, Today and Tomorrow*. New Delhi, Ministry of Information and Broadcasting.
- Mody, B. (1991). *Designing messages for Developmental Communication*, New Delhi, SAGE Publications.
- Raines, C., & Williamson, L. (1995). *Using Visual Aids- the effective use of type, colour and graphics*. New Delhi, Viva books private Ltd.
- Rajsingh, A., & Saxena, A. (2008). *Prasar Siksha me Sampreshan va Nirdesh Takneek*. Jaipur, University Book House.
- Ray, G.L. (1991). *Extension Communication & Management*. Calcutta, Naya Prakash.
- Raydu, C.S. (1993). *Media and Communication Management*. Bombay, Himalaya Publishing House.
- Sandhu, A. S. (1993). *Textbook on agricultural communication, Process and Methods*. Culcutta, Oxford and IBH Pub. Co. Pvt. Ltd.
- Singh, R.P., & Rana, G. (2005). *Communication*. New Delhi, Ravi Books.

Communication Process Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Problem/need identification of a community
2. Preparation and use of graphic Aids (Chart/ Graph/ Flash Cards/ Poster Leaflet/ Folder)
3. Selection and use of extension methods and media

Family Clothing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

- Upon completion of the course students will be able to:
- Select fabrics and clothes for different age groups.
- Intelligently buy and care garments and house hold textile materials.
- Understand the consumer problems and their rights

Syllabus :

Unit I Selection of fabric for different garments

- Garment type and their selection- outer garments and under garments
- Readymade and home made garments

Unit II Family clothing decisions

- Steps and factors. Family wardrobe principles- community, budget, occasion, climate, occupation, interest, size, composition of the family, fashion, quality and accessories

Unit III Children's clothes

- Selection of fabrics, design, colour for children garments according to age
- Clothing for adolescence, middle age and old age
- Factors influencing consumption of textiles

Unit IV Sociological, physical and psychological aspect of clothing

- Definition and intelligent buying & care of table linen, towels and bathroom ensemble
- Buying guidelines for bed sheet, pillow slips, blanket. Selection of upholstery, carpet and cushion materials

Unit V Problems of textile consumer, market practices that exploit

- consumer
- Causes of exploitation
- Concept and significance of consumer education
- Labelling to help consumer in intelligent selection and care
- Precautions to be observed during purchase of textile
- Consumer redressal - consumer protection act, procedure for filing complaints

References :

- Chahar(2007). *Consumer protection movement in India : problems and prospects*. New Delhi : Kanishka Publishers.
- Lewis, D.S. & Bowers, M.G.(1960). *Clothing construction and wardrobe planning*. New York : Macmillan Book Company.
- Tate, M.T., and Glisson, O. (1967). *Family clothing*. New York : John Wiley and Sons.
- Wingate, Isabel B. (1965). *Textile Fabrics and Their Selection*. London : Prentice- Hall, INC.

Family Clothing Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

Drafting, cutting and stitching of clothing for:

Infant- Baby layette, Romper

Children- Frock, Shirt/Bushirt, Shorts (Designing and construction with emphasis on growth, comfort, self help features)

Adult- Blouse, Kalidar / Simple Kurta, Salwar / Churidar pyjama, Gent's pyjama

Guiding Child Behaviour

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning Outcomes:

Upon completion of the course students will be able to:

Underline different rearing practices and their implications

Analyze various behavioral problems and habit disorders under difficult circumstances and exceptionalities

Analyze a problem, identify appropriate guidance strategies and effectively handle the problems

Syllabus :

Unit-I Different child rearing practices and their impact on personality formation-

Feeding & weaning, toilet training, sleep pattern, hygienic practices and vaccination

Disciplinary techniques

Unit-II Guiding the pre-school child

Behavioural problems - sibling rivalry, aggression,

Habit disorders - bed wetting, thumb sucking, nail biting, speech difficulty

Unit-III Child in social context

Socialization and agents of socialization (Family, Peer group, School)

Problems in social context - unmotivated to school, Isolation

Unit-IV Fostering adolescence development

Stresses of adolescence - teenage pregnancy, heterosexual relations, homosexuality, masturbation

Problem issues - career choices & aspiration, early and late maturation and drug addiction

Unit-V Exceptional children

Meaning and types of exceptionality

Guiding parents of exceptional children

References:

Harvey, D. (1975). *Baby Book*. London : Marshall, Cavendish.

Hetherington, E. Mavis & Parke, Ross D. (1993). *Child Psychology : A Contemporary View Point*. NY: McGraw Hill.

Heward, W. L. & Orlansky, M. D. (1992). *Exceptional Children*. NY: Meryll Publishers.

Kumar, R.N. (1993). *Baby & Child care*. New Delhi: UBS Publishers.

Lynch, Eleemon W & Lewis Rena B. (1988). *Exceptional children and adults - An introduction to special education*. Glenview: Scott Foresman and Co.

Schaefer, C.E. & Millman, H.L. (1981). *How to help children with common problems*. New York, NY: Van Nostrand Reinhold Company.

Spock, Benjamin (1976). *Baby and Child Care*. New York : Pocket books.

Guiding Child Behaviour Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus:

Recommendations for feeding, weaning and formula preparation

Demonstration on sterilization of bottles

Collection of articles and preparation of scrap book on problems related to child rearing and behavior

Use of any two psychological tests

Identifying and develop a theme / activity/ plan of action that need behavioral modification

Survey to identify causes of morbidity and mortality in mother and children

Survey to collect information regarding (a) Child rearing practices (b) feeding practices

Case study of a child with behavioral problem

Textile Designing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning Outcomes:

Upon completion the course, students will be able to:

Explore inspiration sources of design for basic sketching and painting

Differentiate and develop various types of motifs

Use creative and technical skills for designing textiles with special emphasis on applied design

Use concept, theories and specification of color in selection of apparels for men, women and children

Syllabus :

Unit I Design Analysis

- Structural and applied design variation in fiber, yarn and fabric construction, embroidery, dyeing, printing and finishing.
- Introduction to standard textile fabric terms- cambric, denim, gabardine, poplin and velvet etc

Unit II Elements and principles of designs in relation to textiles

- Principles of designs – harmony, balance, proportion, rhythm and emphasis
- Elements of designs – line, form, colour and texture

Unit III History of textile design

- Classification of textile design : woven and printed
- Design Inspiration and sources of design for basic sketching and painting: nature, religion and methodology, crafts, arts, architecture and other methods of getting designs

Unit IV Process of Designing

- Textile motifs
- Motif development : geometric, simplified, stylized, naturalized, abstract and ornamental
- Textile symbols and motif repeat and patterns, big and small motifs, enlargement and reduction, growth of a motif, combining motifs, all over patterns

Unit V Concept of colours and design

Eye: its parts, Perception of an eye

Colour Specification : CIE and Munsell colour system

Theories of colour

Colour and its defects- colour blindness and its types

Effect of colour schemes on textile designing

Role of colours in selection of men, women and children wear

References:

Cole, D. (2007). *Patterns new surface design*. London: Laurence King Publication,
Corbman, B.S (1985). *Textile fiber to fabric*. New Delhi: Mc. Graw Hill Publication

Hess, K. P. (1959). *Textile fibers and their use*. New Delhi: Oxford and IBH Publication company

Naik S. D. and Wilson . J. (2006): *Surface designing and Textile fabrics*. New Delhi: New age international (P) Limited Publishers

Shenai, V. A. (1997). *History of Textile Designs*. Mumbai: Sevak Publications

Terry, A. G. (1979). *Printed textile A guide to creative design fundamentals*. New Jersey, England: Prentice hall inc.

Vidyasagar, P.V.(1998). *Handbook of textiles*. New Delhi: Mittal Publication

Watson and William. (1998). *Textile Design and Colour*. Mumbai: Bombay University Publication

E–Resources:

Elements and principles of design-Slide share, <https://www.slideshare.net/admecoinstitute/principles-of-design-30520900>

Indian Heritage - Textiles of India,

<http://www.indian-heritage.org/alangaram/textiles/textiles.html>

How colour notion works – Munsell color system,

<https://munsell.com/about-munsell-color/how-color-notation-works/>

Dyeing, Printing and Finishing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning Outcomes:

Upon completion of the course, students will be able to:

Analyze basic elements and principles of various dyes, prints and finishes.

Extend and expand their ideas and creativity in designing

Reason about eco-friendly aspects in relation to textile industries and provide solutions at multiple level of production

Syllabus :

Unit I Introduction to dyeing

- a) Classification, definition and chemical components
- b) Terminology and theory of dyeing
- c) Kinetics and mode of action of dyes
- d) Stages of dyeing

Unit II Introduction to Printing

- a) Definition, terminology of printing, difference between printing and dyeing
- b) Style of Printing: Direct, dyed, resist and discharge
- c) Method of Printing: Block, stencil, Screen, Batik, tie and dye and fabric Painting.
- d) Procedure of Printing

Unit III Introduction to finishes

- a) Definition, classification of finishes and importance of finishes
- b) Basic finishes used for preparation of fabric for dyeing and printing: Singeing, Desizing, Sizing, Bleaching, Scouring, Mercerization Carbonizing

Unit IV

- a) Special finishes Napping, flocking, water Repellent, wrinkle resistant, permanent press, calendaring, flame retardant and water absorbents.
- b) Textile dyeing and printing auxiliaries used for different textile processing.

Unit V

After treatment for printed goods at cottage and Industrial level.

Baking

Curing.

Steaming.

- b) Industrial level practices for dyeing, printing and finishes.
- c) Legal and environmental concerns

- d) Environmental health and safety
- e) Laws and regulation.

References:

- Alexander (1972). *Textile Products: Selection, use and care*. London, UK: Miffin Company.
- Corbman, B.P. (1983). *Textiles: Fiber to Fabric* (6th ed.). New York, NY: McGraw Hill Publication.
- Gohl, E. P. G. & Vilensky, L. D. (2005). *Textile Science* (2nd ed.). New Delhi, India: CBS Publishers.
- Hall, A.J. (1980). *The standard Handbook of Textiles* (8th ed.). London, UK: Newness Butterworth.
- Hess, K.P. (1959). *Textile fibers and their use* (6th ed.). New Delhi, India: Oxford and IBH Publication co.
- Shenai, V. A. (1985). *Technology of Printing: Technology of textile processing* Mumbai, India: Sevak Publication.
- Shenai, V. A. (1997). *History of Textile designs*. Mumbai, India: Sevak Publications.
- Vidyasagar, P.V. (1998). *Handbook of textiles*. New Delhi, India: Mittal Publication.
- Watson & William (1998). *Textile Design & Colour*. Mumbai, India: Bombay University Publication.

E-Resources:

Textile fibers, dyes, finishes and processes

<https://www.scribd.com/document/25717442/Textile-Fibers-Dyes-Finishes-and-Processes>

Textile dyeing and Printing

<https://www.scribd.com/doc/54185948/Textile-Dyeing-and-Printing>

Classification of dyes

<https://www.textileschool.com/383/types-of-dyes-classification-based-on-chemical-structure/>

Method of printing

<http://eacharya.inflibnet.ac.in/index.php/content/index/57206af18ae36c6781c073ae>

Style of printing

<http://eacharya.inflibnet.ac.in/index.php/content/index/57206af18ae36c6781c073ac>

Textile dyeing industry and environmental hazard

https://file.scirp.org/pdf/NS20120100003_72866800.pdf

Impact of dyeing process on environment

http://cdn.intechopen.com/pdfs/41411/InTech-Textile_dyes_dyeing_process_and_environmental_impact.pdf

Indian textile industry and environmental issues

<https://pdfs.semanticscholar.org/7761/d7fca806e9f6fb64d5b1e7aed3e44a032bbf.pdf>

Methods and Material for Child Study

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course, students will be able to:

Explain characteristics and requirements of different groups of children

Explain major methods and approaches of child study

Design and create play materials and plan learning experiences for promoting various concepts and commutative skills in children

Syllabus :

Unit I Approaches and Methods

Characteristics of childhood (emphasis on state of helplessness to gradual control over body.

Importance and ways of meeting child's psychological needs to promote feeling of security, trust and acceptance.

Approaches of child study – Baby Biographies, life span developmental approach.

Methods of child study – Observation, Ethnographic study, case study, correlation study, experiments.

Unit II Stimulating Activities

Activities for stimulation and sensory motor experiences – seeing, hearing, touching, feeling and movements.

Activities to promote manipulation, concept formation, communication and perceptual discrimination.

Language activities –

Music & songs

Rhymes

Stories

Unit III Activities and Materials

Social science activities

Science activities

Mathematical activities

Art and creative activities

Unit IV Other Materials

Sand – Characteristics, values, materials required and teacher's role

Water – Characteristics, values, materials required and teacher's role

Puppetry – Characteristics – Values, kinds, script

Unit V Creative Drama

Creative Drama and Role play

Values

Techniques involved in creative drama – rhythmic movements, pantomime, story building

Basic staging techniques, use of light and sound effect

References :

Levine E. Laura (2011). *Child Development :An Active Learning approach*. Los Angeles: Sage Publications.

Papalia E. Diane (2004). *Human Development (9th ed.)*. New Delhi : Mc Graw Hill Education (India) Private Ltd.

Santrock W. J. (2008). *A tropical approach to Life -Span Development(3rd. ed)*. New Delhi : Tata Mc Graw-Hill Publication Company Ltd.

Methods and Material for Child Study Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Activities of Tearing, Cutting and Pasting
2. Modeling with clay, plasticine, dough, saw dust, straw, match sticks, rope, thick paper fold.
3. Preparation of tools for observation, Interview, case study
4. Preparation of puppets
5. Theme based dramatization
6. Display of bulletin board for picture talk
7. Develop riddles for language and concepts
8. Evaluate few stories
9. Prepare materials and activities to promote various concepts.
10. Plan field trip to – Institutions, parks, Zoo, Drams, TV station, Post office etc.
11. Collect traditional stories & folk songs from different parts of country
12. Compile outdoor and indoor games

Assessment of Nutritional Status

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

- Upon completion of the course students will be able to:
- Use skills in anthropometric measurements and assessment of nutritional status
- Conduct dietary surveys in the community
- Get Employment in different NGO's and government agencies working in the field of nutrition
- work independently in the field of community nutrition

Syllabus :

- Unit I** Definition of nutritional status, stages of nutritional status. Factors contributing to nutritional status of individual and community – food and food production, food distribution, economical, social, geographical, demographic and religious. Vital health statistics
- Unit II** Anthropometric assessments as a tool to assess nutritional status Weight, recumbent length, height, knee height, elbow breadth, and skin fold thickness- single and multiple. Waist and hip circumference, mid upper circumference, MUAMC and MUAMA
- Unit III** Anthropometry indices
- Head and chest circumference for age, weight for age, weight for height, Brief introduction of reference data WHO, NCHS and ICMR. Evaluation of indices- WHO classifications
- Unit IV** Assessment of food consumption at community (Food account inventory, household record, list record) and individual (24 hours recall method, repeated 24 hrs., dietary history, food frequency, weighted food record and estimated food record) level
- Unit V** (a) Biochemical assessment for protein energy nutrition and deficiency of these nutrient vitamin A,D,E, thiamin, riboflavin, niacin, B6, folic acid, ascorbic acid, iron and iodine
- (b) Clinical assessment and biophysical assessment.

References:

- Bamji, M.S., Rao, P.N., and Reddy, V. (1996) .*Text Book of Human Nutrition*. New Delhi:Oxford & IBH Publishing Co. Pvt. Ltd.
- Gibson, R.S. (2005). *Assessment of Nutritional Status*. New Delhi:Oxford University Press.
- Jelliffe, D. B. (1966). *Assessment of Nutritional Status of the Community*. W.H.O.

E-Resources:

- Anthropometry procedures Manual_CDC http://www.cdc.gov/nchs/data/nhanes_07_08/manual_an.pdf
- WHO Child Growth Standards - World Health Organization
- <http://www.who.int/child growth/standard>

Assessment of Nutritional Status Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus:

1. Practice of anthropometry. Height, weight, BMI, MUAC, Head and Chest circumference, waist and Hip Circumference Measurement of skin fold thickness.
2. Determination of hemoglobin.
3. Dietary survey
4. Growth Chart

Introduction to Work Study

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course, students will be able to:

Analyze changes in human body at work

Analyze and reason out concept of Ergonomics and its applications to develop user-centered approach

Develop human centered approach to work and workplace designing

Analyze the indoor climate components for ergonomic designing

Syllabus:

Unit I Work Study

Components of work study- Time study and method study

Work study techniques - Formal and informal

Mundell's classes of change

Unit II The Worker- Costs of work

Affective component- Motivation

Cognitive component- Guilford's model of intellect

Temporal component - Work curve, rest periods and fatigue

Physical component- Principles of biomechanics, indicators of physical stress (heart rate, VO2 max), work physiology (static and dynamic work)

Unit III The Work

Functional design for seated and standing workers

Workstation analysis- user- machine- environment interface

Unit IV Indoor Climate in Workplace

Illumination- Principles of good lighting

Noise level and their control in workplaces

Quality of air – Humidity and temperature

Unit V Ergonomics – Human factors

Meaning, areas of study in ergonomics, criteria to assess ergonomic fit

Relationship between optimal design and performance

Man machine environment system

References:

Bridger R.S. (2009). *Introduction to Ergonomics*. New York :Mc Graw Hill Inc.

Galer I. (1987). *Applied Ergonomics Handbook (2nd ed.)*. London:Butterworth & Co. Publications Ltd .

Salvendy G. (2006). *Handbook of Human Factors and Ergonomics*. New York:John Wiley & Sons.

Sanders M., McCormick E. (1993). *Human Factors in Engineering and Design*. New York:McGraw Hill.

E-Resources:

Human Factors

https://www.fac.ksu.edu.sa/sites/default/files/human_factors.ppt

Early Childhood Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Explain significance of early childhood years, historical development and philosophical ideas related to early childhood education

Get proficiency in planning programmes and curriculum including various components to promote all round development of young children

Analyze problems, identify various contemporary issues in ECE and plan innovations

Syllabus :

Unit I (a) Significance and objective of ECE

(b) Historical overview of ECE in India and Abroad

(c) Different type of programmes currently offered : objectives of the programme, routine and target group covered by each of the following- Balwadi, Anganwadi, Nursery school, kinder-garten, montessori, mobile creche, ICDS, Play group, creche and day care, laboratory nursery school

Unit II Organization and management of ECE Centre

Material Management – Place/building/space-Plan for various activities, space allotment of outdoor and indoor

Furniture / fixtures/ equipments – criteria for selection, functional utility, maintenance, low cost alternatives

Personnel management: Selection, qualities, roles, duties and responsibilities

Unit III Curriculum and programme planning

Foundations of curriculum development – children's background and experiences, need for movement, exploration, discovery, expression, achievement, success and recognition, development norms & tasks, cultural expectations

Principles of programme planning – from known to unknown, simple to complex, concrete to abstract, Balance between individual and group activity, indoor and outdoor, quiet and active, guided and free activities

Integrated learning approach or project method: Meaning, advantages and planning

Unit IV Pre-school curriculum

Long and short term planning, model lesson plan for a day

Activities in pre school science, music, mathematics, play, social science, language, creative art activities and environmental studies – objectives and role in all round development of child

Alternative to home work such as observations, exploration, experimentations, reporting orally, picture presentations

Evaluation of daily work and reporting to parents

Unit V Understanding, importance and management

Child's first day in nursery school

Laying foundations for security

Observation in ECE Centre

Parents involvement in ECE

Integrated and segregated programme for children with special need

References:

Grewal, J.S. (1995). *Early Childhood Education*. Agra: National Psychological Corporation.

Lawton, J.T. (1988). *Introduction to Childcare & Early Childhood Education*. London: Scott Freeman Co.

Morrison, G.S. (1976). *Early Childhood Education Today*. USA: Merrill Publications.

Read, K.H. (1996). *Nursery School Relationship Laboratory*. Calcutta: Oxford and IBM.

Swaminathan, M. (1984). *Play Activities for Young Children*. New Delhi: UNICEF.

E-Resources:

पाश्चात्य शैक्षिक विचार व विचारक 4MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxQmJYQXJhVkYJYWHM>

अध्यापन-अधिगम तथा मूल्यांकन 2MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxSlg1d2RoaFRzYjg>

पाठ्यचर्या तथा अनुदेश 17MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxejNMUFZxbTl6MGc>

अधिगम के लिए मार्गदर्शन 6MB

<https://drive.google.com/open?id=0Bwk5FIsI0ctxRXNHR011T3JWaFU>

Early Childhood Education Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

Observation of children in nursery school in different situations.

Plan activities for ECE centre: list objectives, analyze tasks to achieve goals, select and organize instructional and learning materials, teacher's role, and preparation of evaluation sheet.

Preparation of materials for reading and writing readiness and different activities in Pre School.

Preparation of stuffed toys, pictures books, encyclopedia and dictionaries.

Micro teaching – peer group teaching used to develop teaching skills.

Assisting Nursery school teacher in different activities.

Learning to maintain different types of records and registers.

Plan project method based lesson.

Plan activities which children can do at home.

Diet Therapy

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes:

Upon completion of the course students will be able to:

Identify the nutritional needs in various diseases

Formulate therapeutic diet according to disease using principles of diet therapy

Apply the knowledge of therapeutic diet for counseling of patients

Demonstrate the nutritional care in community

Syllabus :

Unit I Concept and objectives of diet therapy

Team approach to nutritional care

Therapeutic adaptations of normal diet

Unit II Dietary management in febrile and gastro intestinal disorders -

Typhoid

Tuberculosis

Diarrhoea

Constipation

Peptic Ulcer

Unit III Dietary management in weight related and liver disorders

Obesity

Underweight

Viral hepatitis

Cirrhosis of liver

Unit IV Dietary management in renal disorders and hypertension

Acute glomerulo- nephritis

Ca oxalate calculi

Hypertension

Unit V Dietary management in chronic degenerative disorders

Atherosclerosis

Diabetes mellitus

References:

Antia, F.P. & Abraham, P. (1973). *Clinical dietetics and nutrition*. New Delhi: Oxford University Press.

Khanna, K., Gupta, S., & Passi, S.J. (1997) . *Textbook of Nutrition and Dietetics* ., New Delhi : Phoenix Publishing House Pvt. Ltd.

Passmore, R. ., & Eastwood, M. A.(1986). *Davidson and Passmore Human Nutrition and Dietetics* .Churchill Livingstone.

Robinson, C.H., & Lawler, M. (1982). *Normal and Therapeutic Nutrition*, New Delhi: Oxford IBH Publishing Co.

Sharma, S. (2000). *Human Nutrition and Meal Planning*. New Delhi: Jnanda Publishers

Srilakshmi, B. (2002). *Dietetics*: New Age International (p) Ltd.

Swaminathan, M.(1985). *Fundamentals of Food and Nutrition*, (Vol.II). Bangalore: **Bangalore** Printing and Publishing Co Ltd

Williams, S.R.(1993). *Nutrition and Diet Therapy*. St. Louis:Times Mirror Mosby College Publishing.

E-Resources:

Indian chronic kidney disease guidelines

http://isn-india.org/images/CKD_1.pdf

Dietary Guidelines for Indians

<http://ninindia.org/DietaryGuidelinesforNINwebsite.pdf>

ICMR guidelines for management of type 2 diabetes 2018

<https://medibulletin.com/wp-content/uploads/2018/05/ICMR.diabetesGuidelines.2018.pdf>

Diet Therapy Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

Planning and Preparation of diets for -

- i. Acute fever (full fluid diet)
- ii. Chronic fever (soft diet)
- iii. Diarrhoea
- iv. Constipation
- v. Peptic ulcer
- vi. Obesity
- vii. Underweight
- viii. Viral hepatitis
- ix. Cirrhosis
- x. Acute glomerulonephritis
- xi. Ca oxalate calculi
- xii. Hypertension
- xiii. Diabetes mellitus (using exchange lists)

Nutritional Biochemistry Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	2	1

Syllabus :

Qualitative analysis of main constituents of wheat flour and milk

Analysis of oils or fats: Saponification Number and Iodine Number

Determination of ascorbic acid in food, by titration

Qualitative determination of calcium, phosphorus, and iron in a given sample

Amino acid separation by paper chromatography

Detection of common adulterants in the food stuff

Fashion Dynamics and Illustration

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning Outcomes:

Upon completion of the course students will be able to:

Recognize basic concepts of fashion dynamics, fashion movement and its development.

Interpret and learn to operate practices involved in fashion business.

Find out designers of international and national fame and explore their contribution to the fashion of today

Design and sketch fashion illustrations for different purposes

Syllabus :

Unit I The nature of fashion

- a) Definition & its importance in fashion business
- b) The terminology of fashion : style, fashion, design, taste
- c) Components of fashion : silhouette, details, colour, fabric ,texture, seams, trims
- d) The intangibles of fashion ; group acceptance, change, reflection of time
- e) Principles of fashion adoption

Unit II Fashion development: an overview of

- a) History of fashion industry & retailing
- b) Retail expansion in early twentieth century
- c) Present status of fashion couture
- d) Categories of fashion industry : a brief overview of
 - (i) Primary level
 - (ii) Secondary level

Unit III Fashion change and consumer acceptance

- a) Fashion evolution: fashion cycles and length of cycle
- b) Consumer groups: fashion leaders and followers
- c) Theories of fashion adoption: downward theory, mass market theory, upward theory
- d) Motives for fashion buying: fashion selection

Unit IV Fashion environment & its movement

- a) Environment of fashion: geographic, demographic, psychographic & behavioral
- b) Factors affecting fashion & its change: accelerating factors, retarding factors & recurring fashion

Unit V Fashion research design and analysis

- a) Fashion forecasting: market research, evaluating the collections
- b) Source of fashion information
- c) Development of fashion line /range

- (i) Design source
- (ii) Interpreting theme / range
- (iii) Scope of line
- (iv) Line portfolio

References:

- Abling, B. (1993). *Fashion Sketchbook*. New York: Fairchild publication
- Abling, B. (2017). *Fashion Flats and Technical Drawing*. New York: Bloomsbury Publication
- Abling, B. (2nd ed.). (2005). *Marker Rendering for fashion, Accessory and Home Fashion*. New York: Fairchild Publication.
- Castelino, M. (1994). *Fashion Kaleidoscope*. Calcutta: Rupa and co.
- Diamond, J. & Diamond, E. (V ed.). (2013). *The World of Fashion*. New York, NY: Bloomsbury Publishing Inc.
- Frings, G. S. (1999). *Fashion from Concept to Consumer*. New Jersey: Prentic Hall
- Ireland, P.J. (1995). *Fashion Design Illustration for Children*. London: B. T. Batsford Ltd.
- Ireland, P.J. (2005). *Figure Templates for Fashion Illustration*, Singapore: Page One Publishing Pvt.Ltd.
- Leach, R. (2012). *The Fashion Resource Book : Research for Design*. London: Thames & Hudson Ltd.
- Rousso, C. (2012). *Fashion Forward : A Guide to Fashion Forecasting*. New York: Fair child Books Inc.
- Stone, E. (2004). *The Dynamics of Fashion*. New York: McGraw Hill Book Company
- Tain, L. (3rd ed.). (2010). *Portfolio Presentation : for Fashion Designers*. New York: Fairchild Books Inc.

Fashion Dynamics and Illustration Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Syllabus :

- (i) Sketching of different action croquei (front, back & side view) for child, male & Female
- (ii) Garment and Garment Details
 - Necklines and collars
 - Sleeve details
 - Frills, fringes and gathers, cowls and cascades
 - Hemlines and insertion
 - Lacings, Maura me and patch work
 - Pleats, quelling and ties
 - Shirring , smocking, hip openings, fastening
 - Yokes, tucks and tassels
 - Shirts and pants
 - Suits, blouses, coats and jackets
- (iii) Sketching of Accessories
 - Hats and Headgear.
 - Sunglass
 - Footwears
 - Bags and purses
 - Jewellery.
- (iv) Basic Rendering techniques
 - Colour matching using different media – charcoal, crayons, pen markers, brushes, paper
 - Pattern & texture – checks, gingham, plaids, stripes
 - Reducing a print
 - Shading
- (v) Theme Rendering
 - Casual wear
 - Sports wear
 - Executive wear
 - Night wear
 - Bridal wear
 - Evening wear
 - Beck wear
 - Traditional wear

Welfare Programmes

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
3	0	0	3

Learning Outcomes:

Upon completion of the course students will be able to:

Discuss welfare services for family and children in India

Interpret various types of services to meet the needs of family and children

Analyze the institutional services for women and children; old age and children with special need

Summarize the role of international agencies in child welfare

Syllabus :

Unit I Concept of welfare services

Meaning and definition of welfare services

Historical orientation of family and child welfare agencies

Categories of child Welfare services-supportive, protective and supplementary

Maternal and child health services

Nutrition services

Unit II Institutional Services for Women and Children

Recreational institutions for children – Bal Bhawan and Holiday Homes

Institutional Services for women and children in distress – Short stay homes, SOS village, rescue homes

Unit III Agencies and Services for aged

Services for the aged – Day Care Centres, old age homes, old age pension schemes

Agencies for the aged – Help age India, Senior Citizens' association in Major cities, Grant –in-aid programme

Unit IV International organizations

Role of international agencies in child welfare: WHO, ILO, UNICEF, FAO, UNESCO -international NGO-AMI, CARE, IUCW, ICCW

Unit V Services for Children with special need & Youth

Blind and deaf

Physically handicapped

Mentally retarded

Juvenile delinquents

Programmes for Youth

References:

Alfred, K. (1980). *Child Welfare Services* . New York : Mc-Millan Publishers.

Choudhary, D.P. (1985). *Child Welfare Development*, Delhi: Atma Ram & Sons .

Fonseca, M.B. (1991). *Counselling for Marital Happiness*, Bombay : Manaktalas .

Verma, V.S. & Singh, M. (1988). *Legal Rights for Women and Families* . New Delhi:Women's Legal Aid Centre.

Surface Ornamentation Techniques for Textiles

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

Upon completion the course, students will be able to:

Plan and develop various textile designs using basic elements and principles of design

Apply knowledge of different dyes, finishes, and style of printing to design various fabrics

Syllabus :

1. Process of designing
 - a) Collection of different motifs
 - b) Arrangements & placement of motif
 - c) Preparation of portfolio of different motifs arrangements and colour schemes using different themes and texture
2. Dyeing

Cotton yarn/fabric with direct dye by varying temperature, percentage shade and material liquor ratio.
Cotton yarn with basic dyes by mordant, vat dyes, azoic dyes and reactive dyes

Woolen yarn with acid and basic dyes.

Dyeing of nylon with disperse dyes
3. Printing

Printing through different techniques: Tie and dye, Batik, Block, Stencil, Screen and fabric painting
4. Finishing

Identification of finishes

Study of labels pertaining to finish applied

Portfolio of various types of dyed, printed and finished fabric swatches

Basics of Home Science and Resource Management

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

Interpret concept and scope of Home Science discipline

Develop an insight into fundamentals of Resource and their management

Syllabus:

Unit 1 Fundamentals of Home Science

1. Definition, Philosophy and objectives of Home Science
2. Historical development of the field of Home Science in India (in brief)
3. Scope of Home Science - Educational and Vocational

Unit 2 Resource Management

1. Definition and concept of Resource Management
2. Systems Approach to Management
3. Family Resource Management as a system

Unit 3 Decision Making and Work Study

1. Decision making-Concept, Steps and Classification of decisions
2. Work Simplification-Work Study techniques, Classes of change
3. Management Process

Unit 4 Resources

1. Importance, types and characteristics
2. Obstacles to the improvement of resource management-lack of awareness of resources and management, failure to evaluate results, seeking readymade answers, lack of information etc.
3. Resources constraints continuum.
4. Guidelines to increase satisfaction from resources

Unit 5 Factors Motivating Management

1. Values - sources, classification
2. Goals - types, characteristics
3. Standards - types, characteristics

References:

- Bansal, I., & Kumari, C. (2010). *Home Science: An Introduction*. Newai (Raj) : Navjeevan Publishers.
- Chandra, A. (1978). *Introduction to Home Science*. New Delhi: Metropolitan Book Company, Ltd.
- Daecon, R.E., & Firebaugh, F.M. (1975). *Context and concepts of Management*. USA: Houghton Mifflin Company.
- Gross, I.H., & Crandall, E.W. (1980). *Management for modern families* (3rd ed.). New Jersey: Prentice Hall Inc. Engle Wood Cliffs.
- Jain, V. (2002). *Grih Prabandh, Sadhan Vyavastha awem aantrik sazza*. Jaipur: Abhishek Publication.
- Koontz, H., & Weihrich, H. (2009). *Essentials of Management*. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
- Patni, M., & Sharma, L. (2017). *Grih prabandh* (25thed.). Agra: Star Publication.
- Stoner, J.,Freeman,R., & Gilbert, D. (1995). *Management* (6thed.). New Delhi: Prentice Hall of India Pvt. Ltd.
- Tripathy, P.C., & Reddy, P.N. (2001). *Principles of Management*. New Delhi: Tata McGraw Hill Publishing Co. Ltd.

Wangundy, A.B. (1981). *Techniques of structured problem solving*. New York :Van Nostrand Reinhold Company.

Interior Decoration Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes: After the completion of the course, students will be able to:

Design and draw floor plans to meet a given set of requirements

Apply informed judgments in designing interiors

Syllabus :

1. Floor Plan drawing using engineering scales
2. Elements of Art
3. Principles of Design
4. Development of Colour Wheel
5. Development of Value Chart
6. Development of Colour Schemes
7. Furniture Arrangement using cut-outs for residential interiors
 - (a) Living Room
 - (b) Bed Room
 - (c) Kid's Room
 - (d) Space Planning for Kitchen
8. Development of motifs- Naturalistic, Geometric and Stylized

Basics of Human Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After the completion of the course, students will be able to:

- Get insight into concept and various aspects of Human Development
- Appraise concerns and issues related to parenting and development aspects
- Relate theories to developmental aspects

Syllabus :

Unit I Human Development : An Overview

- Scope and significance of Human Development
- Human Development as multi disciplinary science
- Methods of child study

Unit II Orientation to Growth and Development

- Understanding growth and development (definitions)
- General principles of development
- Role of heredity and environment
- Maturation and learning (with reference to Gessell's Maturation point of view and Watson and skinner's Behaviorist point of view)

Unit III Important Child Care Aspects

- Fundamental needs of children
- Child rearing practices, disciplinary practices and their impact on children
- Importance of early years of life (with brief description of Freudian Psycho-analytic view)

Unit IV Dimensions of Development

- Physical and Motor development – factors influencing motor development
- Language development – functions, factors influencing
- Moral development – meaning, factors influencing development (with special reference to Kohlberg's theory)

Unit V Dimensions of Development

- Cognitive development across the life span (with brief introduction to Piaget's theory)
- Emotional development – development of different emotions, factors predisposing to emotional development, characteristics of children's emotion
- Social Development – Importance, factors influencing social development, agents of socialization

References :

- Gupt Ram Babu (1996). *Vikasatmak Monovigyan*, Agra : Ratan Prakashan Mandir.
- Hurlock Elizabeth B. – *Bal Manovigyan* (5th & 6th Edition), New Delhi: Tata Mc Graw Hill.
- Hurlock Elizabeth B. (1978). *Child Development* (6th ed.). New Delhi : Mc. Graw Hill Publishers Ltd..
- Laura.E.Berk (2013). *Child Development*. Illinois : Pearson.
- Musson P., Conger J.J., Kegan J. and Haston A.C. (1990). *Child Development and Personality*. New York: Harper & Row.
- Singh Vrinda (2006) *Manav Vikas evam Parivarik Sambandh*. Jaipur: Panchsheel Parkashan.
- Verma, Priti, & Srivastava, D.N. (1996). *Bal Manovigyan – Bal Vikas*. Agra : Vinod Pustak Mandir.

Fundamentals of Foods and Nutrition

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After the completion of the course, students will be able to:

Describe the functions of food and role of various nutrients, dietary requirement of various nutrients, and effect of deficiencies and excesses

Explain the methods of food preparation and principles applied in food preservation.

Apply and incorporate the knowledge of nutritional requirement in various life stages.

Syllabus :

Unit I

Nutrition as a Science – Definition and explanation, Nutrition health relationship, Nutrition as a process

Definition of terms – ‘Food’, ‘Diet’ and ‘Nutrients’

Changes that occur in food in human body; Digestion, Absorption, Transport and Utilization

Unit II

A brief discussion pertaining to the nutritional importance and functions, deficiencies, sources and requirements of the following Macronutrients:

Carbohydrates

Fat

Protein

Water

Dietary fiber

Unit III A brief discussion pertaining to the nutritional importance and functions, deficiencies, sources and requirements of the following Micronutrients:

Fat soluble vitamins – A,D,E & K

Water soluble vitamins – Vitamin C, Thiamine, Riboflavin, Pyridoxine, Folic acid and B12

Minerals – Calcium, Phosphorus, Iron, Iodine, Sodium, Potassium, Chlorine, Zinc (Elementary idea about dietary and functional importance)

Unit IV

Description of five-food group system and importance in meal planning, concept of balanced diet, selection of foods based on five food group system.

Factors to be considered while doing meal planning (Elementary Idea)

Recommended dietary allowances for infancy, childhood, adolescence, adulthood, old age, pregnancy and lactation (Elementary Idea)

Unit V

Methods of food preparation: use of moist and dry heat; changes occurring in foods during cooking

Brief discussion of factors contributing to food spoilage and principles applied in household preservation

References:

Khanna, K., Gupta S, Mahna R, Puri S, Seth R and Passi SJ. (1997). *Text book of Nutrition & Dietetics*. New Delhi : Phoenix Publishing House Pvt. Ltd..

Mehtab, S. Bamji, K. Krishnawamy and GNV Brahman.(1996). *Text Book of Human Nutrition*, New Delhi : Oxford & IBH Publishing Co. Pvt. Ltd..

Sharma, V .(1995) .*Food & Nutrition Science*(2nd ed.). Meerut : Loyal Book House.

Singh, V. (2006). *Food & Nutrition Science* (3rd ed.). Jaipur: Panchsheel Prakashan.

Srilakshmi, B. (2004). *Nutrition Science*, New Delhi: New Age International Pvt. Ltd.

Swaminathan, M. (1985). *Essentials of Foods and Nutrition Vol.1* Madras : Ganesh and Co.

Wilson, E.D., Fisher K. H. & Fuqua M.E. (1975). *Principles of Nutrition*. Canada : John Wiley and Sons.

E- resources:

Function of food, food groups, food chart

<https://www.slideshare.net/chefkaushal84/food-56547837>

Methods of cooking

<https://www.slideshare.net/laurahuang/methods-of-cooking-ppt-5914731>

Importance of nutrition, consumer rights, special diets, menu panning

<https://www.slideshare.net/itchomecare/8-nutrition-and-food-preparation-15193848>

Nutrition in Health and Disease

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes: After the completion of the course, students will be able to:

- Describe the role of nutrition and nutrients in health, disease and various life stages
- Explain the causes of food spoilage and types of food preservation
- Apply and incorporate the knowledge of therapeutic diet for various disease conditions

Syllabus :

Unit I

- Nutrition and Health – its relationship
- Role of Nutrients in Health: Protein, Fat, Carbohydrate, Iron, Calcium, Sodium, Iodine & Potassium
- Role of Nutrients in Disease conditions (PEM, Obesity, Anemia, Diabetes Mellitus, Hypertension, Goitre, Osteoporosis/ Osteomalacia)
- Animal and plant proteins, mutual supplementation, protein quality.
- Malnutrition – Under and over nutrition, its relationship with nutrient intake (fundamental aspects)

Unit II

- Unit of energy, concept of BMR – activity and calorogenic effect of food
- Calorific value of carbohydrate, protein and fat (food value)
- Factors affecting energy requirement
- Food hygiene, food spoilage and food preservation

Unit III

- Benefits of good nutrition and health habits for body functioning
- Nutrition during (fundamental aspects)
 - a) Infancy
 - b) Adolescence
 - c) Pregnancy
 - d) Lactation

Unit IV

- Concept of diet therapy
- Objectives and principles of diet therapy
- Normal diet
- Therapeutic adaptations of normal diet

Unit V Basic overview of definition, causes symptoms & dietary Management in -

- Fevers (Acute, Chronic)
- Diarrhoea
- Constipation
- Obesity
- Diabetes Mellitus
- Hypertension

References :

- Khanna, K, Gupta S.,Mahna R,Puri S,Seth R and Passi SJ. (1997).*Text book of Nutrition & Dietetics*. New Delhi: Phoenix Publishing House Pvt. Ltd..
- Sharma,V. (1995). *Food & Nutrition Science (3rd ed.)*. Meerut: Loyal Book House.

Singh,V. (2006). *Food & Nutrition Science (3rd ed.)*. Jaipur : Panchsheel Prakashan .
Srilakshmi, B. (2004). *Nutrition Science*. New Delhi : New Age International Pvt. Limited.
Swaminathan, M. (1985). *Essentials of Foods and Nutrition Vol.2* Madras: Ganesh and Co..

E- resources :

Causes of food spoilage, sources, factors and its prevention

<https://www.slideshare.net/MAMATHESH/food-spoilage-microbiology>

Therapeutic diet in various diseases

<https://www.slideshare.net/sapnamanger/therapeutic-diet>

Basic nutrition

<https://www.slideshare.net/jinulazer/ppt-on-nutrients>

Introduction to Community Nutrition and Extension

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After the completion of the course, students will be able to:

- Explain the linkages between nutrition, environment, health and disease
- Recognize the importance of malnutrition as a conditioning factor in relation to many diseases in community
- Get acquainted with the roles of national & international agencies in community nutrition
- Explain importance of extension programmes for the betterment of QOL in rural areas and develop skills for effective communication

Syllabus :

Unit I Concept of extension education

- Meaning, nature of extension education
- Principles of extension education
- Philosophy of extension education
- Objectives of extension education
- Methods of extension teaching

Unit II Communication in Home Science extension

- Communication – meaning, nature, key elements
- Audio- Visual aids– definition, classification, selection, and use in Home Science education as per need of the community

Unit III

- An introduction of the concept of Nutrition and health education in India. Health and nutrition as indices of national progress.
- A brief introduction of role of national and international agencies engaged in the cause of Nutrition and health: National- ICMR, ICAR, CSIR, CFTRI, NIN; International- FAO, WHO, UNICEF and CARE.

Unit IV

- Major nutritional problems in India, their prevalence, causes, signs and symptoms -
PEM, Iron deficiency Anaemia, Iodine deficiency disorders and Vitamin A deficiency disorders
- National & state programmes running to uplift the nutritional status of population – ICDS, Mid day meal programme, Iron deficiency Anaemia Control programme, Vitamin A prophylaxis programme

Unit V

- Importance of water, potable & polluted water, water purification at domestic level.
- Causes, signs & symptoms, case & preventive measures (in brief) of following diseases.
 - (i) Water, food & milk born disease- Cholera, typhoid, diphtheria, hepatitis & tuberculosis.
 - (ii) Worm infestations – caused by round worm, hookworm & ant amoeba histolytica (causing amoebiasis)
- c) Introduction to immunity- Innate, acquired, passive, active, principles of immunization, immunization schedule

References:

- Bamji, M. S., Rao, P.N., & Reddy, V. (1996). *Text book of Human Nutrition*. New Delhi : Oxford and IBH publishing Co Pvt. Ltd.
- Bhargava, B. (1999). *Parivarik Swastha avm samajik Kalyan* (2nd ed.). Jaipur: University Book House Pvt. Ltd.

- Dhama, O.P., & Bhatnagar, O.P. (2010). *Education and communication for development*. New Delhi: Oxford & IBH Publishing Co.
- Harpilini, B.D. (1994). *Grahavigyan mai Prasar Shiksha*. Agra: Star Publication.
- Kalla, P. N., & Gakkhar, A. (2010). *New Dimension of Extension and Communication*. Jaipur: University Book House.
- Kalla, P.N., & Gakkhar, A. (2005). *Prasar Shiksha ke naye Aayam*. Jaipur: Hindi Granth Academy.
- Singh, V. (2005). *Food and Nutrition Science* (3rd ed.). Jaipur : Panchsheel Prakashan.

Life Span Development

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After the completion of the course, students will be able to:

Understand important aspects of development during the whole life span

Understand the issues faced and adjustments required at each stage across the life span

Syllabus :

Unit I

(a) Prenatal Development

Stages of Prenatal Development

Birth process

Influences of genetic and environmental factors.

Types of delivery

Factors affecting and complications during Pregnancy.

(b) Infancy

Developmental tasks

Physical, motor, and language development during infancy, common emotions in infancy

Unit II Early childhood

Developmental tasks.

Physical, motor, social and language development during early childhood.

Role of Pre-school education.

Importance of play and creative activities during childhood

Unit III Middle childhood years

Developmental tasks.

social development during middle childhood.

Role of parents, peers and siblings

Importance of schooling.

Unit IV Adolescence

Developmental tasks.

Concept of puberty and growth spurt

social and emotional development during adolescence

Unit V Adulthood & Old Age

Developmental Tasks

Physical and psychological changes during adulthood

Adjustment problems in old age

References:

Cole, M., & Cole, S. (1995). *The Development of Children*. New York, NY: Freeman & Co.

Craig, G. (1999). *Human Development*. New Jersey, NJ: Prentice Hall.

Gupt, R. (1998). *Matra Kala Shishu Palan avam Bal Vikas*. Agra: Ratan Prakashan Mandir.

Hurlock, E.B. (1978). *Child Development* (6th ed.). New York: McGraw Hill Ltd.

Hurlock, E.B. (1980). *Developmental Psychology – A life span Approach* (5th ed.). New York, NY: Tata McGraw Hill Publishing Co. Ltd.

Hurlock, E.B. (1990). *Vikas Manovigyan*. Pratham Khand/Dutiya Khand, Hindi Madhyam Karyanvay Nideshalaya, Delhi University Dwara Prakashit.

Verma, P. & Srivastava, D.N. (1996). *Bal Manovigyan – Bal Vikas*. Agra: Vinod Pustak Mandir.

E-resources:

Life Span Development

www.pdfdrive.com/life-span-development-e33437743.html

Life-Span Human Development

www.pdfdrive.com/life-span-human-development-e58160481.html

Life-Span Human Development 7th Edition

www.pdfdrive.com/life-span-human-development-7th-ed-e901075.html

Introduction to Textiles

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After the completion of the course, students will be able to:

Get basic knowledge about different fibers used in textile Industry, their physical and chemical characteristics and end use

Identify different methods of yarn and fabric manufacturing and their characteristics and utility

Analyze different techniques used to enrich the surface of fabric through dyeing and printing and finishing

Discuss the use of different types of washing methods , equipments and different agents used in care and maintenance of fabric

Evaluate different practices involved in Textile Industry and at household level

Syllabus :

Unit I Introduction and classification of textile fibers

Physical and Chemical properties of cotton, wool, silk, nylon, polyester, acrylic, acetate and their importance to the consumer

Unit II Construction of yarn and fabric

Yarn manufacturing – natural and man – made fiber spinning process

Fabric manufacturing – weaving, basic weaves, loom and its parts, knitting

Unit III

Dyeing with synthetic dyes

Printing : styles and various methods of printing

Basic or routine finishes

Unit IV

Laundering methods and equipments.

Soaps and detergents.

Water; hard and soft

Other laundry agents – brief introduction to bleaches, stiffening agents and blues

Unit V

Stain removal – domestic and chemical methods

Dry cleaning

Washing, drying, ironing and folding of different garments

Care and storage of various garments

Mending and renovation of garments

References :

Corbman, B. P. (1985). *Textile Fibres to Fabric*. New Delhi: Gregg Division - Mc. Graw Hill Inc.

Dantyagi, S. (1967). *Fundamentals of Textiles and Their Care*. New Delhi: Orient Longman.

Deolkar, D. (1971). *Household Textiles and Laundry Work*. New Delhi: Atmaram and sons.

Hollen, N. & Saddler, J. (1964). *Textile*. (5th ed.). New York, NY: Mc. Millan Publishing Co.

Joseph, L. M. (1986). *Introductory Textile Science*. America: Halt, Rinehart and Winston.

Kadolph, S. J. & Langbord, A. L. (11th ed.). (2014). *Textiles*, New Jersey: Prentice - Hall Inc.

Tortora, P.G. (1978). *Understanding Textiles*, New York, NY: Macmillan Publishing Company.

Family Dynamics and Parent Education

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After the completion of the course, students will be able to:

Gain information about importance, problems and adjustment in marriage life and family

Attain knowledge about role of parents and their involvement for overall development of the child

Get awareness about parent and community education for betterment of society

Syllabus :

Unit I

Concepts of marriage – Definition, meaning & goals of marriage.

Types and forms of marriage

Factors influencing mate selection

Dating, Courtship and Engagement - Meaning and objectives

Unit II

Adjustment in marriage – meaning, factor affecting marital adjustment and major areas of adjustment

Social problems and their impact on family relations – child marriage, dowry system, widowhood, remarriage & extra marital relations.

Marriage Counseling – meaning , need and importance

Unit III

Family – definition and meaning

Functions of family

Types of family

Breakup of family – division, separation, desertion.

Changing trends in family structure and roles

Unit IV

Meaning, need of parent education and community education

Principles and objectives of Parent education

Brief introduction of methods of parent education – Home visit, school visit and parent teacher meeting

Programme planning for parents and community education – factors and evaluation procedure

Unit V (i) Concept of mental health & role of parent in maintaining good mental health.

(ii) Some problem behaviours,- cure and prevention

Bedwetting

Sibling Rivalry

Aggression & Hostility

Isolated Child

Drug Abuse

Masturbation

References:

Bhushan V, & Sachdeva R. (1983). *Introduction to Sociology*. Allahabad: Kitab Mahal.

Gupt R.B. (1996). *Vikasatmak Manovigyan*. Agra: Ratan Prakashan Mandir.

Mukharjee, R.K. (1979). *Indian Society*. Jaipur, Chaura Rasta: College Book Centre.

Rice F.P. (1983). *Marriage and Family*. Boston: Allyn & Bacon.

Schaefer, C.E., & Millman, H.L. (1981). *How to Help Children with Common Problems*. New York, NY: New American Library.

Tomar, R. B. (1976). *Parivarik Samaj Shastra*. Agra: Shree Ram Mehra & Co.

E-resources:

Building Stronger Marriages and Families

<https://www.pdfdrive.com/building-stronger-marriages-and-families-e22030924.html>

Community Education as a Home for Family Support and Education Programs.

<https://www.pdfdrive.com/community-education-as-a-home-for-family-support-and-education-programs-e36264845.html>

Handbook of Parenting Volume 1 Children and Parenting

Introduction to Clothing

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcomes: After the completion of the course, students will be able to:

Understand the basic essentials of clothing construction

Assess the various steps involved in the process of garment making

Gain the skills required for apparel construction

Syllabus :

Unit I

Sociological, Physical and Psychological aspects of clothing

Selection of fabrics, design, colour for children garments according to age Clothing for adolescents, middle age and old age

Unit II

Fundamentals of clothing construction – its importance; terms used in clothing construction.

Equipments – Measuring, Marking, Cutting, Stitching Sewing machine – types, parts, care, handling and problems

Unit III

Principles and elements of art in clothing design

Factors affecting selection of fabric – age, sex, occupation, figure, garment style, fashion

Unit IV

Body measurements and proportion, figure types

Preparation of fabric for garment cutting

Layout types and cutting of the fabric

Unit V

Hand knitting – abbreviations, types and selection of needles and yarn, patterns

Machine knitting – Simple hand knitting machine, its parts and operations

References :

Bendell, P. & Reader's Digest (1995). *Complete guide to sewing*. Montreal. Canada: Penguin printing trade Ltd.

Doongaji, (2002). *Basic processes of clothing construction*. Delhi: Raaj Prakashan.

Mc-Call's (1963). *Sewing Book*. New York: Random House, Inc.

Smith, A. (1981). *Sew simple : A step by step guide to dress making*. Hutchinson, MA: English Sewing Ltd. .

Textile care and Clothing Construction Lab

L T P C

0 0 8 4

Max. Marks : 60

(CA : 20 + ESA : 40)

1. Washing of garments – cotton, silk and wool.
Starching and Ironing
Removal of stains.
2. Construction process in garment making, simple stitches, seams and seam finishes, darts, pleats, tucks, gathers, finishing of raw edges – hemming, piping, facing etc., placket opening, fastners.
3. Embroidery stitches: Samples of different stitches: using at least two types of stitches on any article.
4. Drafting and stitching of the following garments:
Jhabla, Jangia, Romper or Frock for Children, saree blouse or Punjabi kurta, salwar or churidar.
5. To knit anyone of the following:-
Babasuit, Cardigan, Pullover.

Cell and Molecular Biology - I

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes::

On completion of the course, students will be able to:

Gain expertise in the ultra structural information of cell besides the detailed views of the cell interior.

Understand the complex molecular mechanisms occurring in the cell.

Describe types, structural organization and packaging of chromosomes.

Unit 1

General introduction to the science of biotechnology, cell biology, molecular biology and their scope.

Structural and functional organization of prokaryotic and eukaryotic cell, difference between prokaryotic and eukaryotic cell.

Molecular structure of cell wall and plasma membrane of eukaryotic cell.

Ultrastructural organization of cilia, flagella and basal bodies.

Basic idea of different types of cell junctions.

Unit 2

Transport across cell membrane: Passive transport (simple & facilitated diffusion) and active transport (primary & secondary).

Role of extra cellular signals in cellular metabolism.

Basic concept of receptors (GPCR, receptor tyrosine kinase and intracellular receptors) that mediate the response to extra cellular signals.

Basic concept of signal transduction (adenylate cyclase pathway and inositol lipid pathway).

Cell division, cell cycle & its regulation.

Unit 3

A study of ultrastructural organization and functions of eukaryotic cell organelles:

Mitochondria.

Chloroplast.

Endoplasmic reticulum.

Golgi complex.

Lysosomes.

Peroxisomes.

Unit 4

Ultrastructural organization of nucleus and nucleolus.

Structural organization of chromosomes including lampbrush and polytene chromosomes. DNA packaging into chromosomes.

Types of chromosomes based on number and position of centromere. Karyotype.

Molecular structure and types of DNA, denaturation and renaturation, T_m value.

Molecular structure and types of RNA.

DNA replication in prokaryotes and eukaryotes.

Unit 5

Mechanism of transcription in prokaryotes.

Mechanism of transcription in eukaryotes, RNA processing.

Genetic code.

Mechanism of translation in prokaryotes and eukaryotes.

Differences between translation of prokaryotes and eukaryotes.

Suggested Books:

De Robertis, E.D.P., De Robertis, E.M.F. (1987). *Cell and Molecular Biology* (8th ed.). USA: Lea & Febiger.

Gupta, P.K. (2005). *Cell and Molecular Biology*. Meerut: Rastogi Publications.

Hardin, J., Bertoni, G.P. (2016). *Becker's World of the Cell* (9th ed.). USA: Pearson education.

Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino, M.A., Killian, D. (2018). *Concepts of Genetics* (12th ed.). USA: Pearson.

Krebs, J.E., Goldstein, E.S., Kilpatrick, S.T. (2012). *Lewin's Genes XI* (11th ed.). USA: Jones and Bartlett Publishers.

Lodish, H., Berk, A. Kaiser, C.A., Krieger, M. Scott, M.P. (2007). *Molecular Cell Biology* (6th ed.). USA: W H Freeman.

Malacinski, G.M. (2015). *Freifelders Essentials of Molecular Biology* (4th ed.). USA: Jones & Bartlett.

Paul, A. (2011). *Textbook of Cell & Molecular Biology*. Kolkata: Books & Allied Ltd.

Powar, C.B. (2014). *Essentials of Cytology*. Mumbai: Himalaya Publishing House.

Rastogi, V.B. (2010). *Fundamental of Molecular Biology*. New Delhi: ANE Books.

Rastogi, V.B. (2016). *Introductory Cytology – Knrrn*. Meerut: Kedar Nath Ram Nath Publishers.

Singh, B.D. (2015). *Biotechnology*. New Delhi: Kalyani Publishers.

Tamarin, R.H. (2004). *Principles of Genetics* (7th ed.). USA: McGraw-Hill Higher Education.

Verma, P.S., Agarwal, V.K. (2004). *Cell Biology, Genetics, Molecular Biology, Evolution & Ecology*. New Delhi: S. Chand Publisher.

Weaver, R.F. (2011). *Molecular Biology* (5th ed.). USA: McGraw-Hill Education.

Suggested e-Resources:

Cell organelles

<https://www.khanacademy.org/test-prep/mcat/cells/eukaryotic-cells/a/organelles-article>

<https://www.ncbi.nlm.nih.gov/books/NBK21743/>

DNA packaging

<https://www.nature.com/scitable/topicpage/dna-packaging-nucleosomes-and-chromatin-310>

Replication, transcription, translation

<https://www.atdbio.com/content/14/Transcription-Translation-and-Replication>

Signal transduction pathway

<https://www.ncbi.nlm.nih.gov/books/NBK9870/>

Cell biology

<https://nptel.ac.in/courses/102103012/6>

Cell biology & organelles

<https://www.nicholls.edu/biol-ds/biol155/Lectures/Cell%20Biology.pdf>

Molecular cell biology

<https://nptel.ac.in/courses/102106025/>

<https://nptel.ac.in/courses/122103039/22>

Cell and Molecular Biology – I Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes::

On completion of the course, students will be able to:

Understand the basics of cell structure and transport mechanism.

Gain knowledge about isolation and estimation of nucleic acid from cell.

Perform analysis of chromosomes and types of cell division.

Organization and working of optical microscope: Dissecting and compound microscopes.

To examine the phenomenon of cell permeability using hypotonic, isotonic and hypertonic solutions.

Study of salivary gland chromosomes.

Preparation of various stages of mitosis and meiosis.

Cell counting (RBC) using hemocytometer.

Calibration of microscope using stage and ocular micrometer with the help of camera lucida.

Determination of DNA content by DPA method.

To determine the λ_{max} for given DNA sample.

Double staining of *Calotropis* sp. stem, leaf material.

To observe cyclosis through temporary mount of a plant cell.

Preparation and precipitation of casein from buffalo milk.

Suggested Books:

Ghose, K., & Manna, B. (2016). *Practical Zoology* (4th ed.). Kolkata: New Central Book Agency.

Lal, S.S. (2016). *A Textbook of Practical Zoology* Vol-III (2nd ed.). Meerut: Rastogi Publication.

Biochemistry, Biophysics and Enzymology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

To demonstrate an understanding of fundamental biochemical principles, such as the structure/function of biomolecules, metabolic pathways, and the regulation of biological/biochemical processes.

Gain knowledge of basic energy metabolism of cells and identify some of common reaction mechanisms in biochemical processes.

Describe structure, functions, kinetics, regulation and the mechanisms of action of enzymes.

Explain chemical messenger molecules of the nervous system including neurotransmitters and synaptic neurotransmission.

Unit 1

Structure and colligative properties of water.

pH, pK, acids, bases, buffers. Ionic product of water, Henderson-Hasselbalch equation.

Carbohydrates-Classification, structure, properties and functions.

Amino acids and proteins-Classification, structure, properties and functions.

Lipids-Classification, structure, properties and functions.

Unit 2

Bioenergetics-Energy and its forms, principles of thermodynamics.

Energy rich biomolecules-(ATP, NADP and other phosphorylated compounds).

Coordinated control of metabolism: Various techniques used to study metabolism. Some key metabolic pathways: Glycolysis, citric acid cycle and pentose phosphate pathway.

Metabolism of tryptophan, palmitic acid, purine and pyrimidines.

Unit 3

Classification, structure and functions of coenzymes.

Vitamins: Classification, structure and functions.

Classification, properties and metabolic significance of secondary metabolites (terpenoids, alkaloids, phenols).

Three dimensional structure of proteins: Peptide bonds, disulphide cross links, α -helix, β -sheet, helix-coil transitions. Ramachandran plots.

Unit 4

Nucleic acids-Various confirmations of nucleotides, glycosidic bond rotation. Base stacking.

Electrical properties of biological compartments, electrochemical gradients, membrane potential.

Mechanism of ATP synthesis: Oxidative phosphorylation, chemiosmotic hypothesis and photophosphorylation.

Nerve transmission: Resting membrane potential, propagation of nerve impulse and an idea about neurotransmitters.

Structure of striated muscles, muscle proteins and biophysical events of muscle contraction.

Unit 5

Classification, nomenclature and general properties of enzymes.

Introduction to mechanism of enzyme action (lock and key hypothesis, induced fit hypothesis).

Enzyme inhibition: competitive, non- competitive and uncompetitive.

Isolation and purification of enzymes.

Kinetics of enzyme catalyzed reaction (Michaelis-Menten law), double reciprocal plot.

Suggested Books:

- Berg, J.M., Stryer, L. Tymoczko, J.L. & Gatto, G.J. (2015). *Biochemistry* (8th ed.). New York, USA: WH Freeman.
- Cantor, C.R., & Schimmel, P.R. (1980). *Biophysical Chemistry, Part 2: Techniques for the Study of Biological Structure and Function* (1st ed.). New York, USA: W. H. Freeman and Company.
- Cantor, C.R., & Schimmel, P.R. (1980). *Biophysical Chemistry: Part 1: The Conformation of Biological Macromolecules*. New York, USA: W. H. Freeman and Company.
- Cantor, C.R., & Schimmel, P.R. (1980). *Biophysical Chemistry: Part 3: The Behaviour of Biological Macromolecules*. New York, USA: W. H. Freeman and Company.
- Conn, E.E., Stumpf, P.K., & Bruening, G. (2006). *Outlines of Biochemistry* (5th ed.). New Jersey: Wiley-Blackwell.
- Copeland, R.A. (2008). *Enzymes: A Practical Introduction to Structure, Mechanism & Data Analysis* (2nd ed.). India: Wiley-VCH.
- Daune, M., Duffin, W.J., & Blow, D. (1999). *Molecular Biophysics: Structures in Motion*. UK: UK: Oxford University Press.
- Gupta, S.N. (2015). *Biochemistry* (2nd ed.). Meerut: Rastogi Publication.
- Jain, J.L., Jain, S., & Jain, N. (2016). *Fundamentals of Biochemistry* (7th ed.). New Delhi: S Chand.
- Mathews, C.K., Van Holde, K.E., Appling, D.R., & Anthony-Cahill, S.J. (2012). *Biochemistry* (4th ed.). London, UK: Pearson Education.
- Narayanan, P. (2007). *Essentials of Biophysics* (2nd ed.). New Delhi: New Age International.
- Nelson, D.L., & Cox, M.M. (2017). *Lehninger Principles of Biochemistry* (7th ed.). USA: W H Freeman & Co.
- Palmer, T. (2001). *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry* (V Ed.). Cambridge: Horwood Publishing Ltd.
- Rajeswari, M.R. (2013). *An Introduction to Biophysics* (1st ed.). Meerut: Rastogi Publication.
- Rodwell, V., Bender, D., Kennelly, P., & Weil, P.A. (2015). *Harpers Illustrated Biochemistry* (30th ed.). New York, USA: McGraw-Hill Education / Medical.
- Satyanarayana, U., & Chakrapani, U. (2017). *Essentials of Biochemistry* (end ed.). Kolkata: Booka & Allied Ltd.
- Voet, D., & Voet, J.G. (2010). *Biochemistry* (4th ed.). New York, USA: John Wiley & Sons Inc.
- Zubay, G., Parson, W.W., & Vance, D.E. (1995). *Principles of Biochemistry*. USA: Brown (William C.) Co.

Suggested e-Resources:**Enzymology**

<https://nptel.ac.in/courses/102102033/14>

Biomolecules

http://www.biologie.ens.fr/~mthomas/L3/intro_biologie/2-sucres-lipides-acides-nucleiques.pdf

ETC

<https://www.khanacademy.org/science/biology/cellular-respiration-and-fermentation/oxidative-phosphorylation/a/oxidative-phosphorylation-etc>

<http://courses.chem.indiana.edu/c483/documents/lecture23.pdf>

Biochemistry

<https://nptel.ac.in/courses/102105034/3>

Muscle structure & contraction

<https://opentextbc.ca/biology/chapter/19-4-muscle-contraction-and-locomotion/>

Biochemistry, Biophysics and Enzymology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

Apply the scientific method to the biochemical processes of experimentation and hypothesis testing.

Identify and distinguish the carbohydrates, proteins and lipids based on specific biochemical tests.

Understand the molecular basis of various pathological conditions from the perspective of biochemical reactions.

Gain an understanding of the preparation of crude protein lysate, enzymatic assay, effect of time and enzyme concentration on its activity.

To find out the $\lambda_{\max}$ of protein (BSA).

Qualitative analysis of carbohydrates (reducing and non Reducing): Molisch's test, Benedict's test, Fehling's test, Tollen's phloroglucinol, Barfoed's test, Seliwanoff's test, acidic hydrolysis test for sucrose.

Qualitative test for proteins: Biuret's test, Ninhydrin test, Xanthoproteic test, Million's test, Sakaguchi test, Fohl's test.

Qualitative analysis of lipids: Solubility test, Grease spot test, Emulsification test, Saponification test, Unsaturation test, Acrolein test, Salkowski test, Lieberman-Burchard's test.

Determination of iodine number.

Determination of the acid value of lipid.

Determination of saponification value of fats and oil.

Titration curve of glycine (determination of isoelectric point).

Preparation of enzyme extract from horse gram seeds and determination of urease activity.

To check time linearity and protein linearity of urease catalyzed reaction.

Determination of salivary amylase activity.

Stability of salivary amylase with respect to temperature and pH.

Suggested Books:

Deb, A.C. (2013). *Comprehensible Viva & Practical Biochemistry* (2nd ed.). Kolkata: New Central Book Agency.

Kumar, A., Grg, S., & Garg, N. (2017). *Biochemical Tests: Principles & Protocols*. New Delhi: Viva Books.

Rao, B.S., & Deshpande, V. (2012). *Experimental Biochemistry*. New Delhi: I.K. International Publisher.

Sadasivam, S., & Manickam, A. (1996). *Biochemical Methods* (2nd ed.). New Delhi: New Age International Publishers.

Saxena, J., Baunthiyal., & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.

Sharma, S. (2007). *Experiments and Techniques in Biochemistry* (1st ed.). New Delhi: Galgotia Publication.

Genetics, Microbiology and Immunology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

Learn fundamental molecular principles of genetics and relationship between phenotype and genotype in human genetic traits.

Understand the characteristic features and ultrastructure of bacteria, fungi, yeast and viruses.

Gain theoretical knowledge of techniques in microbiology.

Understand about the immune system and various related mechanisms of cells and molecules involved in fighting pathogens.

Unit 1

An overview of Mendel's law of inheritance.

Gene-gene interaction, multiple alleles.

Linkage and crossing over.

Sex determination, sex linked inheritance.

Cytoplasmic inheritance.

Human genetics: Pedigree analysis.

Unit 2

Chromosomal aberrations: Structural and numerical.

Mutation: Spontaneous and induced, chemical and physical mutagens, induced mutations in plants, animals and microbes for economic benefit of human.

Regulation of gene expression in prokaryotes: Lac and Trp operons.

Population genetics: Hardy Weinberg law.

Unit 3

Characteristic features and ultrastructure of bacteria.

General account of different groups: Cyanobacteria, fungi, yeast, viruses, *Mycoplasma* and actinomycetes.

General characteristics of bacteriophage (T₄, λ and phi x 174).

Industrial applications of microorganisms in food and medicines.

Unit 4

Bacterial genetics: Brief idea of plasmids, transposable elements, transformation, transduction, conjugation.

Techniques in microbiology: Media preparation, sterilization methods, isolation and pure culture techniques, staining techniques (Gram's, negative and endospore staining), preservation and maintenance of culture.

An introduction to science of immunology.

Innate and acquired immunity, active and passive immunity.

Unit 5

Phylogeny and ontogeny of immune system: Cells of immune system and preliminary idea about their differentiation, organization and structure of lymphoid organs.

Nature of antigens: Antigenicity and immunogenicity, factors affecting them, epitopes and haptens.

Structure and function of antibodies: Classes and subclasses.

Nature of immune response: Humoral and cell mediated immune response.

General idea of Major Histocompatibility Complex (MHC) and their significance. Monoclonal antibodies and their applications.

Suggested Books:

Gardner, E.J., Simmons, M.J., & Snustad, D.P. (2005). *Principles of Genetics* (8th ed.). New Jersey, USA: John Wiley & Sons Ltd.

Hartl, D.L. & Jones, E.W. (1998). *Genetics: Principles & Analysis* (4th ed.). Canada: Jones and Barlett Publishers.

Hartwell (2010). *Genetics-From Genes to Genomes* (4th ed.) USA: McGraw-Hill Education.

Khan, F. H. (2009). *Elements of Immunology* (1st ed.). Pearson Education India.

Kindt, T.J., Osborne, B.A., & Goldsby, R.A. (2006). *Kuby Immunology* (6th ed.). New York, USA: W. H. Freeman & Company.

Klug, W.S., Cummings, M.R., Spencer, C.A. & Palladino, M.A. (2015). *Essential of Genetics* (9th ed.). Noida: Pearson Education India.

Madigan, M. T., Martinko, J. M., Dunlap, P. V., & Clark, D. P. (2005). *Brock Biology of Microorganisms* (12th ed.). San Fransisco: Benjamin Cummings.

Maloy, S.R., Cronan, J.E., & Friefelder, D. (1994). *Microbial Genetics* (2nd ed.). USA: Jones and Bartlett.

Owen, J., Punt, J., Stranford, S., & Jones, P. (2018). *Kuby Immunology* (7th ed.). USA: W. H. Freeman and Company.

Pelczar, M.J., Chan, E.C.S., & Krieg, N.R. (2007). *Microbiology* (5th ed.). New York, U.S.: Tata McGraw-Hill Inc.

Rastogi, V.B. (2018). *Genetics* (4th ed.). Medtech.

Shetty, N. (2005). *Immunology: Introductory Textbook*. New Delhi: New Age International Publishers.

Singh, B.D. (2014). *Fundamentals of Genetics* (332nd ed.). New Delhi: Kalyani Publishers.

Tamarin, R.H. (2004). *Principles of Genetics* (7th ed.). USA: McGraw-Hill Higher Education.

Tizard, I.R. (1995). *Immunology: Introduction* (4th ed.). Philadelphia: Saunders College Publishing.

Tortora, G.J., Funke, B.R., & Case, C.L. (2016) *Microbiology: An Introduction* (12th ed.). London, UK: Pearson.

Verma, P.S. & Agarwal, V.K. (2010). *Genetics* (9th ed.). New Delhi: S. Chand and company.

Weaver, R.F. (2011). *Molecular Biology* (5th ed.). New York, USA: McGraw-Hill Education.

Willey, J.M., Sherwood, L., & Woolverton, C.J. (2007). *Prescott, Harley and Klein's Microbiology*, (7th ed.). USA: Mc Graw Hill Higher Education.

Suggested e-Resources:

Immunology

<https://nptel.ac.in/courses/102103038/3>

Immunity

<https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-the-immune-system/a/hs-the-immune-system-review>

Microbiology

<https://nptel.ac.in/courses/102103015/>

Structure of bacteria & viruses

<https://instruct.uwo.ca/biology/090b/1290b%201-7.pdf>

http://ocw.jhsph.edu/courses/EpiInfectiousDisease/PDFs/EID_lec2_Dick.pdf

Mendelian Genetics & Deviation

<https://www.khanacademy.org/science/biology/classical-genetics/genetics/a/multiple-alleles-incomplete-dominance-and-codominance>

variations-on-mendelian-

<http://download.nos.org/srsec314newE/PDFBIO.EL21.pdf>

Genetics, Microbiology and Immunology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

Understand the clinical relevance of genetic concepts, inheritance and expression of human blood groups.

Acquire and demonstrate competency in routine microbiological laboratory skills applicable to microbiological research and clinical methods.

Explain basic immunological laboratory techniques and use immunoassays to analyze unknown samples successfully.

To prepare basic liquid media, solid media, agar slants and agar deep tube for the routine cultivation of bacteria and fungi.

Isolation of pure culture by streak plate method.

Isolation of microorganisms from soil by serial dilution and determination of CFU.

Isolation of microorganisms from air by direct plate exposure method.

Preservation of microbial cultures by making glycerol stock and revival of culture.

To perform Gram's staining, endospore staining and negative staining of bacteria.

Assessment of bacterial motility by hanging drop method.

Antibiotic sensitivity test using *Bacillus subtilis*.

Lactic acid estimation.

Study of chiasma formation and calculation of chiasma frequency in meiosis.

Problems of genetics:

Mendel's law and its deviation.

Human genetics: Widow's peak, earlobe, index finger, straight and curly hair, rolling of tongue.

Testing of blood groups including Rh factors to observe the phenomenon of agglutination.

To study the various lymphoid glands (spleen and thymus).

To study different type of cells participating in non-specific immunity.

Immuno precipitation by double diffusion technique.

Suggested Books:

Aneja, K.R. (1996). *Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation* (2nd ed.). New Delhi: Wishwa Prakashan.

Ghose, K., & Manna, B. (2016). *Practical Zoology* (4th ed.). Kolkata: New Central Book Agency.

Kumar, V. (2011). *Laboratory Manual of Microbiology*. New Delhi: Scientific Publishers.

Mahajan, R., Sharma, J., & Mahajan, R.K. (2010). *Practical Manual of Biotechnology* (1st ed.). New Delhi: Vayu Education of India.

Genetic Engineering, rDNA Technology and Cell & Tissue Culture Technology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course, students will be able to:

Understand the various tools of recombinant DNA technology and their applications in different fields.

Describe the principles, process of gene cloning and generation of recombinant libraries.

Learn theoretical aspects of different cell culture techniques and their uses in therapeutic applications.

Gain basic knowledge of patents and biosafety guidelines.

Unit 1

Introduction and historical background of genetic engineering.

Isolation and purification of DNA from bacterial, plant and animal cells.

Vectors: plasmids, cosmids and phages.

Restriction enzymes, ligases, S1 nucleases, DNA polymerases, reverse transcriptase.

Unit 2

DNA primers, cDNA synthesis and cloning: mRNA enrichment, reverse transcription.

cDNA library.

Linkers, adaptors, blunt end ligation, homopolymer tailing.

Genomic library construction and screening.

Unit 3

Molecular markers- RAPD, RFLP, AFLP, SNP.

Techniques used in identification of recombinant DNA clones.

Cloning and expression of foreign genes in prokaryotes (*E. coli*).

Cloning and expression of foreign genes in eukaryotes (e.g. yeast).

Brief idea about gene cloning in plant and mammalian cells.

Transposon mediated gene tagging.

Unit 4

Introduction, historical background and terminology used in cell culture, tissue culture lab: basic requirements, sterilization techniques.

Media: Types, preparation and composition.

Primary and established (including discontinuous and continuous) cell lines.

Cytotoxicity and transformation/transfection of cells.

Animal cell products.

Patents and biosafety guidelines.

Unit 5

Clonal propagation in plants.

Somatic embryogenesis, protoplast isolation and culture, viability tests.

Production of haploids and their applications.

Zygotic embryo culture.

Somaclonal variations.

Suggested Books:

Bhojwani, S.S., & Razdan, M.K. (1996). *Plant Tissue Culture: Theory and Practice*. Netherlands: Elsevier Science.

Boylan, M., & Brown, K.E. *Genetic Engineering: Science And Ethics On The New Frontier*.

Brown, T.A. (2010). *Gene Cloning and DNA Analysis: An Introduction* (6th ed.). USA: Wiley-Blackwell.

Chawla, H.S. (2009). *Introduction to Plant Biotechnology* (3rd ed.). USA: CRC Press.

Glick, B.R., & Patten, C.L. (2017). *Molecular Biotechnology: Principles and Applications of Recombinant DNA* (5th ed.). USA: American Society for Microbiology Press.

Gupta, P.K. (2005). *Biotechnology and Genomics*. Meerut: Rastogi Publication.

Gupta, P.K. (2017). *Animal Biotechnology*. Meerut: Rastogi Publication.

Howe, C. (2007). *Gene Cloning & Manipulation* (2nd ed.). New Delhi: Cambridge University Press.

Primrose, S.B., & Twyman, R. (2006). *Principles of Gene Manipulation and Genomics* (7th ed.) UK: Oxford University Press.

Razdan, M.K. (2003). *Introduction to Plant Tissue Culture* (2nd ed.). USA: Science Pub Inc.

Shrivastava, S. (2012). *Molecular Techniques in Biochemistry & Biotechnology*. Kolkata: New Central Book Agency.

Watson, J.D., Tania, A.B., & Stephen, P.B. (2017). *Molecular Biology of the Gene* (7th ed.). USA: Pearson Education.

Winnacker, E.L. (1987). *From Genes to Clones: Introduction to Gene Technology*. Germany: Wiley VCH.

Suggested e-Resources:

Cloning

<https://nptel.ac.in/courses/102103045/>

Molecular markers

<http://www.biologydiscussion.com/plants/molecular-marker-study-notes/10883>

Plant biotechnology

<https://nptel.ac.in/courses/102103016/12>

cDNA library

<http://www.biotechnologynotes.com/dna-libraries/notes-on-cdna-library-dna-libraries/517>

Genetic engineering

<https://nptel.ac.in/courses/102103013/>

Enzymes of genetic engineering

<http://cec.nic.in/wpresources/module/Zoology/Paper-12/49/content/downloads/file1.pdf>

Animal cell culture

<https://nptel.ac.in/courses/102104059/>

Genetic Engineering, rDNA Technology and Cell & Tissue Culture Technology Lab

Max. Marks : 100

(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

Learn all technicalities of setting up a plant tissue culture laboratory.

Learn the techniques of isolation and estimation of nucleic acids.

Gain practical knowledge about chromatographic purification of proteins.

Tissue culture, media preparation-MS/White media, slant preparation.

Aseptic techniques.

Excision of embryo/ovule/anther from the provided material and its inoculation.

Encapsulation of zygotic embryo.

Demonstration of column chromatography.

Extraction of proteins by phenol extraction.

Estimation of proteins by Popov's method.

To determine the melting curve and base composition of DNA.

Estimation of RNA content by orcinol method.

Isolation of plasmid from bacterial cell and determination of purity.

Cell immobilization (yeast).

Setting of a biotechnology laboratory, viz., tissue culture, fermentation, molecular biology, rDNA technology, biochemistry etc. (at least one).

Suggested Books:

Saxena, J., Baunthiyal., & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.

Sharma, R.K., & Sangha, S.P.S. (2009). *Basic Techniques in Biochemistry & Molecular Biology*. New Delhi: I.K. International Publisher.

Swamy, P.M. (2008). *Laboratory Manual on Biotechnology* (1st ed.). Meerut: Rastogi Publication.

Advances in Biotechnology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
6	0	0	6

Learning Outcomes:

On completion of the course students will be able to:

Understand the different techniques of DNA sequencing, gene synthesis, gene silencing, PCR and blotting.

Describe the industrial production of biopesticides, biopolymer and biopolysaccharides using fermentation techniques.

Gain theoretical knowledge of cryopreservation, artificial insemination, IVF-ET technique, transgenic plants and transgenic animals.

Unit 1

Techniques in molecular biology: Gene sequencing, solid phase automated synthesis of DNA.

PCR and its variants: nested, inverse, real time, touch down and hot start.

Northern, Southern and Western blotting, hybridization.

Molecular probes and their applications.

An overview of drug designing.

Gene therapy: An overview of its types and vectors used.

Unit 2

Fermentation processes, batch, fed batch and continuous.

Bioreactor: Components, types of bioreactor-CSTR, loop reactor, fluidized bed reactor.

Biopesticides-(*Bt* genes).

Biopolymers (β -hydroxy butyrate).

Biopolysaccharide (xanthum gum).

Unit 3

Human genome project: History and salient features.

Arabidopsis as a model plant for genetic engineering.

Stem cells: Current status.

Gene silencing: Antisense RNA technology and RNAi.

Cassette vectors.

Edible vaccines.

DNA chips.

Unit 4

Chloroplast engineering.

A brief introduction of proteomics and metabolomics.

Terminator seed technology.

Seed storage proteins.

Therapeutic proteins.

Biosensor.

Unit 5

Cryopreservation, transport of germplasm (semen, ovum, embryo).

Artificial insemination, *in vitro* fertilization and embryo transfer.

Transgenic plants: Resistance to herbicides, fungal and viral pathogens, environmental stress, male sterility, regulation of transgene expression, plants suitable for food processing, molecular farming.

Biological nitrogen fixation and its genetic engineering.

Transgenic animals.

Suggested Books:

Balasubramanian, D., Bryce, C.F.A., Dharmalingam, K., Green, J., & Jayaraman, K. (2004). *Concepts in Biotechnology*. Hyderabad: University Press.

Borem, A., Santos, F.R., & Bowen, D.E. (2003). *Understanding Biotechnology* (1st ed.). USA: Prentice Hall.

Brown, T.A. (2010). *Gene Cloning and DNA Analysis: An Introduction* (VI Ed.). USA: Wiley-Blackwell.

Crueger, W., & Crueger, A. (2017). *Biotechnology: A Textbook of Industrial Microbiology* (3rd ed.). New York: Medtech.

Gupta, P.K. (2005). *Biotechnology and Genomics*. Meerut: Rastogi Publication.

Kumar, H.D. (1998). *Modern Concept of Biotechnology*. New Delhi: Vikas Publishing House.

Owen, J., Punt, J., Stranford, S., & Jones, P. (2018). *Kuby Immunology* (8th ed.). USA: W. H. Freeman and Company.

Shrivastava, S. (2012). *Molecular Techniques in Biochemistry & Biotechnology*. Kolkata: New Central Book Agency.

Sudbery, P. (2010). *Human Molecular Genetics* (3rd ed.). USA: Pearson Education.

Suggested e-Resources:

Gene therapy

<https://nptel.ac.in/courses/102103041/>

Bioreactors

<https://nptel.ac.in/courses/102106053/>

PCR, hybridization & blotting technique <http://www.tulane.edu/~wiser/methods/notes.pdf>

IVF-ET

<https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/fertility-center/documents/In-Vito-Fertilization-4-29-15-updated.pdf>

Transgenic plants

<https://popups.uliege.be/1780-4507/index.php?id=11844>

RNAi

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC309050/>

Advances in Biotechnology Lab

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
0	0	4	2

Learning Outcomes:

On completion of the course, students will be able to:

Demonstrate the skills required for basic laboratory procedures and principles of reagent preparation.

Design, conduct experiments, analyze and interpret data for investigating problems in biotechnology and allied fields.

Understand the importance of the practical aspects of different techniques like electrophoresis, fermentation, and spectroscopy etc, currently used in biomedical research.

Isolation and estimation of genomic DNA from *E. coli*.

Agarose gel electrophoresis of DNA.

Seed germination under stress condition.

To find out absorption spectrum of the oxidized and reduced form of a molecular species (NAD and NADH).

To determine the LD₅₀ value of pesticide / weedicide.

Chlorophyll estimation from the given samples.

Extraction and estimation of total phenolic content using standard curve of gallic acid.

Isolation of protoplast and its culture using microchamber technique.

Demonstration of fermenter.

Determination of total hardness of water.

Submission of project report based on any topic related to Biotechnology.

Suggested Books:

Saxena, J., Baunthiyal., & Ravi, I. (2015). *Laboratory Manual of Microbiology, Biochemistry and Molecular Biology*. Jodhpur: Scientific Publishers.

Sharma, R.K., & Sangha, S.P.S. (2009). *Basic Techniques in Biochemistry & Molecular Biology*. New Delhi: I.K. International Publisher.

Swamy, P.M. (2008). *Laboratory Manual on Biotechnology* (1st ed.). Meerut: Rastogi Publication.

Vats, S. (2015). *A laboratory Text book of Biochemistry, Molecular Biology and Microbiology*. Germany: GRIN Verlag.

BASIC CELL, MOLECULAR BIOLOGY & BIOLOGICAL DATABASES

Section A

Cell Biology: Prokaryotic & Eukaryotic Cells, Introduction of cell organelles (Mitochondria, Chloroplast, ER, Golgi, Lysosomes & Peroxisomes, Nucleus & Nucleolus) Cellular Membrane: Structure and function of membranes, Cell-Cell interactions & signal transduction: signaling by hormones and neurotransmitters, receptors, G-proteins, protein kinases & second messengers, Concepts of Signal hypothesis and protein targeting.

Section B

Prokaryotic and Eukaryotic genomes, structure, organization, function, Evolution of Genomes. Prokaryotic gene expression, Operons – Positive & Negative regulation. Mechanism of Gene Expression in Eukaryotes, Promoter & regulatory sequences, transcription factors. Processing of RNA, Basic mechanism involved in translation & its regulation

Section C

Biological Databases: Primary Secondary, Composite Databases & their file format. Nucleic Acids (GenBank, DDBJ, EMBL), Proteins (SWISS-PROT, PIR, PDB), Specialized (KEGG, Transfac, ReBase), NCBI, Entry & Retrieval of data from public databases.

Suggested Readings:

1. Genomes-T.A.Brown, John Wiley & Sons, Publishers.
2. Gene- Benjamin Lewin.
3. Cell and Molecular Biology- P.K.Gupta.
4. Bioinformatics –Sequence and Genome analysis-David W. mount.
5. Introduction to Bioinformatics-Terasa K. Attwood.
6. Bioinformatics –A practical guide to the analysis of genes and proteins-Baxevanis and Ouellette.
7. Molecular Biology of The Cell- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter.

Structural Biology

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

After successful completion of the course, students should be able to:
understand the biophysical processes working at molecular level.
develop analytical understanding of macromolecular folding and interactions.

Section A

Introduction to proteins:– Amino acids classification and their physicochemical properties.
Hierarchical organization of protein structures – primary, secondary, tertiary and quaternary structure of proteins.
Ramachandran Map. Motifs and domains.
Packing of protein structure Structures of oligomeric proteins and study of interaction interfaces
Base pairing in nucleic acids – Watson-Crick and Hoogsteen; geometrical and structural properties of A, B, & Z DNA.
Secondary and Tertiary structures of RNA.

Section B

Principles and practices in Centrifugation, Chromatography and Electrophoresis for isolation & purification of biomacromolecules.
Circular Dichroism Spectroscopy.
X-Ray crystallography: Introduction, Bragg's law; Crystal system, Bravais Lattices, Space group, symmetry. Protein crystallization, Phase problem and its solutions. Calculation and analysis of electron density map.
Nuclear magnetic resonance: Introduction, chemical shift, NOE and coupling constant, spin – spin coupling and relaxation; 2D – NMR spectroscopy (COSY, NOESY).

Section C

Three dimensional structure comparison and classification of proteins (VAST, DALI).
Assignment of protein secondary structural elements; DSSP and STRIDE methods.
Various types of weak interactions and their roles in stabilizing the biomolecular structures and their interactions. Macromolecular interactions.
Protein-Protein, Protein – DNA and Protein – Ligand interactions

Suggested Books:

Nelson, D.L. & Cox, M.M. (2017) *Lehninger's Principles of Biochemistry* (7th Ed.). W.H. Freeman.
Schulz, G.E.& Schirmer, R.H. (1979). *Principles of Protein Structure*. Springer.
Cantor, C.R. & Schimmel, P.R. (1980). *Biophysical Chemistry* (1st Ed.). W. H. Freeman.
Wilson, K. & Walker, J. (2010). *Practical Biochemistry* (7th Ed.). Cambridge University Press
Schwede, T. & Peitsch, M. (2008). *Computational Structural Biology: methods and applications*. World Scientific Press.

Suggested e-Resources:

X-ray crystallography:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1186895/>

VAST: <https://structure.ncbi.nlm.nih.gov/Structure/VAST/vast.shtml>

DALI: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2896194/>

Computer Fundamentals and Perl Programming

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

1. Use of various arithmetic and logical operators.
2. Programming based on string manipulation (concatenation, splitting etc.)
3. Regular expression and its applications. Use of s/// and tr/// operators.
4. Pattern matching to locate and count motifs in a string.
5. Constructing arrays. addition and removal of elements from array, exploring array.
6. Use hashes in conversion of three letter code to one letter code and proteing translation.
7. Perl subroutines.
8. Generating random DNA and its comparison with real DNA.
9. File handling, reading data from a file writing data to a file and editing a file.
10. Directory handling, make a directory, change present working directory, reading files from a directory.
11. Introduction to Perl modules, construction of simple module.

Section A

Block diagram of computer, Its components and functions, Representation of data, Number System Conversion, Introductory Boolean algebra, Concept of program, Programming languages, Introduction to Operating Systems; Linux OS, Compilers, Interpreters, Algorithms and flowcharts.

Section B

Overview of Perl language: Perl language and syntax, strings, arrays, hashes, pattern matching, file handling.

Section C

Perl language: Directories, subroutines, references, packages, libraries, modules, classes, objects, introduction to Bioperl.

Suggested Readings:

1. Sinha P.K Computer Fundamentals, BPB publication, New Delhi
2. Tom Christian Sen, Nathan Torkington, Perl Cook book, 2nd Edition, O'REILLY
3. James D. Tisdall, Beginning Perl for Bioinformatics, 2001, O'REILLY
4. James D. Tisdall, Mastering Perl for Bioinformatics, 2003, O'REILLY
5. Larry Wall, John Orwant, Tom Christian Sen, Programming Perl, O'REILLY

Introductory Mathematics

Max. Marks : 100
(CA: 40 + ESA: 60)

L	T	P	C
4	0	0	4

Learning Outcome:

After successful completion of the course, students should be able to:

understand the principles of algebra.

Solve the complex biological problems using calculus methods.

Understand the geometrical properties.

Develop a basic understanding of statistics and statistical distributions.

Section A

Set Theory; Introduction to sets and elements, Universal, and empty sets, subsets. Venn diagrams, Set operations and algebra of sets, ordered sets, cartesian product of sets, Classes of sets, power sets and partition. Relations; product sets, equivalence relations, partial ordering relations.

Logarithms- Definition and laws regarding product, quotient, power and change of base.

Introduction to complex numbers; algebra of complex number, modulus and conjugate of a complex number.

Introduction to Matrix: types, Order and transpose of matrix. Operations on matrix; addition, subtraction, multiplication. Associative and distributive laws of matrix, Inverse of Matrix and matrix division; determinant of a matrix, Eigen values and Eigenvectors of matrix.

Section B

Differential Calculus- Derivative of a function, Concept of limit, Continuity, Differentiation, Maxima and Minima of a function.

Introduction to Partial Differentiation.

Integral Calculus: The Idea of the Integral, The Definite Integrals, Indefinite Integrals, Area under curve.

Trigonometric ratios, De Moivre's theorem.

The general equation of a Straight line, slope of a line, intercepts of a line, Angle between two lines, Intersection of two lines, The general equations of a Circle, Parabola, Ellipse, Hyperbola, Cylinder, Cone and Sphere.

Section C

Probability theory and probability distributions; Concepts of random experiment, sample space and events, definition of probability and some elementary results of probability.

Conditional probability and Bayes theorem.

Random variable, probability mass function and probability distribution function, cumulative distribution function, Binomial, Poisson and Normal(Gaussian) distribution.

Measures of central tendency- Mean, Median, Mode. Measures of dispersion- range, mean deviation, variance, standard deviation, skewness and kurtosis. Bivariate data: Correlation and regression analysis.

Suggested Books:

Artin M. (2015) Algebra (2nd Ed.). Pearson Education.

Aitken, M., Broadhurst, B. & Hladky, S. B. (2009). Mathematics for Biological Scientists. Garland Science.

Thomas, G.B. (2013). Thomas Calculus (12th Ed.) Pearson education.

Spiegel, M.R. & Stephens, L. J. (2014). Schaum's Outline Statistics (4th Ed.) McGraw-Hills Education.

Spiegel, M., Schiller, J., Srinivasan, R.A.& Goswami, D. (2017). Schaum's Outline Probability *and Statistic* (3rd Ed.). McGraw-Hills Education.

Statistical Techniques

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Concept of variable, attribute, statistical population and sample Treatment of data-collection of primary and secondary data, representation of data (tabular, diagrammatic and graphical methods) Sample survey verses census survey-procedure, advantages and limitations Curve fitting through principle of least squares fitting of straight line, parabola, exponential and power curves Bi-variate distribution-correlation and regression

Section B

Theory of probability- Random experiment, mutually exclusive and independent events, classical and axiomatic approaches of probability, conditional probability, simple applications of addition and multiplication laws of probability, Bayes Theorem. Probability Distributions-Binomial, Multinomial, Poisson and normal distributions with their properties, applications and fitting

Section C

Testing of hypothesis- Meaning and need, one tail and two tail tests, large and small sample tests. Test of significance of mean, variance, proportion and correlation coefficient, Chi-square test of goodness of fit and independence of attributes. Analysis of variance of one way and two way (one observation per cell) classified data. Design of experiment- layout and analysis of completely randomized design (CRD) and randomized block design (RBD), Basic idea of Cluster analysis and Principle component analysis.

Suggested Readings:

1. Gupta O.P.: Mathematical Statistics; Kedarnath Publication, Meerut
2. Goon A.M., Gupta M.K., Dasgupta B. : Fundamentals of statistics vol-I & II
3. Rohatgi V.K.: An introduction of probability theory and mathematical statistics; Wiley Eastern Publisher Ltd, New Delhi
4. Das M.N., Giri N.C.: Design and analysis of experiments

Computational Biology and Molecular Modeling

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Sequence alignment: Scoring matrices-PAM and BLOSUM- Local and Global alignment concepts, Dynamic programming methodology- Needleman- Wunsch algorithm, Smith-Waterman algorithm, Databases similarity searching: Algorithms of FASTA, BLAST and their variants, Multiple sequence alignment, Progressive alignment.

Section B

Gene finding methods: content and signal methods, Background of transform techniques, Fourier transform and gene prediction. Probabilistic models: Markov chain, Random Walk, Hidden Markov models. Molecular modeling: Quantum mechanical and molecular orbital methods.

Section C

Introduction to semi-empirical, molecular mechanics and ab initio techniques, potential energy surfaces, docking and modeling substrate receptor interactions. Software tools for modeling bimolecular, molecular electrostatic potentials, charge analysis. Protein conformations, folding and mutation through modeling.

Suggested Readings:

1. Molecular Modeling-Principles and applications-Andrew R. Leach.
2. Bioinformatics –Sequence and Genome analysis-David W. Mount.
3. Bioinformatics-from Genomes to drugs- Thomas Lengauer.
4. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids, Richard Durbin, S. Eddy, A. Krogh, G. Mitchison.
5. David Mount (2001) Bioinformatics – Sequence and Genome analysis, CSHL Press.

PROTEOMICS, SEQUENCE ANALYSIS & SYSTEMS BIOLOGY

Section A

Molecular Biology based Sequence Analysis: Alignment, Primer Selection, Phylogeny, Molecular Phylogenetic analysis using NJ, UPGMA methods. Introduction to Functional and Comparative genomics, Genome Comparison & Analysis: Homologues, Orthologues and Paralogues, Horizontal gene transfer.

Section B

Proteomics: Basic concepts of Proteomics and analytical look, 2D-Gel Electrophoresis, Mass Spectroscopy, Peptide Sequencing. Global expression analysis, Serial analysis of gene expression (SAGE), Technique of Micro array, Micro array design, Analysis of Microarray data using, K-Means Clustering, Nearest Neighbor and Hierarchical Clustering. Application of Micro array, Protein Arrays.

Section C

Genome Sequencing, Genome Assembly. Introduction to Systems Biology, Metabolomics: Metabolic pathways (Shikimate Pathway), Drug target identification method, Biological System: Molecular networks, Ecosystems, Elements of Systems modeling. Gene Regulatory Network and the models (logical, continuous, stochastic etc.).

Suggested Readings:

1. Bioinformatics –Sequence and Genome analysis-David W. mount.
2. Structural Bioinformatics-Philip E.Bourne and Helge Weissig.
3. Practical Biochemistry-Wilson and Walker.
4. Bioinformatics-from Genomes to drugs- Thomas lengauer.
5. DNA Microarrays and Gene Expression: From Experiments to Data Analysis and Modeling — by Pierre Baldi.
6. Discovering genomics, proteomics, and bioinformatics by A Malcolm Campbell; Laurie J Heyer.
7. Microarray Bioinformatics by Dov Stekel.

Database Management Systems

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction: - Data base system concepts, Comparison between traditional file system and DBMS, Database Users, Data models, schemas and instances, Data independence, 3-level architecture of DBMS, Overall data base structure. Data modeling using Entity Relationship Model: - ER model, mapping constraints, Concept of super key, candidate key, primary key, Generalization, aggregation, reducing ER diagrams to tables. Relational Data Model: concepts, integrity constraints, relational algebra, SQL queries.

Section B

Data Base design: - Functional Dependency and its types, normal forms: first, second, third and BCNF, multi-valued dependency, fourth normal form, join dependency and fifth normal form. Steps in database design. Transaction processing: Introduction, ACID properties, Concurrency control techniques: Locking techniques, Time stamping, Optimistic approach, Multi-version. Management of deadlocks, Query processing and optimization.

Section C

Recovery, Integrity and security of Databases. Distributed Database systems: Introduction, Fragmentation, Replication, Transparency, Consistency and Concurrency control, Homogeneous Vs Heterogeneous systems. Advanced topic in databases: temporal database, spatial database, data mining, data warehousing and its applications. Case studies using NCBI, SwissProt and PDB.

Suggested Readings:

1. Korth, Silbertz, Sudarshan, "Data base concepts", McGraw-Hill
2. Elmasari, Navathe, "Fundamentals of Database Systems", Addison Wesley
3. Date C.J, " An Introduction to Database systems" Addison Wesley
4. Majumdar & Bhattacharya, " Database Management System", TMH
5. Ramkrishna, Gehkre, " Database Management System", McGraw-Hill
6. Alexion Leon, "Fundamental of Database Management System",
7. Data mining concept and technique by Han

Computer Aided Drug Designing

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction to Pharmacogenomics and Pharmacogenetics, Clinical trials in Pharmacogenomics, Polymorphism of CYP450 enzymes affecting drug response, Role of SNP in Pharmacogenomics, The Multi Drug Resistance proteins: drug carriers affecting drug response.

Section B

Basics of Drug Pharmacokinetics and Pharmacodynamics, Molecular descriptors, QSAR methodologies 3D QSAR. Structure based drug designing, Ligand based drug designing, Different docking methodologies, success stories in docking.

Section C

Pharmacophore modeling, Pharmacophore generation – (Hiphop and HypoGen theories), Combinatorial libraries, High throughput screening, Virtual screening, Lipinski's rule of five and its applications. Chemoinformatics: Introduction, Chemical Databases (ACD, MDDR and WDI), Application of Chemoinformatics in CADD.

Suggested Readings:

1. Bioinformatics-from Genomes to drugs- Thomas Lengauer.
2. Molecular Modeling-Principles and applications-Andrew R. Leach.
3. Fundamentals of Medicinal Chemistry by Gareth Thomas.
4. Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy-David E. Golan.
5. Pharmacogenomics: An Approach to New Drug Development: Chiranjib Chakraborty, Atanu Bhattacharyya

Evolutionary Computing

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Overview of natural evolution, Evolutionary algorithm and its application, Genetic algorithm, Examples of Evolutionary Computing such as Artificial Immune Systems, Computational Embryology, Artificial Life, Ant colony optimization and Swarm intelligence.

Section B

Introduction to Artificial neural network, Neuron model, neural network architectures, Learning Rules (Hebbian, Competitive, Boltzmann) Supervised and unsupervised learning, Types of neural networks: Perceptron, MLP, recurrent network, self-organizing Feature maps, Applications of NN.

Section C

Science of genetics – objectives, terminologies, methods, Mendelian principles of inheritance, sex linked inheritance, Concept of linkage, linkage maps and recombination, Mutations – molecular, gene/point and chromosomal, Phenotype and genotype relationships, gene interactions, Genetics of populations, genetics and evolution, Genetics and diseases, cancer.

Suggested Readings:

1. An Introduction to Genetic Algorithms, Melanie Mitchell
2. Thomas Bäck, Evolutionary Algorithms in Theory and Practice: Evolution
3. Strategies, Evolutionary Programming, Genetic Algorithms, Oxford University Press, 1996.
4. Evolutionary computation in bioinformatics by Gary Fogel, David W. Corne, Gary B. Fogel, David Corne
5. Evolutionary Computation in Bioinformatics by Morgan Kaufmann
6. Neural network by Simon Haykins.

Functional and Comparative Genomics

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction to Functional and Comparative Genomics, Application of molecular markers with references to RAPD, RFLP, AFLP, STS, SSR etc., Protein Profiling, Transgenic Animals & Plants, Knockouts.

Section B

Strategies for generating Expressed Sequence Tags, EST Clustering (TIGR Gene Indices, STACK), ESTs and gene discovery, ESTs and sequence polymorphisms, EST databases (DbEST, UNIGene), The nature of Single Nucleotide Polymorphisms (SNP), distribution of SNPs, Applications of SNP technology.

Section C

Comparative genomics of prokaryotes and eukaryotes, Protein evolution by exon shuffling. General purpose databases for comparative genomics, in silico gene prediction, Phylogenetic Analysis, MUMMER

Suggested Readings:

1. A Primer of Genome Science- Greg Gibson, Spencer V. Muse
2. Bioinformatics and Functional Genomics- Jonathan Pevsner
3. Cell and Molecular biology-P.K.Gupta
4. Bioinformatics –Sequence and Genome analysis-David W. Mount.
5. Principles of genome analysis and genomics- S. B. Primrose and R. M. Twyman.

Mining and Warehousing of Biological Data

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Fundamentals of Data Mining – concept, definitions, why data mining, kind of data for data mining, knowledge discovery in databases (KDD), data mining functionalities, data mining primitives, classification of data mining systems, data mining techniques, major issues in data mining.

Data Preprocessing – Needs for preprocessing the data, data cleaning, data integration and transformation, data reduction, data discretization and concept hierarchy generation.

Data Warehousing – need, definitions, characteristics, data marts, metadata, operational versus analytical databases, data warehouse architecture, multi dimensional data model, schemas for multidimensional databases, introduction to DMQL, implementation of data warehouse, OLAP, OLTP, ROLAP, MOLAP, HOLAP.

Section B

Association Rules Mining – market basket analysis, apriori algorithm, FP-growth method, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules

Classification and Prediction – classification by decision tree induction, classification by back propagation, linear and non-linear regression, classifier accuracy.

Clustering – types of data in clustering, categorization of clustering methods, Major Clustering Methods (K-means, Hierarchical clustering, DBSCAN).

Section C

Mining Complex Types of Data - Spatial databases, multimedia databases, time-series and sequence data, text mining, web mining, trends in data mining, Introduction to various data mining tools (SAS Enterprise Miner 5.1, Oracle Data Mining, SPSS Clementine 8.5).

Biological databases, Application of data mining in DNA/protein sequence analysis, protein structure analysis, gene expression analysis, application of specific examples of designing biological databases, application of mining and warehousing in bioinformatics.

Suggested Readings:

1. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publication, Second edition, 2006.
2. Daryl Morey, Mark Maybury, Bhavani Thuraisingham, Knowledge Management, Classic and Contemporary Works, The MIT Press.
3. Bellover Richard F, Knowledge Management Strategy and Technology, Artech House, Boston.
4. Baxeavanis, A.D. & Ouellettee, B.F.F.: Bioinformatics: a practical guide to the analysis of genes and proteins. (2nd. Ed.) New York. Wiley Interscience, 2001.
5. Mount, D. W.: Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor. CSHL Press, 2001.
6. Marshall D. Abrams, Sushil Jajodia, and Harold J. Podell, eds. Information Security: An Integrated Collection of Essays, IEEE Computer Society Press, 1995.

Molecular Structure Prediction and Visualization

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Protein 3Dstructure determination: Basic principles of NMR, chemical shift, The Nuclear Overhauser Effect (NOE), Correlation Spectroscopy (COSY), Nuclear Overhauser Effect Spectroscopy (NOESY), Protein 3D structure determination using NMR. Structural features of RNA, RNA structure prediction algorithms.

Section B

Protein structure prediction: Steps in Homology modeling, Threading; Contact potential, structural profile and segment matching method, Abinitio method. Protein structure comparison, Purpose of structure comparison and algorithms (dynamic programming, distance matrix), Predicting Protein Function from Structure.

Section C

Applications of the visualization softwares like Rasmol and SWISS PDB Viewer. Application of Hidden Markov Model, Support Vector Machine and Artificial Neural Network in structure prediction. Optimization methods: Montecarlo and Simulated annealing.

Suggested Readings:

1. Biophysical Chemistry-Cantor and Schimmel.
2. Bioinformatics –Sequence and Genome analysis-David W. mount.
3. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids, Richard Durbin, S. Eddy, A. Krogh, G. Mitchison.
4. Structural Bioinformatics-Philip E.Bourne and Helge Weissig.

LTPC
0 0 8 4

Max. Marks : 100
(CA: 40 + ESA: 60)

1. Analysis of a given biological problem using bioinformatics tools.

Transcriptomics and Metabolomics

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Transcriptome and Transcriptomics, The Insights of Transcriptomics (mRNA regulation), Transcriptome Project (Human, Mouse, Cancer, Fungal). Genome Wide Gene Expression Analysis: cDNA-Microarrays - Analysis of Microarray data, Application of Micro array. EST-expressed sequence tags, EST Generation, EST Clustering, ESTs and gene discovery, database and web tools for ESTs project. Serial analysis of gene expression (SAGE), SAGE data and its role in gene discovery, Tissue Specific Transcriptomics and Expression Pattern Analysis.

Section B

Transcriptomics in functional genomics, Transcriptomics and Disorders, Transcriptomics in drug design, Transcriptomics in Human cancer hazard assessment, Transcriptomics and Phylogenetics applications, Impact of transcriptomics on Pharmaceutical Research. Tools for Transcriptomics and Transcriptome Analysis, Bioconductor. Introduction to Systems Biology, Computational Challenge in system Biology. Systems biology in drug discovery and pathway analysis.

Section C

Metabolome and Metabolomics, Metabolic profiling and fingerprinting, Metabolic pathway analysis and metabolic networks, Single Cell Metabolomics, Metabotype Concept. Computational Methods to Interpret and Integrate Metabolomic Data, Metabolomics data processing workflow, Online metabolic databases (Human Metabolome Databases, KEGG, BioCyc) and pipelines. Applications of Metabolomics: Drug-screening, human health etc. Plant metabolomics.

Suggested Readings:

1. Transcriptomics: Expression pattern analysis. by Gomase, Virendra.
2. Metabolomics, by Ute Roessner, ISBN 978-953-51-0046-1, Hard cover, 364 pages, Publisher: InTech.

Biointrepreneurship

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Entrepreneurship: meaning and definition; fundamentals of entrepreneurship; development of entrepreneurship through training, achievement motivation training- theory and concept, Kakinada experiment: developing achievement motivation, experiential exercises, scoring and coding; Entrepreneurship in area of Biotechnology; MSMEs: definition, role in India's Economic development, regulations covering MSMEs, sources of information and non financial support, Incentives and benefits available to MSMEs entrepreneurs; schemes for women entrepreneurs, psychological stress encountered by women in the light of her dual role and managing it.

Section B

Business Opportunity sensing and idea generation, Idea Feasibility testing through market research, Developing Vision and Mission statements, Deciding the offering and identifying target market, Positioning the offering, Designing Sales Process, Marketing mix and promotional strategies, Maintaining and hiring team, Knowing Competitors; preparing revenue model up to break-even point, Projecting future moves of business, Product Road Map, writing a detailed Business Plan, Basics of finance & accounting, Raising Funds- banks, financial institutions, venture capitalists, angel investors, bootstrapping; Role of incubation centres

Section C

Role of Knowledge centres like universities and institutions and R & D; Role of Technology and Upgradation; Managing technology transfer; Regulation for transfer of foreign Technology; Technology Transfer agencies; Business Crisis and its management; Ethical Entrepreneurship; Social Entrepreneurship; Use of IT in business administration, Available Software for better financial management; Setting an E-Business; Key Leadership and Management skills.

Note:

- Section A is informative and should be dealt with the help of cases and live examples of enterprises and entrepreneurs.
- Section B is totally practical and should be dealt by clubbing students into team and working together for a mock paper company, developing B-Plan and presenting it.
- Section C covers supporting information and learning's that can be of help to a budding entrepreneur.

Suggested Readings:

1. Jain P.C.: Hand book for new entrepreneurs: Oxford University Press.
2. Lalitha D. Rani : Women Entrepreneurs, A.P.H. Publishing Corporation.
3. Drucker Peter F : Innovation and Entrepreneurship, New Delhi Heineman, UBSPD

4. David Holt : Entrepreneurship and New Venture Creation, Prentice Hall of India.
5. Other Suggested readings apart from text books include motivational titles in air for instance, The Goal, Rich Dad Poor Dad, Count you Chicken Before they Hatch, The Winning, A Monk who sold his Ferrari, Stay Hungry Stay Foolish, 60 Keys to Success etc.

Suggested Websites

- www.techcrunch.com
- www.demo.com
- www.nurturetalent.com
- www.nurturetalent.com
- www.yourstory.in
- www.plugged.in
- www.techcircle.in

Suggested Activities

- B-Plan Competitions
- Business Marketer (like held in Navotkarsh)
- Idea Generation Exercises
- Movie Screening
- Extempore on random topics

Cloud Computing

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Section A

Introduction to Cloud Computing, Definition, Characteristics, Components, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Cloud computing platforms: Infrastructure as service: Platform as Service: Google App Engine,

Introduction to Cloud Technologies, Study of Hypervisors, Compare SOAP and REST, Web services, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services.

Section B

Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Multitenant software: Multi-entity support, Multi-schema approach, Multitenance using cloud data stores, Data access control for enterprise applications.

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, Map-Reduce and extensions: Parallel computing.

Section C

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control Identity management, Access control, Autonomic Security

Cloud computing security challenges: Virtualization security management virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud. Issues in cloud computing, Implementing real time application over cloud platform.

Suggested Readings:

1. "Cloud Computing, Implementation, Management, and Security", by John W. Rittinghouse and James F. Ransome, ISBN:978-1-4398-0680-7, CRC Press, 2010
2. Cloud Computing for Dummies by Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition)
3. Enterprise Cloud Computing by Gautam Shroff, Cambridge
4. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
5. Cloud Security&Privacy by Tim Malhar, S.Kumaraswamy, S.Latif (SPD,O'REILLY)
6. Cloud Computing: A Practical Approach, Antohy T Velte, et.al McGraw Hill

Neural Networks

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Section A

Introduction to Neural Networks, Models of a Neuron, Network architectures, feedback, learning process - error correction, learning, Hebbian, Competitive, Boltzman, Supervised and unsupervised learning, the perceptron model, Multilayer perceptrons.

Section B

Recurrent Networks, the Hopfield Network, the Boltzmann machine, its Markov Chain model, self organizing systems : Hebbian learning, Competitive learning.

Section C

Modular Networks, associative Model, Stochastic Model, Temporal processing : Back propagation learning, real time recurrent networks.

VLSI implementations of Neural Networks : Design considerations, Neurocomputing hardware.

Suggested Readings:

1. Haykin S., Neural Networks, Prentice Hall, 1994
2. Domany E., Van Hemmen J.L. and Schutten K. (Eds.), Model of Neural Networks , springer-Verlag, Berlin Heidelberg, New York, London, Paris, Tokyo, Hong Kong and Barcelona.
3. Soulie, Françoise Fogelam and Hérault Jeanny, Neurocomputing : Algorithms, architectures and applications, Springer-Verlag, Berlin Heidelberg, New York, London, Paris, Tokyo, Hong Kong and Barcelona.
4. Eckmiller Rolf and Malshburg christoph v.d. (E.ds.), Neural Computers, Springer-Verlag, Berlin, Heidelberg, New York, London, Paris, Tokyo, Hong Kong and Barcelona.
5. Yegnanarayana B, “Artificial Neural Networks, Prentice Hall, 2003.

Parallel Computing

Section A

Introduction to parallel computing, advantages of parallel computing. Solving problems in parallel : Temporal parallelism, Data parallelism and their comparison. Intertask dependency and task graphs. Structures of parallel computers: Pipelined

Parallel computers, Array processors, Shared memory multi-processor, message passing multiprocessors, MMC systems. Integer Arithmetic : Carry look-ahead addition and carry-save addition on binary tree, integer multiplication and convolution on a linear array. Elementary sorting algorithm.

Section B

Matrix Algorithms : Matrix-Vector multiplication and solving lower triangular system of equations on a linear array, matrix multiplication, LU decomposition, matrix inversion, Gaussian elimination on a mesh.

Graph Algorithms : Mesh algorithm for transitive closure, connected component, shortest path, breadth first search and minimum spanning tree. Mesh of trees and its applications such as Matrix-Vector multiplication, Convolution and integer multiplication.

Section C

More fancier networks : r-dimensional mesh of trees, shuffle trees, shuffle-exchange network, hypercube, De-bruijn network and butterfly. Some examples on these networks, sorting and FFT on butterfly.

Introduction to dataflow computers. Parallelism in logic programming. Programming parallel computers.

Suggested Readings:

1. Rajaraman V., Elements of Parallel Processing, Prentice-Hall of India, 1990
2. Quinn, Michal J., Designing Efficient Algorithms on Parallel Computers, Mc-Graw Hill International, NewYork, 1978
3. Analysis and design of parallel algorithms:arithmetic and matrix problems, S. Lakshmivarahan, Sudarshan Kumar Dhall, , Mc-Graw Hill Int. 1990

BIOINFORMATICS

L	T	P	C
4	0	0	4
Maximum Marks 100			
(CA: 40 + ESA: 60)			

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Introduction of computers: Basic components and their functions, hardware and software, Input-Output devices.
- Basic concepts about data and information, Representation of data in computers in binary, bits and bytes. Computer words coding (ASCII and EBCDIC), Number System Conversion.
- Conceptual understanding of assemblers, Compilers, Operating System.
- Introduction to Programming languages, C++, Perl.

Section-B

- Information Retrieval: LAN, WAN, Introduction to Internet, WWW, NICNET, ERNET, On-line publishing ventures eg. Biomed Central, BTIS Network in India.
- Introduction to Microarray Technology and its applications.
- Biological Databases: Primary Sequence databases (Protein and DNA databases), Secondary databases, Composite databases. Online international database access.

Section-C

- Sequence Alignment and Databases searching: Evolutionary basis of sequence alignment, Optimal alignment methods; Dot Plot, Dynamic Programming.
- Databases similarity searching: Algorithms of FASTA, BLAST.
- Statistical significance of alignment, Substitution Scores and Gap penalties.
- Multiple Sequence alignment: CLUSTAL W. Phylogenetic Analysis, UPGMA, N-J Methods. EMBOSS.

Books Recommended :

- A textbook of Bioinformatics : Sharma, Munjal & Shanker, Rastogi Publication, Meerut
- Fundamental of computer : P.K. Sinha
- Introduction to Bioinformatics : Parrysmith and Attwood
- Introduction to Bioinformatics : Baxevenis and Oulette
- Internet for Molecular Biologist : Swindell
- Molecular databases for protein sequences and structure studies - An Introduction Silence : J., Sillince M., Springerberlagd, Berlin 1972
- Leaping from Basic to C++ : Robert J. Traister, A.P. Professional Cambridge
- Perl 5 Unleashed : Kamran Husain & Robert F Breedlore SAMS Publishing.
- Bioinformatics : David, Mount.

ANALYTICAL TECHNIQUES-I

L	T	P	C

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

Chromatographic methods for macromolecule separation- TLC and Paper chromatography, gel permeation; ion exchange; hydrophobic, Reverse-phase and Affinity chromatography; HPLC, FPLC and GLC.

Electrophoretic techniques :

Theory and application of polyacrylamide and agarose gel electrophoresis, capillary electrophoresis; 2D electrophoresis; Disc gel electrophoresis; Gradient electrophoresis; Pulse field gel electrophoresis, Isoelectric focusing.

Section-B

Microscopy- Microscope and its modifications- Light, Phase contrast and interference, Fluorescence, Confocal, Electron (TEM & SEM), Electron tunneling and Atomic Force Microscopy

Centrifugation -Basic principle & theory, Types of centrifuges- Micro centrifuge, High speed & Ultracentrifuges; Preparative centrifugation, differential & density gradient centrifugation. Analytical centrifugation & its applications.

Section-C

Spectroscopy-Principle, instrumentation applications in biological sciences: UV-visible spectrophotometry Fluorometry & Atomic absorption Spectrophotometer (AAS). Principle and application of NMR, X-ray crystallography, API-electrospray, mass spectroscopy and MALDI-TOF, Circular Dichroism

Radioactivity :

Radioactive and stable isotopes; Pattern and rate of radioactive decay; Measurement of radioactivity; Geiger-Muller counter; solid and liquid scintillation counters (Basic principal, instrumentation and technique); brief idea of radiation dosimetry; Cerenkov radiation; autoradiography.

Books Recommended :

- Practical Biochemistry : Keith Wilson and John Walker, Cambridge University Press.
- Physical Biochemistry : David Friefelder.
- Instrumental methods of chemical analysis : Chatwal and Anand, Himalaya Publishing House.
- Instrumental methods of chemical analysis : B.K. Sharma, Goel Publishing House.
- X-Ray Methods : C. Whiston.
- The Electron Microscope in Biology : A. V. Grimstone.
- Tertiary level biology - Methods in Experimental biology : R. Ralph Blackie.
- Animal Tissue Technique : G.L. Humason.
- NMR and Chemistry : J.W. Akitt, Chapman and Hall.

BIOCHEMISTRY AND BIOPHYSICS

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Hydrogen bonding and structure of water molecule, Ionization of water, pH and colligative properties of water.
- Bioenergetics : First & second law of thermodynamics, concept of free energy, change in standard free energy, ATP and its hydrolysis.
- Carbohydrates : general classification, Polysaccharides : & proteoglycans : Starch, glycogen, cellulose, chitin & bacterial cell wall. Glycosaminoglycans & proteoglycans in extracellular matrix.

Section-B

- Electron transport system in mitochondria & chloroplasts. Oxidative phosphorylation, P/O ratio, Uncouplers.
- Lipids - Glycerophospholipids, sphingolipids, gangliosides, Eicosanoids & prostaglandins. Cholesterol & its biosynthesis.
- Proteins & amino acids - Zwitterionic properties of amino acids & titration curves. Peptide bonds, disulphide cross links, various levels of structural organization of proteins.
- Ramachandran plot, Alpha-helix, Beta sheet, Helix-coil transitions.

Section-C

- Structure function relationship in model proteins like ribonuclease A, haemoglobin, chymotrypsin.
- Biosynthesis of purines and pyrimidines, *de novo* and salvage pathway, various conformations of nucleotides, glycosidic bond rotation, base-stacking.
- Mechano-Chemical Process: Molecular structure of muscle-Actin, myosin, troponin, tropomyosin, Muscle Contraction.
- Action Potential and propagation of neuronal computation through nerve fibre.

Books Recommended :

- Principles of Biochemistry : A.L. Lehninger, Nelson and Cox, McMillan Worth Publishers.
- Biochemistry : Voet and Voet, John Wiley and Sons, Inc. USA.
- Biophysical Chemistry Vol. I, II & III : Cantor and Schimmel, Freeman.
- Biochemistry : Zubey, WCB.
- Biochemistry : Garrett and Grisham, Harcourt.
- Biochemistry : Stryer, W. H. Freeman.
- Understanding Enzymes : T. Palmer, Horwood.
- Harper's review of Biochemistry : R.K. Murray et al., Prentice-Hall International Inc.
- Fundamentals of Biochemistry : Cohn and Stumpf.
- Molecular Biophysics-Structure in Motion : Michel Daune, Oxford University Press.
- Biochemistry : Christopher K. Mathews, Pearson Education.

BIOCHEMISTRY AND BIOPHYSICS

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Hydrogen bonding and structure of water molecule, Ionization of water, pH and colligative properties of water.
- Bioenergetics : First & second law of thermodynamics, concept of free energy, change in standard free energy, ATP and its hydrolysis.
- Carbohydrates : general classification, Polysaccharides : & proteoglycans : Starch, glycogen, cellulose, chitin & bacterial cell wall. Glycosaminoglycans & proteoglycans in extracellular matrix.

Section-B

- Electron transport system in mitochondria & chloroplasts. Oxidative phosphorylation, P/O ratio, Uncouplers.
- Lipids - Glycerophospholipids, sphingolipids, gangliosides, Eicosanoids & prostaglandins. Cholesterol & its biosynthesis.
- Proteins & amino acids - Zwitterionic properties of amino acids & titration curves. Peptide bonds, disulphide cross links, various levels of structural organization of proteins.
- Ramachandran plot, Alpha-helix, Beta sheet, Helix-coil transitions.

Section-C

- Structure function relationship in model proteins like ribonuclease A, haemoglobin, chymotrypsin.
- Biosynthesis of purines and pyrimidines, *de novo* and salvage pathway, various conformations of nucleotides, glycosidic bond rotation, base-stacking.
- Mechano-Chemical Process: Molecular structure of muscle-Actin, myosin, troponin, tropomyosin, Muscle Contraction.
- Action Potential and propagation of neuronal computation through nerve fibre.

Books Recommended :

- Principles of Biochemistry : A.L. Lehninger, Nelson and Cox, McMillan Worth Publishers.
- Biochemistry : Voet and Voet, John Wiley and Sons, Inc. USA.
- Biophysical Chemistry Vol. I, II & III : Cantor and Schimmel, Freeman.
- Biochemistry : Zubey, WCB.
- Biochemistry : Garrett and Grisham, Harcourt.
- Biochemistry : Stryer, W. H. Freeman.
- Understanding Enzymes : T. Palmer, Horwood.
- Harper's review of Biochemistry : R.K. Murray et al., Prentice-Hall International Inc.
- Fundamentals of Biochemistry : Cohn and Stumf.
- Molecular Biophysics-Structure in Motion : Michel Daune, Oxford University Press.
- Biochemistry : Christopher K. Mathews, Pearson Education

L T P C
0 0 12 6
Maximum Marks 100
(CA: 40 + ESA: 60)

1. Demonstration, principle and use of lab equipments : Centrifuges (Table top and high speed), Balances (electrical and digital).
2. Demonstration, principle and use of lab equipments : Spectrophotometer, pH meter.
3. Estimation of proteins by Lowry's and TCA methods.
4. Estimation of carbohydrates (reducing and non-reducing sugar).
5. Estimation of fats (cholesterol).
6. Preparation and purification of casein from buffalo milk.
7. Separation of amino acids by TLC and paper chromatography.
8. Determination of Logic properties (pH value of Lysine by titration).
9. To find λ_{max} for proteins.
10. Use of selective and diagnostic media for cultivation, isolation, enumeration and purification of microorganisms.
11. Measurement of bacterial and fungal growth.
12. Isolation and enumeration of microbes from air/soil by serial dilution/agar plating method.
13. Antibiotic sensitivity test.
14. Microbiological examination of food.
15. Citric acid production by *A. niger*.
16. Study of cell division in plants and animals, Giant chromosomes.
17. Separation of different organelles/molecules by sucrose density gradient/differential gradient.
18. Separation and identification of serum proteins/plant proteins by gel electrophoresis.
19. Histochemical localization of biomolecules (protein, carbohydrate or any other).
20. Bioinformatics exercise 1.
21. Bioinformatics exercise 2.

CELL AND MOLECULAR BIOLOGY

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Molecular structure and function: Structural models, Composition and dynamics; Transport of ions and macromolecules; Pumps, carriers and channels; Membrane carbohydrates and their significance in cellular recognition; cellular junctions and adhesions; structure and functional significance of plasmodesmata.
- Endocytosis and exocytosis, clathrin & coatamer coated vesicles, SNARE proteins.
- Cell to cell signalling : autocrine, paracrine and endocrine stimulation.
- Signalling via G-protein linked cell-surface receptors, adenylate cyclase system, inositol phosphate pathway, role of Ca^{2+} -ions.
- Signalling via enzyme-linked surface receptors, tyrosine kinases.
- Steroid receptors.

Section-B

- Mitochondrial membrane organization, transport of proteins into mitochondria and chloroplasts. Genome of mitochondria and chloroplasts.
- Concept of signal peptide, SRP, SRP Receptor, transport of soluble and membrane bound proteins in Endoplasmic Reticulum, ER Resident proteins, ER chaperone proteins and their functions, glycosylation of proteins in ER.
- Golgi apparatus, role in protein glycosylation and transport.
- Lysosomes, intracellular digestion, sorting of lysosomal enzymes in Golgi, lysosomal storage diseases.

Section-C

- Replication of genetic material in prokaryotes and eukaryotes: initiation, elongation and termination; Replication of single stranded circular DNA.
- Prokaryotic transcription: Transcription units; RNA polymerase structure and assembly; Promoters; Rho-dependent and Rho-independent termination; Anti-termination.
- Eukaryotic transcription: RNA polymerase structure and assembly; RNA polymerase I, II, III; eukaryotic promoters and enhancers; general transcription factors; TATA binding proteins (TBP) and TBP associated factors (TAF).
- Post transcriptional modifications: processing of hnRNA, tRNA and rRNA; 5'-Cap formation; 3'-end processing and polyadenylation; Splicing; RNA editing; Nuclear export of mRNA; mRNA stability; Catalytic RNA.

- Translation: Translation machinery; Ribosomes: composition and assembly; Genetic code: degeneracy of codons, initiation and termination codons, wobble hypothesis, genetic code in mitochondria; Isoaccepting tRNA; Mechanism of initiation, elongation and termination; Co- and post-translational modifications.

Books recommended :

- Cell and Molecular Biology : De Robertis & De Robertis, B.I. Waverly Pvt. Ltd., New Delhi.
- The world of the cell : W.M. Becker, Pearson Education.
- Cell and Molecular Biology : G. Karp, John Wiley & Sons.
- The Cell - A Molecular Approach : Cooper, Sinauer.
- Cell and Molecular Biology : P.K. Gupta, Rastogi Publications.
- Molecular Cell Biology : Lodish, Baltimore, W. H. Freeman & Co.
- Molecular Biology of the Cell : Bruce Albert, Garland Publication, NY.
- Essentials of Cytology : C.B. Powar, Himalaya Publications.
- Principles of Genetics : Gardner, Simmons, Snustad, John Wiley & Sons.
- Gene VIII : Lewin, Pearson Education.
- Molecular Biology of Gene : J.D. Watson, Pearson Education.
- Molecular Biology : David Freifelder, Narosa Publishing House, New Delhi.
- Molecular Biology : R. Weaver, WCB McGraw Hill.

MICROBIOLOGY

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Discovery of Micro-organisms.
- Criteria for classification; molecular approaches
- Bacteria : General features, Structural organisation, Nutrition, Growth, Respiration and Reproduction.
- Methanogens and Methylophiles, Chemolithotrophs, Phototrophs, Sulphur reducing bacteria.
- Archaeobacteria

Section-B

- Nature of viruses, Organisation of virion, Animal, Plant and Bacterial Viruses.
- Virus replication, Cultivation of viruses & Virulence factor.
- Isolation and screening of industrially important microbes.
- Improvement of strains.

Section-C

- Biofertilizer and Compost.
- Biopesticides, Biopolymers and Biosurfactants
- Industrial production of various metabolites with special example of antibiotics, organic acids and alcohol
- Microbes in the disposal of sewage: sewage treatment processes, sewage water and transmission of diseases, indicator organisms.

Books Recommended :

- Introductory Microbiology : F.C. Ross, Columbus Charles E. Mehrill.
- Microbiology - Fundamentals and Applications : S.S. Purohit, Agro Botanical Publishers, Bikaner.
- Modern Concepts of Microbiology : H.D. Kumar and S. Kumar, Vikas Publishing House, New Delhi.
- Microbiology : M.J. Pelczar, C.E.C. Sun and N.R. Krieg, Tata Mc Graw Hill, New Delhi.
- A Text book of Microbiology : R.C. Dubey and D.K. Maheshwari, S. Chand and Company.
- Microbiology : K.L. Burdon and R.P. Williams, Mcmillan Worth Publishers.
- Microbiology : B.D. Davis et al. : Harper and Row Publishers.
- Microbiology : E.W. Nester et al., Saunders international edition.
- Principle of Fermentation Technology : P.F. Stanbury and A. Whittaker, Pergamon Press.
- Fundamental principles of Bacteriology : A.J. Salle, Tata McGraw Hill.
- T.D. Boock's World of Microbiology : Madigan
- Microbiology : Prescott.

Second Semester
BIOSCIENCE LAB - II

L T P C
0 0 12 6
Maximum Marks 100
(CA: 40 + ESA: 60)

1. To obtain standard curve of p-nitrophenol solution.
2. To prepare a sample of enzyme extract.
3. To determine activity of acid phosphatase from peas/moong seedlings.
4. Purification of an enzymatic protein by salt precipitation.
5. Determination of kinetic properties (K_m and V_{max} values) of an enzyme.
6. To check time and protein linearity of an enzymatic reaction.
7. Immobilization of an enzyme.
8. Blood film preparation and identification of leucocytes.
9. Lymphoid organs and their microscopic organization.
10. Immunization, collection of serum.
11. Double diffusion and immuno-electrophoresis.
12. ELISA : Determination of antibody titre.
13. Immunodiagnosics (Demonstration using commercial kits).
14. Extraction and estimation of RNA.
15. Extraction and estimation of DNA.
16. To find λ_{max} for nucleic acids.
17. Preparation of metaphase chromosomes.
18. Detection of ADH activity in tissue/cells by cytochemical staining using *Drosophila*.
19. Statistical problem.
20. Genetic problem - (chromosome mapping).

BIOSTATISTICS AND RESEARCH METHODOLOGY

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Scope of Biostatistics, variables in biology, collection, classification, tabulation of data.
- Frequency distribution, Diagrammatic and graphical presentation of statistical data, Sampling techniques.
- Measures of central location and dispersion, Simple measure of skewness and kurtosis.
- Probability, conditional probability.

Section-B

- Binomial, Poisson and Normal Distribution.
- Correlation and Regression : Least Square method of fitting, Standard error of estimate, Correlation and regression coefficient.
- Basic idea of significance testing, level of significance, students 't' test, χ^2 (chi-square) test and F-test, Analysis of variance.

Section-C

- Introduction of Research Methodology : Meaning and importance, Nature and areas of research in Biological Sciences.
- Formulation of a research problem (Hypothesis).
- Elements in Research Methodology; Research Designs (CRD, RBD, LSD).
- Ethical, Legal and Social Issues in Biological Research.
- Writing of Research Report/Research Paper : Various components and their organization.

Books Recommended :

- Statistical methods for Research : S. Singh, et. al. (1988) Central Publishing, Ludhiana.
- Fundamentals of Statistics : D. N. Enhance.
- Statistical Methods : S.P. Gupta, S. Chand Publications.
- Research Methodology : G.R. Basotia, K.K. Sharma.
- Research Methodology : C.H. Chaudhary, RBSA Publication.
- Fundamentals of Biostatistics : Khan & Khanam, Ukaz Publications.
- Biostatistical analysis - Jerold Zar.
- Elements of Biostatistics in Health Sciences : W. Daviell.

GENETICS

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Definition of gene: genetic & biochemical view; Gene: unit of structure & function, complementation test.
- Mendelian Genetics: Mendel's experimental design; Mendelian Genetics in humans: Pedigree analysis.
- Extensions of Mendelian Genetics Principles: Modification of dominance relationships, Gene interactions and modified Mendelian ratios, Multiple alleles, Essential and lethal genes.
- Non Mendelian inheritance: Extrachromosomal inheritance; Genomic imprinting; isodisomy; Complex inheritance-genetic and environmental variation; Heritability; Twin studies; Behavioral traits; Analysis of quantitative traits.
- Linkage & Crossing over: Tetrad analysis, mapping of gene order and centromere location in fungi

Section-B

- Genome organization: Organization of bacterial genome; Structure of eukaryotic chromosomes, organization of DNA into chromosomes; Heterochromatin and euchromatin.
- Regulation of gene expression in prokaryotes: transcriptional regulation-Positive and negative; Operon concept- *lac*, *trp* and *ara* operons; transcriptional control in phage.
- Regulation of gene expression in eukaryotes.
- Mutations: Nonsense, missense and point mutations; Intragenic and intergenic suppression; Frameshift mutations; Mutagens; Molecular mechanism of mutations.
- Transposable genetic elements in prokaryotes and eukaryotes: Insertion sequences, composite and complex transposons, replicative and non-replicative transposons; Mechanism of transposition; Role of transposons in mutation; Genetic analysis using transposons.

Section-C

- Cytogenetics: Cell division and errors in cell division; Non disjunction; Structural and numerical chromosomal abnormalities-deletion; duplication; translocation; Sex determination; Lyon hypothesis; Role of Y chromosome; Genetic recombination; Disorders of sex chromosomes and autosomes;
- Molecular cytogenetics-Fluorescence In Situ Hybridization (FISH); Comparative Genomic Hybridization (CGH).
- Genetics of bacteria and bacteriophages: Genetic analysis of Bacteria; Genetic mapping in bacteria by conjugation, transformation and transduction; Mapping of bacteriophage gene.

- Population genetics: the Hardy-Weinberg law; Genetic variation in natural populations; Forces that change gene frequency in populations; Genetic basis of speciation.

Books Recommended :

- Principles of Genetics 4th Ed : Snustad & Simmons, John Wiley & Sons.
- i-Genetics : P.J. Russel, Pearson Education.
- Principles of Genetics 8th Ed : Gardner, Simmons, Snustad, John Wiley & Sons.
- Genetics : P.K. Gupta, Rastogi Publications.
- Genetics - A molecular approach : T.A. Brown, Chapman and Hall.
- Concepts of Genetics 7th Ed. : William S. Klug, Pearson Education.
- Principles of Genetics : R.H. Tamarin, Tata McGraw Hill.
- Genetics-From Genes to Genomes : Hartwell, McGraw Hill.
- Genetics 5th Eds. : D.L. Hartl and E.W. Jones, Jones and Barlett Publishers, Canada.
- An Introduction to Genetic Analysis : Suzuki, Griffith, Miller & Lewonith.
- Molecular Biology : Weaver, WCB McGraw Hill.

IMMUNOLOGY

L	T	P	C
4	0	0	4

Maximum Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Basic concepts of immunology: Specific and nonspecific defense mechanisms (innate and acquired immunity), organs and cells of immune system.
- Antigen and Antigenicity: Concept of immunogens, antigens, heptans, mitogens and superantigens. Properties of antigens, cross reactivity, special group of antigens: bacterial antigens, viral antigens, cell surface antigens (MHC), autoantigens, isoantigens and frossman antigens (Heterophilic antigens).
- Immunoglobulins : Structure and properties of immunoglobulins, immunoglobulin isotypes and their sigificance, immunoglobulins as antigens : isotypes, allotypes and idiotypes.
- Complement System.

Section-B

- Cell - mediated immune responses : origin, maturation and characterization of T-Lymphocytes, monocytes and macrophages, Characteristics of antigen presentation and its significance, Concepts of memory cell, mode of action and functioning of T_H, T_C, C_{TLS} and NK cells, Lymphokines, the product of T cell activation.
- Humoral immune responses : Origin, maturation and characterisation of B Lymphocytes, activation and proliferation of B and T cells, antibody generation *in vivo*.
- Immunological Tolerance and Autoimmunity : Characteristics and the mechanism of immunologic tolerance, factors affecting immunologic tolerance and mechanisms of autoimmunity.
- Hypersensitivity : Type I, II, III and IV.

Section-C

- Hybrid and Chimeric monoclonal antibodies, catalytic antibodies
- Surface plasmon resonance, Biosensor assay for assessing ligand-receptor interaction.
- Measurement of low molecular weight non-immunogenic compounds (such as secondary metabolites); phytohormones immunoassays.
- Advanced immunological techniques: Immunofluorescent and Immunogold labelling

Books Recommended :

- The Elements of Immunology : Fahim H. Khan, Pearson Education
- Essentials of Immunology : W.H. Hildemann
- Understanding Immunology : A.J. Cunningham
- Immunology : E. Benjamini
- Immunology : Kubly, John Wiley & Sons.
- Immunochemistry in practice : A. Johnstone & R. Thorpe.
- Immunology : K.R. Joshi & N.O. Osama, Agro Botanica Publications.
- Immunology - An Introduction : Ian R. Tizzard, Saunders College Publications.
- Principles of Cellular and Molecular Immunology : J.M. Austin and K.J. Wood, Oxford University Press.
- Lecture notes on Immunology : G. Reeves and I. Todd, Black well Science.
- Essential Immunology : Lan M. Roitt, English language book society/Blackwell science.
- Biochemistry & Molecular Biology of Plants : B.B. Buchanan, I.K. International.
- A Basic Course in Immunology : Benjamini.

ENZYMOLOGY AND ENZYME TECHNOLOGY

L	T	P	C
4	0	0	4
Maximum Marks 100			
(CA: 40 + ESA: 60)			

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- History and introduction to enzymes : Classification of enzymes. IUPAC system, nomenclature, E.C. numbers.
- Enzyme kinetics (Michaelis - Menten laws), importance and determination of V_{max} and K_m values, Hofstee's plot, L & B plots.
- Bisubstrate reactions-ordered & random sequential mechanism. Theorell chance mechanism, ping pong mechanism, products of inhibition in bisubstrate reactions.
- Enzyme inhibition : competitive, non-competitive and other types.

Section-B

- Extraction of soluble and membrane bound enzymes from microbial, plant and animal tissues.
- Purification of enzymes : salt precipitation, gel filtration, ion exchange and affinity chromatography.
- Regulation of enzyme activity, various controls (metabolic compartmentation, covalent modifications and others), feedback regulation, allosteric enzymes.
- Coenzymes, Isozymes and Multienzyme complexes.
- Methods of storing enzymes.

Section-C

- Large scale production of enzymes including genetic engineering approaches for their over production.
- Enzyme engineering; identification of active sites, approaches for modification of catalytic properties.
- Techniques of enzyme immobilization and their applications in:
 - (i) Food industry- High fructose syrup, cheese making and beer industry.
 - (ii) Antibiotics and other Pharamaceuticals
 - (iii) Medical applications
 - (iv) Analysis of substances, enzyme electrodes, enzyme thermistors.
- Basic idea of proteomics

Books Recommended :

- Understanding Enzymes : T. Palmer.
- Fundamentals of Enzymology : Price and Stevenson.
- The Enzyme : Dixon and Webb, Academic Press, London.
- Methods in Enzymology :Academic Press.
- The Enzyme Molecule : W. Ferdinan, John Wiley and sons.
- Protein Methods : D.M. Bollag and S.J. Edelstein, Wiley-Liss.
- The Nature of Enzymology : F.L. Foster, John Wiley and sons.
- Enzyme technology, biotechnology Vol 7 : John Wiley and sons.
- Enzyme, Biomass, Food and Feed Biotechnology Vol. 9 : John Wiley and Sons.

GENETIC ENGINEERING

L	T	P	C
4	0	0	4
Maximum Marks 100			
(CA: 40 + ESA: 60)			

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

Basic concepts of DNA structure and properties, restriction enzymes, DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase, Cohesive and blunt end ligation, Linkers, Adapters, Homopolymeric tailing, Labeling of DNA, Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques, Northern, Southern and Colony Hybridization, Fluorescence in situ hybridization, Chromatin immunoprecipitation, DNA-Protein Interaction-Electromobility shift assay, DNaseI footprinting, Methyl interference assay, Isolation of genomic DNA from prokaryotes and eukaryotes, Isolation of Plasmid DNA and Bacteriophage DNA. Isolation of total RNA and mRNA.

Section-B

Plasmids, Bacteriophages, pBR322 and pUC series of vectors, M13 and P2 phage based vectors, High capacity vectors: Cosmids, phagemid, phasemid, YAC, BAC, Animal and Plant virus based cloning vectors, Shuttle vectors, Expression vectors, pMal, GST, pET-based vectors, Insertion of foreign DNA into Host Cells, Transformation, Constructions of libraries, cDNA and genomic libraries, cDNA and genomic cloning, Expression cloning, Jumping and hopping libraries, South-western and Far-western cloning, Protein-protein interactive cloning and Yeast two hybrid system, Phage display.

Section-C

Primer designing, Fidelity of thermostable enzymes, DNA polymerase, Types of PCR- multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, in situ PCR, cloning of PCR products, T-vectors, Proof reading enzymes, Principles in maximizing gene expression, Gene expression analyses, differential gene expression methods, Introduction of DNA into mammalian cells, transfection techniques.

Books Recommended :

- Molecular Cloning Vol. 1, 2 and 3 : Sambrook, Russell and Maniatis, Cold Spring Harbor laboratory, 2001.
- Molecular Biology of Gene : J.D. Watson, Pearson Education.
- An Introduction to Gene Technology-From genes to clones : Winnacker, VCH.
- Principles of Gene Manipulation : Old and Primrose.
- Molecular Biotechnology : B.R. Glick and J.J. Pasternak, ASM Press Washington, USA.
- Genetic Engineering : Science and ethics on new frontier : Michael Boylan, Pearson Education.
- An Introduction to Genetic Engineering : S.T. Nicholl, Cambridge University Press.
- Recombinant DNA Methodology : Grossman and Noldave, Academic Press.
- Recombinant DNA : J.D. Watson, W.H. Freeman
- Gene Cloning : T.A. Brown.
- Principles of Gene Manipulation : Primrose & Twyman.

RECOMBINANT DNA TECHNOLOGY

L	T	P	C
4	0	0	4

Max. Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Chemical synthesis of DNA : Phosphodiester, triester approaches, amidite method, solid phase automated synthesis of DNA.
- Sequencing of DNA : Chemical and dideoxy methods, random and directed approaches, automated DNA sequencing, improved gel based sequencers, mass spectrometry based sequencing, pyrosequencing, 454 sequencing technologies.
- PCR in gene recombination, Deletion, Addition, Overlap extension. PCR in molecular diagnostics. Viral and bacterial detection, PCR based mutagenesis, Mutation detection: SSCP, DGGE, RFLP, Oligo ligation assay (OLA), Mismatch chemical cleavage (MCC), High resolution melt analyses, Allele-specific amplification (ASA).
- Applications of Transposons in genetic engineering : construction of R plasmids, gene tagging and isolation, mutagenesis genome characterization etc.

Section-B

- Vectors expressing cloned DNA in *E. coli*.
- Molecular cloning in *E. coli* & *Bacillus subtilis*.
- Cloning in yeast.
- DNA cloning in mammalian cells with SV-40 vector.
- Cloning in plants : Direct and vector based approaches.

Section-C

- Site directed mutagenesis.
- New Diagnostics in rDNA technology : Detection of genetic disorders, test for pathogens, DNA finger printing.
- Gene Silencing techniques, Introduction of siRNA and siRNA technology, Micro RNA, Construction of siRNA vectors, Principle and application of gene silencing, Gene knockouts, Gene replacement, Gene targeting, Transgenics, gene therapy. Basic idea of drug designing.
- Cloning and expression of human interferon gene.

Books recommended :

- Molecular Cloning Vol. 1, 2 and 3 : Sambrook and Russell, Cold Spring Harbor laboratory, 2001.
- Molecular Biology of Gene : J.D. Watson, Pearson Education.
- An Introduction to Gene Technology-From genes to clones : Winnacker, VCH.
- Principles of Gene Manipulation : Old and Primrose.
- Molecular Biotechnology : B.R. Glick and J.J. Pasternak, ASM Press, Washington, USA.
- Genetic Engineering : Science and ethics on new frontier : Michael Boylan, Pearson Education.
- An Introduction to Genetic Engineering : S.T. Nicholl, Cambridge University Press.
- Recombinant DNA : J.D. Watson, W.H. Freeman.
- Nucleic acid and biotechnology : H.D. Kumar.
- Understanding DNA and Gene Cloning : Darlica, John Wiley and Sons.

CELL AND TISSUE CULTURE TECHNOLOGY

L T P C
4 0 0 4
Max. Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Historical background and terminology used in cell & tissue culture.
- Basic techniques of cell and tissue culture, sterilization, aseptic tissue transfer, concept of totipotency.
- Nutritional requirement to cell *in vitro*, various types of nutrient media.
- Contamination and cytotoxicity
- Cryopreservation and cell storage.
- Isolation of plant cells, single cell cultures and cloning.

Section-B

- Organogenesis and somatic embryogenesis, applications in agriculture, horticulture & forestry.
- Haploid production : Androgenesis, gynogenesis various techniques, applications.
- Production of disease free plants by tissue culture methods.
- Protoplast isolation and culture, fusion of protoplasts.
- Somatic hybrids, selection methods, gene expression in somatic hybrids.

Section-C

- Disaggregation of animal tissue, Isolation of cells, single cell culture, Routine maintenance of animal cell lines.
- Cloning & selection of specific animal cell types.
- Transfection: gene transfer methods for adherent and non-adherent cell culture.
- Cell fusion: fusogen, animal somatic cell fusion and selection of cybrids.
- Animal organ culture
- Elementary idea about animal cell culture products.

Books Recommended :

- Plant Tissue Culture : S.S. Bhojwani and M.K. Razdan, Elsevier Science, The Netherlands.
- An Introduction to Plant Tissue Culture : M.K. Razdan.
- Cell Culture Methods and Cell biology Vol. 4 : D.W. Barends.
- Cell and Tissue Culture - laboratory procedure : A. Doyle.
- Plant Tissue Culture - A Practical Approach : R.A. Dixon, IRL Press.
- Biotechnology in Agriculture and Forestry : Y.P.S. Bajaj, Narosa.
- Plant cell and Tissue Culture : Rienert and Yeoman.
- Plant Cell Culture : Butenko.
- Plant Tissue Culture Methods and Applications in Agriculture : T.A. Thorpe, Academic Press Inc.

ENVIRONMENTAL BIOTECHNOLOGY

L T P C

4 0 0 4

Max. Marks 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Current status of biotechnology in environmental protection.
- Sewage & waste water treatment: Physical, Chemical and biological treatments; Aerobic processes & anaerobic processes, Primary, secondary and tertiary treatments; Sludge dewatering & its disposal; Water reclamation.
- Solid waste management: Methods & disposal of non hazardous and hazardous solid wastes, recycling, methods of disposal of radioactive waste.
- Conservation of Biodiversity: *Ex-situ* & *in-situ* methods.

Section-B

- Environmental Biotechnology in Agriculture: Biofertilizers and microbial inoculants, Biopesticides.
- Biodegradation of xenobiotic compounds: Simple aromatics, chlorinated polycyclic aromatic petroleum products, Pesticides and surfactants.
- Bioremediation & Bioaugmentation: Reforestation through micro-propagation, development of stress tolerant plants, and use of mycorrhiza in reforestation of soil contaminated with heavy metals.

Section-C

- Biofuels: Energy crops, Conventional sources of biofuel, Second and third generation of biofuel, Biogas, Bioethanol, Biohydrogen. Biodegradable plastics.
- Bioindicators and Biosensors for detection of environmental pollution.
- Environmental genetics: Degradative plasmids, release of GE microbes in environment.

Books Recommended :

- Environmental Impact Assessment : Clark, Bissel & Watham.
- Introduction to Toxicology : J.A. Timberell.
- Fundamentals of Ecology : Eugen P. Odum.
- Field Biology : R.L. Smith.
- Encyclopedia of Pollution & its Control : Vol.I-VI.
- Environmental Chemistry : B.K. Sharma and H. Kaue, Goel Publishing House, Meerut.
- Environmental Biotechnology : S.K. Aggarwal, APH Publishing Corporation.
- Environmental Chemistry : A.K. Bhagi and G.R. Chatwal, Himalaya Publishing House, New Delhi.

PLANT BIOTECHNOLOGY

L T P C
4 0 0 4
Max. Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Introduction, examples of current use of plant biotechnology.
- Development of pathogen resistant plants (virus & insect resistance).
- Development of plants of improved seed quality.
- Artificial seeds.
- Development of plants resistant to environmental stress.
- Development of herbicide resistant plants.
- Future outlook.

Section-B

- Immobilization of cells.
- Gene delivery methods in intact and cultured tissues and cells.
 - (i) *Agrobacterium*, Ti plasmids, co-integrate and binary vectors. Other vectors - viral vectors.
 - (ii) Direct DNA uptake, microprojectile delivery, electroporation, microinjection, Liposomes.
- Chloroplast engineering : Advantages of chloroplast transgenics, applications in production of biopharmaceuticals, introduction of agronomic traits, viz. disease resistance, herbicide resistance, salt and drought resistance; phytoremediation etc.
- Biotechnology of Biological Nitrogen fixation : *nif* genes

Section-C

- Production of metabolites; metabolic engineering and industrial products : plant secondary metabolites; control mechanisms and manipulation of phenyl propanoids and shikimate pathways; general strategy towards production of plant cell products.
- Biotransformation using plant cells.
- Cryobiology of plant cell cultures and establishment of gene banks.
- Edible vaccines.
- Radiobiology of cultured plant cells.

Books Recommended :

- Biotechnology - A Laboratory Course : J. M. Becker, G.A. Coldwell and E.A. Zachgo, Academic Press, New York.
- Genetic Engineering Technology in Industrial Pharmacy : Ed. - J.M. Tabor.
- Tissue Culture, Methods and Applications : P.F. Kruse.
- Plant Tissue Culture : Sharma and Alam; IK International Publisier Pvt. Ltd.

IMMUNOTECHNOLOGY

L T P C
4 0 0 4
Max. Marks 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Structure, genomic organisation, expression and functions of major histocompatibility complex.
- Organisation and expression of immunoglobulin genes & antibody diversity.
- T cell receptors - genomic organisation, structure and isolation of TCR.
- Immune regulation, Positive and negative selection in thymus, Apoptosis.

Section-B

- Immunity to infectious diseases.
- Immunodeficiency and AIDS.
- Transplantation Immunology.
- Tumor Biology.

Section-C

- Various Approaches to Vaccines.
- T cell cloning, Engineered antibodies production.
- Radioimmunoassay, Enzyme linked immunosorbant assay, ELISPOT, Immunoblotting (western blotting)
- Immunofluorescence, Immunoelectron microscopy, Cell Cytotoxicity assays & Flow cytometry.

Books Recommended :

- Essentials of Immunology. W.H. Hildemann, Elsevier Scientific Publishing Co. Inc.
- Understanding Immunology. A.J. Cunningham, Academic Press.
- Immunochemistry in Practice : A. Johnstone and R. Thorpe. Blackwell Scientific Publications.

BIOTECHNOLOGY LAB - I

L T P C
0 0 12 6
Max. Marks 100
(CA: 40 + ESA: 60)

1. Determination of total hardness of water.
2. Degradation of pesticide in soil and estimation of its residue.
3. Determination of fluoride in water/soil/biosamples.
4. Determination of BOD values.
5. Determination of LD₅₀ for common pesticides/weedicides.
6. Bacteriological analysis of waste water.
7. Detection of mutagens by Ames test.
8. Isolation and determination of plasmid DNA from *E. coli*.
9. Electrophoretic separation of plasmid DNA.
10. Restriction digestion of plasmid DNA.
11. To obtain transposon Tn5 insertion into the genome of AK 631 strain of *Rhizobium meliloti* using suicide plasmid vector PGS 9.
12. To transfer plasmid PJB3JI from J53 strain of *E. coli* to HB101 strain of *E.coli*.
13. Estimation of Biomass.
14. Estimation of growth and product yield in a Bioconversion process.
15. Comparison between aerobic and anaerobic process.
16. Enzyme biosynthesis and measurement of its activity.
17. Culture of stem explants.
18. Embryo culture.

ENVIRONMENTAL BIOLOGY AND TOXICOLOGY

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Concept of energy, conventional & non-conventional energy sources. Fossil fuels, hydro, wind and nuclear power, geothermal, solar and bioenergy.
- Energy flow in organisms, energy pathways & models, energy efficiencies, conservation of energy.
- Classification & characteristics of resources : water, soil, forest, wild life, land use.
- Conservation of natural resources : water, soil, forest and wild life.

Section-B

- Origin of pollutants : industrial, agricultural, domestic and vehicular sources.
- Pollutant & their toxicology : Heavy metals and trace elements. agrochemicals (Pesticides, herbicides, rodenticides & fungicides, detergents) & particulate matter.
- Types of radiations including ionizing & non-ionizing radiations & their interaction with matter.
- Radiations as environmental pollutants.
- Effects of radiations at cellular, molecular & genetic level.

Section-C

- Mutagenecity, carcinogenicity.
- Green house effect, acid rains.
- Ozone layer depletion, photochemical smog.
- Types of solid wastes, transport, reuse & recycling.

Books recommended :

- Environmental Impact Assessment : Clark, Bissel & Watham.
- Introduction to Toxicology : J.A. Timberell.
- Fundamentals of Ecology : Eugene P. Odum.
- Field Biology : R.L. Smith.
- Encyclopedia of pollution & its control : Vol. I-VI

ADVANCE ANIMAL PHYSIOLOGY

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- A general idea, about the functions of exoskeleton in animals, thermoregulation in ectotherms and endotherms, occurrence of bioluminescence among animals.
- An idea about mechanoreception, equilibrium reception phonoreception, chemoreception electroreception and photoreception.
- Nutritional pattern in animals, mechanism of digestion absorption and assimilation of different food materials, digestive enzymes and the regulation of their secretion in mammals, physiology of defecation.

Section-B

- Different types of respiratory organs in animals, mechanism of respiration and its regulation in mammals, mechanism of exchange of CO₂ and O₂ at cellular level, respiratory pigments in animals, respiratory quotient, oxygen equilibrium curves, Bohr's effect.
- An idea about types of circulating systems in animals, different types of hearts on physiological basis, cardiac cycle, cardiac output and its regulation in mammals.
- Composition and functions of mammalian blood, blood volume, blood pressure, mechanism of blood coagulation, blood group system.

Section-C

- An idea about the various types of excreting organs and excreting products in animals, functional structure of nephron, ornithine cycle, production of urine and its regulation, counter current mechanism, micturition and its control.
- Fluid, electrolytes and acid base balance, homeostasis in mammals.
- Mechanism of muscle contraction of different types of vertebrate muscles, energy supply and heat production, mechanical properties of muscles, invertebrate muscles and mechanism of their contraction.

Books Recommended :

- Comparative animal physiology : Prosser and Brown.
- Function of Human body : A.C. Guyton.
- Eckert Animal physiology-Mechanism and adaptation : Randall and Burggren.
- Human Anatomy & Physiology: E.N. Mereib, Pearron Education.
- Human physiology Vol. I and Vol. II : C.C. Chatterjee.
- Human physiology Vol. I and Vol. II : E. Babsky, B. Khodorov, G. Kositsky and A. Zubkov.
- Principles of anatomy and physiology : G.M. Tortora
- Animal physiology : Goodman.
- Animal physiology : Laural Sherwood, Thompson Learning.

ANIMAL CELL AND TISSUE CULTURE TECHNIQUES

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Historical background, terminology used in cell & tissue culture.
- Basic aseptic techniques used for cell & tissue culture.
- Physical Environment: Surface, pH, Temperature.
- Chemical Environment - Properties of media, balanced salt solutions, Natural media, Synthetic Media (with Serum & Serum free media), Complex media.
- Primary Cell Culture: Disaggregation Techniques, Isolation, Propagation, Immortalization of cell lines, Routine maintenance.

Section-B

- Characterization of cell line, Need for characterization, species verification, cloning and plating efficiency.
- Contamination and cytotoxicity: Sources and types of microbial contamination, Monitoring: Viability assay, Survival assay and transformation assay.
- Preservation of cell lines: cryopreservation, cell banks, transporting cells.
- Viral & chemical induction for transformation of cells in culture.

Section-C

- Somatic Hybridization: Fusogens, basis of somatic hybridization technology, storage of hybridoma cells, Productions of monoclonal antibodies.
- Gene transfer using cultured cells.
- Animal cell culture products.
- Transgenic animals.

Books Recommended :

- Cell culture methods for molecular & cell biology Vol. 4 : D.W. Barnes.
- Cell & Tissue culture laboratory Procedure : A. Doyle.
- Animal Cell Culture, a practical approach : R.I. Freshney, Wiley-Liss.
- Normal renal tissues & cell culture : C.C. Harri, B.F. Trumps. G.D. Stonen.
- Animal cell Biotechnology - Vol. 4 : Spier and Griffiths.

ANIMAL DIVERSITY - I

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Basic concept of taxonomy and systematics, terms & definition, contribution and role of systematics
- Current trends in taxonomy : Morphological, embryological, ecological, behavioural, cytological, biochemical & numerical taxonomy.
- Zoological classification : International code of zoological nomenclature, principles of nomenclature, Kinds of classification, Linnaean hierarchy.

Section-B

- Diagnostic features and phylogeny of Protozoa, Porifera, Coelentrata & Ctenophora.
- Diagnostic features and phylogeny of Platyhelminthes, Nematoda, Acanthocephala & Rotifera.
- Diagnostic features and phylogeny of Annelida & Mollusca.

Section-C

- Diagnostic features and phylogeny of Arthropoda, Onychophora & Echinodermata.
- Diagnostic features and phylogeny of Ectoprocta, Brachiopoda & Chaetognatha.
- Diagnostic features and phylogeny of Hemichordata & Protochordata.

Books Recommended :

- Principles of systematics : Ernest Mayr.
- Theory and practice of Animal Taxonomy : V. C. Kapoor.
- Animal diversity : Fingerhann.
- Text book of invertebrate Zoology : J.A. Young.
- Text book of invertebrate Zoology : S.N. Prasad.
- The invertebrates : Hyman Series.
- Cambridge Natural History series.
- Invertebrate Zoology : Parker & Haswell.
- Invertebrate Zoology : P.A. Maglitsch, F.R. Seham, Oxford univ. Press.

ANIMAL DIVERSITY-II

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Diagnostic features and phylogeny of Fishes & Amphibia.
- Diagnostic features and phylogeny of Reptilia & Birds.
- Diagnostic features and phylogeny of Mammals.

Section-B

- Basic idea about origin of life.
- Mechanism of evolution (a) Species & Speciation (b) Variation (c) Mutation (d) Isolation (e) Natural Selection (f) Hardy-Weinberg law (g) Adaptations (h) Concept of Modern Synthetic theory.

Section-C

- Distribution of animals in time and space.
- An introduction to the science of Palaeontology, Fossil record, Dating & significance.
- Evolution of Horse and *Homo sapiens*.

Books Recommended :

- Text book of Vertebrate Zoology : S.N. Prasad.
- Vertebrate Zoology : Parker & Haswell.
- Vertebrate Biology : R.T. Orr.
- Anatomy & Physiology : C.C. Chatterjee.

ANIMAL SCIENCE LAB – II

L T P C

0 1 2 6

Max. Marks : 100

(CA: 40 + ESA: 60)

- Evolution of chordates on the basis of skeletal and integumentary systems.
- Study of connecting links of chordates with the help of specimens or models available in the lab.
- Study of some representatives of chordates showing following adaptations :
 - Aquatic
 - Desert
 - Fossorial and cursorial
 - Aerial and arboreal
- Haematological determinations :
 - Estimation of blood sugar
 - Estimation of serum total proteins
 - Estimation of serum cholesterol
 - Estimation of blood calcium
 - SGPT and SGOT
 - Estimation of Hemoglobin by light absorbance method
 - TLC, DLC
 - Neutrophil phagocytic index
 - ESR
- Examination of abnormal or pathological constituents of urine
 - Reducing sugars
 - Proteins
 - Blood
 - Bile pigment and salts
- Experiments based on reproduction biology
 - Study of vaginal smear of rat or mice to detect various stages of estrous cycle.
 - Pregnancy Test
- Preparation of report on local/wild fauna.
- Preparation of phylogenetic tree of animal kingdom
- Microscopic study :
 - Microscopic study of different developmental stages of blastula and gastrula.
 - Identification of stages of oogenesis and spermatogenesis.
 - Microscopic study of endocrine glands: Pituitary, Parathyroid Adrenal, Thymus, Hypothalamus.

ETHOLOGY AND NEUROBIOLOGY

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- An introduction to the field of neurobiology.
- Introduction to nervous system.
- Anatomy of brain, spinal cord and nerve.
- Neuroglia and Blood brain barrier.
- Physiology of nerve impulse conduction, synapse and neuromuscular junction.
- Classification & anatomy of receptors and sense organs.
- An idea about the physiology of sleep and pain.

Section-B

- Definition of Ethology, ethological approach to the study of behaviour, a brief outline of classical and modern theories of ethology.
- Development of behaviour-Instinct, learning, imprinting and motivation.
- Neural mechanism of learning.
- Genes and behaviour.

Section-C

- Biological communication.
- Biological clocks and rhythms.
- Social behaviour - The advantages of grouping, sociology, social insects, social organisation of vertebrates, primates
- Applied ethology-Ways in which an ethological research can be applied to practical problems.

Books Recommended :

- Human physiology : C.C. Chatterjee
- Text book of medical physiology : Guyton.
- The Study of Animal Behaviour : Fellicity Hunt Ingford.
- An Introduction to Animal behaviour : A. Manning, Cambridge Univ. Press.
- Ethology : R. Mathur, Rastogi Publications.
- The oxford companion to Animal Behaviour : M.C. David
- Animal Behaviour : M.P. Arora.
- An Introduction to Ethology : P.J.B. Slaters, Cambridge Univ. Press.
- Principles of Anatomy & Physiology - GM Tortora.

HISTOLOGY

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Introduction to Histology, methods for the study of histology and observation of living and killed tissue.
- Epithelial tissue : Classification, special structural features, and specialization of free surface epithelia.
- Connective tissue : General types and special properties of connective tissue with special reference to cartilage and bone.

Section-B

- Liquid connective tissue : blood, bone marrow and lymphoid tissue.
- Muscular tissue : Structure of different types of muscular tissue (Skeletal, Cardiac & Smooth muscles)
- Nervous tissue : Structure of the elements of nerves tissue, neurons, nerve fibers. neuralgia, synapse and meninges.

Section-C

- Histological study of the organs with special reference to mammal : Skin, Oesophagus, Stomach, Intestine, Rectum, Liver, Pancreas, Trachea, Lung, Blood vessels, Kidney, Testis, Ovary, Uterus, Retina, Cochlea and Vestibule.

Books Recommended :

- Histology : Bloom.
- A Textbook of Histology : Narayan.
- Basic Histochemistry : Summner, John Wiley & Sons.
- A Textbook of Histology : Leeson and Leeson.
- Histology : Janquera

MEDICAL PATHOLOGY

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- An introduction to the science of medical pathology.
- Cell injury & adaptation : Causes of cell injury, death and adaptation, pathogenesis & morphology of cell injury, intracellular accumulations, subcellular alterations, cellular adaptations, calcification & hyaline change.
- Fluid & Haemodynamic dearrangements : Edema hyperemia, haemorrhage, thrombosis, embolism, unfarction, shock.

Section-B

- Genetic diseases : Autosomal dominant & recessive disorders, Sex-chromosomal disorders, disorders with Multifactorial inheritance, disorders with variable modes of transmission.
- Neoplasia : Characteristics of benign & malignant neoplasms, attributes of transformed (cancerous) cells Carcinogenic agent and their cellular interactions unifying theory of carcinogenesis.
- Nutritional disorders : Protein -calorie Malnutrition (PCM), vitamin deficiencies, trace elements deficiency, obesity, diet & cancer.

Section-C

- Study of some disorders of common interest : Dental decay (caries), peptic ulcers, haemorrhoids, appendicitis, jaundice, viral hepatitis, cholelithiasis (Gallstone), angina pectoris (AP).
- Myocardial Infarction (MI), hypertension, meningitis, intracranial haemorrhage, Parkinsons disease, osteoarthritis & rheumatoid arthritis.

Books Recommended :

- Pathologic Basis of Disease : Cortran, Kumar, Rubbins.
- Basic Pathology 7th ed. : Kumar, Cortran, Robbins, Elsevier.
- Method Pathology : Vinay Kumar
- Basic Pathology : S.L. Robins & Vinay Kumar, W.B. Snnders Co.

REPRODUCTION BIOLOGY AND ENDOCRINOLOGY

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Introduction and scope of endocrinology and reproduction biology.
- General survey of endocrine gland in vertebrates, study of structure and functions of pituitary, hypophyseal - hypothalamus complex, thyroid, parathyroid, adrenal and pancreas.
- Neuroendocrine system in invertebrates with special reference to insects and crustaceans.

Section-B

- Synthesis, secretion, transport and mechanism of action of hormones.
- Origin of primordial germ cells, spermatogenesis and spermeiogenesis, oogenesis and fertilization.
- Breeding seasons, reproductive cycles and their hormonal regulation in animals.

Section-C

- Endocrine control of gestation, lactation and parturition in mammals.
- Hormonal control of growth and metamorphosis in insects, Pheromones.
- Hormonal control of migration in birds and fishes.

Books Recommended :

- Endocrinology : Turner.
- Endocrinology : Hadley, Pearson Education.
- Comparative endocrinology : P.S. Bentley.
- Comparative endocrinology : Gorbman.
- Reproduction : Cohen.
- Reproductive physiology : B. Nalabandhuv.
- Physiology of reproductions : Marshall.
- Reproduction in Domestic animals : H.H. Cole and P.T. Ceeps.
- Comparative spermatology : Baccio Daccet.
- Textbook of Medical Physiology : A.C. Guyton.

ANIMAL SCIENCE LAB - I

L T P C

00 126

Max. Marks : 100
(CA: 40 + ESA: 60)

- Study of protista on the basis of Locomotory organs.
- Study of Parazoans on the basis of Skeletal, Canal and Reproductive systems.
- Study of metazoans on the morphological, germ layer and coelom basis taking the examples of each class or order as necessary.
- Study of the salient features of non-chordate connecting links with the help of specimens or models available in the lab.
- Study of some representative of non-chordate showing protective, feeding and parasitic adaptation.
- Study of microscopic slides of
 - Mouthparts of House fly/*Apis* and Mosquito
 - Histological Slides - Skin, Stomach, intestine, pancreas, liver, kidney, lungs, ear, testes, ovary.
- Preparation of permanent slides : Microtomy.
- Quality analysis of drinking water :
 - Estimation of Total hardness.
 - Estimation of Calcium content.
 - Estimation of Magnesium content.
 - Estimation of Chloride content.
 - Estimation of Sulphate content.
 - Estimation of Alkalinity.
 - Estimation of Dissolved Oxygen.
 - Estimation of Fluoride
- Study of life cycle of insects of economic importance.
- Lac insect, silkworm, honeybee and some stored grain pests with the help of specimens/chart/models/CD.

ADVANCE HORTICULTURE AND ETHNOBOTANY

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Basic horticultural techniques (soil preparation, bed preparation, transplantation & pruning)
- Vegetative propagation of plants (a) cutting (b) grafting (c) budding (d) layering (e) other special structures.
- Bonsai : Types, forms, structure and styles.
- Soil less culture (hydroponic, cocopeat)

Section-B

- Greenhouse Technology : Importance, types and operation techniques.
- Commercial cultivation of cutflowers (Roses, Gerberas & Carnations)
- Study of foliage plants (*Ficus*, *Croton* & *Coleus*)
- Study of one locally available vegetables (root, leafy, cole crops)

Section-C

- Study of tropical fruits (Mango, Amla, Date palm)
- Scope of ethnobotany in India.
- Ethnobotany with special reference to food, fruit, fuel, fodder, fibre & medicinal plants.
- Plants in folklore, folk songs, superstition and festivals.

Books Recommended :

- Introduction to Agricultural Botany in India Chalam, G.V.I. Venkateshwarlu J. : Asia Publishing House, New Delhi.
- Ankur : (Magazine)
- A Hand book of Field & Herbarium Methods : S.K. Jain & R.R. Rao, Today & Tomorrow's Printers & Publications, New Delhi.
- Contributions to Indian Ethnobotany : S.K. Jain
- A Manual of Ethnobotany : S.K. Jain
- Plant Propagation : Hartmann and Kester.
- Plant Propagation : M.K. Sandhu.

ANGIOSPERM TAXONOMY

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Classification System : (i) Takhtajan (ii) Cronquist (iii) Dahlgren.
- Botanical Nomenclature : (i) History of codes (ii) ICBN (iii) Principles (iv) Important international rules (v) Type (vi) Priority (vii) Amendments of codes.
- Modern trends in Plant taxonomy with special reference to evidence from the following branches (i) Anatomy (ii) Embryology (iii) Palynology (iv) Cytogenetics (v) Phytochemistry (vi) Numerical taxonomy.

Section-B

- Phylogeny of Angiosperms : origin of angiosperms, relation of monocotyledons to dicotyledons.
- Study of different taxonomic characters.
- Angiosperm families of special interest :
 - (i) Vesselless angiosperms : Winteraceae, Trochodendraceae, Tetracentraceae.
 - (ii) Insectivorous angiosperms : Lentibulariaceae, Droseraceae, Nepenthaceae.
 - (iii) Parasitic angiosperms : Santalaceae, Loranthaceae, Orobanchaceae, Cuscutaceae, Balanophoraceae.
 - (iv) Saprophytic : Monotropaceae, Burmariaceae.
 - (v) Aquatic, xerophytic and epiphytic angiosperms : Nymphaeaceae Alismataceae. Casuarinaceae, Cactaceae, Orchidaceae, Araceae.

Section-C

- Economically Important families :

Fabaceae, Poaceae, Solanaceae, Malvaceae, Askraceae, Musaceae, Arecaceae, Liliaceae, Apocynaceae, Asclepiadaceae, Cucurbitaceae, Lamiaceae, Myrtaceae, Rutaceae , Euphorbiaceae.

Books Recommended :

- Taxonomy of Angiosperms; Naik V.N. 1988, Tata Mc-Graw Hill Publishing Co., New Delhi.
- Plant Taxonomy & Bio-systematics 2nd edn. : Clive. A. Stace, G. dward Arnold Limited.
- Taxonomy of Vascular Plants : G.H.M. Lawrence, Mc-Millan Co. New York.
- Families of Flowering Plants Vol. 1 & 2 : J. Hutchinson, Oxford University Press.
- Evolution & Phylogeny in Flowering Plants : J. Hutchinson, Academic Press, London.
- Flowering Plants origin & dispersal : A. Takhtajan, Oliver & Boyd, Edinburgh.
- Classification of flowring plants : A.B. Rendle, Houghton Mifflin, Boston.
- Taxonomy Phytogeography & Evolution : O.H. Valentine, Academic Press, London.
- Modern Methods in Plant Taxonomy : V.H. Heywood, Academic Press, London.
- Plant Systematic 2nd ed. : S.B. Jones.
- Plant Systematics Aphylogenetic Approach : WS Judd and CS Campbell 2007, Sinarue Publication, New York

CURRENT TRENDS IN PLANT BIOTECHNOLOGY

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Development of pathogen resistant plants (fungal bacterial & insect resistance, Bt gene, manipulation of phytoalexins, PR proteins).
- Development of plants of improved seed quality.
- Development of abiotic stress resistant plants.
- Terminator seed technology.

Section-B

- Genetic transformation; vector mediated and direct transfer techniques.
- Chloroplast engineering; gene containment.
- *Arabidopsis* as a model plant for genetic engineering.
- Role of nif genes in Biological Nitrogen fixation.

Section-C

- Metabolic engineering and industrial products. General strategy towards production of plant cell products.
- Biotransformation using plant cells.
- Edible vaccines.
- G M foods & Hazards.
- Cryopreservation and Gene Banks.

Books Recommended :

- Biotechnology - A laboratory Course (1990) by J.M. Becker, G.A. Cold well and E.A. Zachgo Academic Press, New York.
- Genetic Engineering Technology in Industrial Pharmacy (1989) Ed. - J.M. Tabor (1989).
- Tissue Culture, Methods and Applications - P.F. Kruse.
- Biochemistry and Molecular Biology of Plants : Buchanan, Gressum and Jones, I K International Publications.

CYTOGENETICS AND PLANT BREEDING

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Breeding methods of self pollinated & cross pollinated crops.
- Improvement of Rice, Wheat & Maize through breeding in India.
- Inbreeding depression & heterosis.
- Incompatibility, pollen fertility, male sterility.

Section-B

- Field technique including randomized block design (RBD) & complete randomized design (CRD).
- Origin, cytology, effect & uses of structural chromosomal aberrations : translocations, inversions, duplications, deficiencies and their role in evolution and genotypic & phenotypic variations.
- Karyotype analysis, uses and its evolution.
- Heterozygote systems in *Oenothera*.

Section-C

- Euploidy, origin, cytology, genetics of haploids, haploids in agriculture.
- Polyploid-types, origin, cytology, genetics & genome analysis.
- Aneuploids - Terminology & chromosome formula, origin, cytology, genetics, transmission, effect & uses of Monosomics, trisomics & nullisomics.
- Extra nuclear inheritance.

Books Recommended :

- Principles of Plant Breeding : Allard, R.W. 1990 John Willey & Sons.
- Cytogenetics & Plant Breeding : Chandrasekharan & F. Parthasarthy & Varadrachary & Co. Madras.
- Methods in Plant breeding : Hayas, H.K., F.R. Immer & I.D.C. Smith, Mc-graw Hill Book Company.
- Introduction to Plant breeding : Biggs, F.N. & Knowles P.F. Reinhold.
- Genetics, Plant breeding : B.D. Singh, Kalyani Publications.
- Cytogenetics, Plant breeding and Evolution : P.K. Gupta, Rastogi Publication.
- Elementary Principles of Plant breeding : H.K. Chaudhary, Oxford & IBH Publishing Co., New Delhi, Bombay.

PLANT ECOLOGY AND BIODIVERSITY CONSERVATION

L T P C

4 0 0 4

Max. Marks : 100

(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Ecology and Ecosystem Concept : Relationship between structure & function in ecosystem, Homeostasis and stability of ecosystems. Concept of biosphere.
- Biogeochemical cycles : Concept, Hydrological, Sedimentary and Gaseous cycles, Recycle pathway.
- Biotic Community : Concept, Community association, discrete and continuous views; species niche; ecotype.

Section-B

- Plant succession : Type of succession, mechanisms of succession, general trends during succession, concepts of climax community.
- Population Dynamics; Properties of population, natality mortality, survivorship, Population age distribution.
- Grime's concept, r and k - strategies and Population growth curves.
- J-sloped and sigmoid growth forms, carrying capacity.
- Types of interaction between species.

Section-C

- Biological diversity : concepts and levels; role of biodiversity in ecosystem functions and stability.
- Evaluation of Biodiversity Index : Shannon - Weininger Index, Dominance Index, Similarity & Dissimilarity Index, Association Index.
- Speciation and extinction; IUCN categories of threat.
- Strategies for conservation - *in situ*, *ex situ* : field gene banks, *in vitro* repositories, cryobanks.

Books Recommended :

- Fundamentals of Ecology - E.P. Odum (Revised Edition)
- Basic Ecology - E.P. Odum.
- Plant and the Ecosystem - W.D. Billing.
- Elements of Ecology G.L. Clarke.
- Plants and Environment - R.F. Daubenmire.
- Environment and Plant Ecology - J.R. Etherington.
- Concepts of Ecology - E.J. Kormondy.
- Ecology - C.J. Krebs.
- Field Biology and Ecology - R.L. Smith
- Ecology workbook - R. Mishra
- Ecology - Richleffs.
- Communities and Ecosystems - R.H. Whittaker
- Foundations of Plant Geography - S.A. Caih.
- Biogeography - C.B. Cox, I.N. Healyrad, P.D. Heore.
- Phytogeography - Goods.
- Comparative Plant Ecology - J.P. Grime, J.Y. Hodgsons and R. Hunt.
- Terrestrial Plant Ecology : Barbor, Burk and Pitts.

PLANT PATHOLOGY

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Host parasite relationship, Infection, development and establishment of the disease.
- Epiphytotics : Compound and simple interest diseases, mathematical model, essential condition and analysis.
- Effect of environment in epidemiology of the disease.
- Genetic variability of plant pathogens.
- Genetic basis of host pathogen interactions, its role in specificity of plant disease.

Section-B

- Plant disease control : Physical, Chemical and Biological (Biocontrol, Breeding, Genetic Engineering).
- A general account of diseases caused by Bacteria, Viruses and Mycoplasma.
- Bacterial diseases : Red stripe of sugarcane, Angular leaf spot of cotton, Soft rot of vegetables.
- Viral diseases : Leaf roll of potato & tomato, Mosaic disease of tomato.
- Mycoplasma diseases : Sandal spike, *Sesamum* phyllody, Little leaf of Brinjal.

Section-C

- Fungal diseases of cereals and millets : Rusts of wheat, Loose and covered smut of wheat and Barley, fungal diseases of Bajra, Charcoal rot of Maize.
- Fungal diseases of vegetables and fruits : Early blight of Potato, Wart disease of Potato, Powdery mildew of Cucurbits & Pea, Die back of Chillies, Tikka disease of Groundnut, Wilt & root rot of Gram, Red rot and smut of Sugarcane.
- Nematode diseases : Root knot of vegetable (Cucumber), Molya disease of Wheat and Barley.
- Insect diseases : General account of plant and animal galls with special reference to Mango & *Ziziphus*.

Books Recommended :

- Introductory Mycology : C.M. Alexopoulos, John Wiley & Sons, New York.
- An Introduction to Viruses : S.B. Biswas, Vani Education.
- Text Book of Modern Pathology : K.S. Bilgrami & H.C. Dubey, Vikas Publishing House, New Delhi.
- Plant Pathology : R.S. Mehrotra, Tata McGraw Hill Publication Co.
- Fungi & Diseases in Plants : E.J. Butler, Tanker Spink & Co., Kolkata.
- Plant Disease : Singh, R.S., Oxford & IBH, New Delhi.
- Fungi & Plant Diseases, B. Mundkur : Macmillan & Co.
- Plant Pathology, Agrios, Simaner Publisher.

PLANT PHYSIOLOGY

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

Assimilation of Carbon in Plants :

- Photosynthetic pigments, their distribution & functions.
- Mechanism of Photosynthesis, Photosynthetic electron transport chain (Photophosphorylation).
- Carbon dioxide reduction cycles in C₃ & C₄ Plants : Enzymes of C₃ & C₄ cycles & their location in the chloroplast.
- Photorespiration : pathway, enzymes & metabolic significance.
- Crassulacean acid metabolism in plants.

Section-B

- Cell wall; Structure & functions, microfibril & matrix polysaccharides, proteins, lignins.
- Plant growth regulators : Physiological importance & mechanism of action of : (a) Auxins (b) Gibberellins (c) Cytokinins (d) Abscissic acid (e) Ethylene.
- Nitrogen Metabolism :
 - Nitrate and nitrite reduction.
 - Nitrogen fixation; mechanism and enzymes.
- Role of temperature and light in plant development with reference to Photoperiodism & vernalization.
- Phytochrome : Structure, function and mechanism of action.

Section-C

Dormancy :

- Nature and forms of dormancy, Mechanism of dormancy, Methods of breaking dormancy, Physiological basis of dormancy.
- Macro & Micronutrients : Availability & Uptake, Role & specific functions of plant nutrients.
- Biosynthesis of secondary metabolites, Major pathways : Shikimic acid, Acetate-malonate & acetate - mevalonate pathways.
- Physiological importance of secondary metabolites.

Books Recommended :

- Plant Physiology : Devlin & Witham, Van Narst.
- Plant Physiology : Salisbury & Ross, Prentice Hall of India.

- Introductory Plant Physiology : Noggle & Fritz, Prentice Hall of Pvt. India.
- Plant Physiology : Taiz and Zeiger, Introduction to Plant Physiology : W.G. Hopkins, John Wiley and Sons Inc.
- Plant Physiology : Pandey & Sinha.
- Biochemistry and Molecular Biology of Plants : Buchanan, Greissum and Jons, I K International

Publications

PLANT SCIENCE LAB-I

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

1. Determination of dissolved O₂ and total hardness in water.
2. Fluoride estimation in different water samples.
3. Biological assessment of water pollution.
4. Preparation of media for tissue culture.
5. Embryo culture.
6. Calibration of microscope and Camera Lucida drawings.
7. Screening of seed borne fungi by Blotter technique/Agar plate method.
8. Study of important bacterial, fungal and viral diseases of plants mentioned in syllabus.
9. Preparation of slides and identification of plant pathogens.
10. Effect of temperature/pH/RH on the growth of fungi.
11. Detailed study of locally available families.
12. Collection of plants and herbarium preparation.

PLANT SCIENCE LAB-II

L T P C

00 126

Max. Marks : 100
(CA: 40 + ESA: 60)

1. Estimation of Chlorophyll pigments.
2. Separation of plant pigments by TLC/Paper chromatography.
3. Isolation of chloroplast and demonstration of Hill's activity.
4. Calculation of RQ of Carbohydrates, fatty acids, and organic acids by Ganong's respirometer.
5. Layout of kitchen garden.
6. Vegetative propagation by cutting and grafting.
7. Vegetative propagation by budding and layering (Gootee).
8. To perform emasculation & hybridization.
9. Isolation of genomic DNA from plants.
10. Karyotype study.
11. Study of plant communities by random quadrat method. Determination of IVI Dominance index.
12. Determination of quotient of similarity of habitats.
13. Determination of Index of Association.
14. Determination of plant diversity indices.
15. Determination of organic carbon in soil.

PLANT TISSUE CULTURE AND EXPERIMENTAL EMBRYOLOGY

L T P C

4 0 0 4

Max. Marks : 100
(CA: 40 + ESA: 60)

Note : The paper is divided into three sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.

Section-A

- Historical background : Basic techniques of Plant tissue culture, surface sterilization, aseptic tissue transfer, concept of totipotency.
- Nutritional requirement of cells *in vitro*, various types of nutrient media.
- Techniques of cell culture; batch culture, continuous cultures, viability and growth tests; single cell cloning.
- Somatic embryogenesis, Organogenesis.

Section-B

- Protoplast technology : Isolation viability test, culture and cell wall formation, Fusion of protoplasts.
- Somatic Hybrids - Selection method, gene expression and various applications of somatic hybridization.
- Micropropagation and cloning of plants. Applications of micropropagation in agriculture, horticulture and forestry.
- Artificial seed Technology.

Section-C

- Variability in tissue culture, somaclonal and other variations.
- Haploid production : Anther culture, ovary culture.
- Zygotic Embryo culture, Endosperm culture.
- Apomixis and its application in agriculture; adventive embryos.

Books Recommended :

- Cell culture Methods for Molecular & Cell Biology Vol. 4 : D.W. Barnes.
- Cell & Tissue Culture : Laboratory Procedure : A. Doyle.
- Plant tissue culture - S.S. Bhojwani and M.K. Razdan, Elsevier.
- An Introduction to Plant Tissue Culture - M.K. Razdan.
- Biotechnology in agriculture and forestry - 17 volumes Y.P.S. Bajaj, Narosa.
- Hand Book of Cell and organ culture (2nd edition). Merchant *et al.*
- Plant Cell Culture - A Practical Approach : R.A. Dixon - IRL Press.
- Applied Plant Biotechnology : Ignacimuthu.
- Plant cell and Tissue Culture : Rienert and Yeoman.
- Plant Cell Culture : Butenko.
- Plant Tissue culture methods and Applications in Agriculture : T.A. Thorpe, Academic Press Inc.