

BANASTHALI VIDYAPITH

Bachelor of Computer Applications



Curriculum Structure

First Semester Examination, December-2019
Second Semester Examination, April/May-2020
Third Semester Examination, December-2020
Fourth Semester Examination, April/May-2021
Fifth Semester Examination, December-2021
Sixth Semester Examination, April/May-2022

BANASTHALI VIDYAPITH
P.O. BANASTHALI VIDYAPITH
(Rajasthan)-304022

July, 2019

No. F. 9-6/81-U.3

**Government of India
Ministry of Education and Culture
(Department of Education)**

New Delhi, the 25th October, 1983

NOTIFICATION

In exercise of the powers conferred by Section 3 of the University Grants Commission Act, 1956 (3 of 1956) the Central Government, on the advice of the Commission, hereby declare that Banasthali Vidyapith, P. O. Banasthali Vidyapith, (Rajasthan) shall be deemed to be a University for the purpose of the aforesaid Act.

Sd/-

(M. R. Kolhatkar)

Joint Secretary of the Government of India

NOTICE

Changes in Bye-laws/Syllabi and Books may from time to time be made by amendment or remaking, and a Candidate shall, except in so far as the Vidyapith determines otherwise, comply with any change that applies to years she has not completed at the time of change.

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Programme Educational Objectives

The main objectives of the programme are:

- › Design and develop applications to analyze and implement databases and write programs in different programming languages to solve all computer science related problems
- › Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects
- › Integrate and apply efficiently the contemporary IT tools to all computer applications
- › Solve and work with a professional context pertaining to ethics, society, culture, environment and business
- › Involve in perennial learning for a continued career development and progress as a computer professional
- › Communicate effectively and present technical information in oral and written reports
- › Function competently as an individual and as a leader in multidisciplinary projects to demonstrate computing and management skills
- › Create and design innovative methodologies to solve complex problems for the betterment of the society
- › Apply the inherent skills with absolute focus to function as a successful entrepreneur
- › BCA graduates who will exhibit effective work ethics and be able to adapt to the challenges of a dynamic job environment.
- › Acquire proficiency in the basic mathematics, statistics and probability employed in Computer Science.

Program Outcomes

After completion of the course, the student will achieve the following:

- **PO1. Domain Knowledge:** Apply the knowledge of mathematics, strong fundamental concepts on data structures, database technologies, programming such as C, C++, Java, COBOL, etc., networking, multimedia in the modeling and design of IT applications. Also apply the knowledge gained on laboratory experiments.
- **PO2. Problem analysis:** Identify, formulate, and analyze existing algorithms for different real life problems using different domain knowledge
- **PO3. Design/development of solutions:** Design, develop, test and maintain desktop, web and cross platform software applications using modern tools and technologies that are technically sound, economically feasible, socially and industrially acceptable.
- **PO4. Analyzing Complex problems:** Use domain based knowledge to function effectively on various problems to achieve a common goal to provide effective solutions for complex real life problems using limited resources.
- **PO5. Usage of Modern IT tools:** Use MS Office tools such as Word, Excel, PowerPoint and Access for computing, analysis and interpretation of data and simulation tools for problem solving in different computer application domain.
- **PO6. The Professional and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional computer applications.
- **PO7. Environment and sustainability:** Understand the impact of the professional computer applications in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- **PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10. Communication:** Exhibit the critical thinking and communication skills required to enable the graduate to communicate business ideas to senior management and general public.
- **PO11. Project Management:** Demonstrate knowledge of the computer application and management principles to apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change

Curriculum Structure

Bachelor of Computer Applications

First Year

Semester - I

| Course Code | Course Name | L | T | P | C* |
|------------------------|---|-----------|----------|----------|-----------|
| BVF 011/ BVF 014 | General English/सामान्य हिन्दी | 2 | 0 | 0 | 2 |
| | Core Foundation Course - I | 2 | 0 | 0 | 2 |
| CS 107 | Computer Fundamentals and Programming | 6 | 0 | 0 | 6 |
| CS 114L | Computer Fundamentals and Programming Lab | 0 | 0 | 4 | 2 |
| MATH 108 | Mathematics - I | 6 | 0 | 0 | 6 |
| MGMT 101 | Accounting and Financial Management | 6 | 0 | 0 | 6 |
| ELE 101L | Basic Digital Electronics Lab | 0 | 0 | 4 | 2 |
| Semester Total: | | 22 | 0 | 8 | 26 |

Semester - II

| Course Code | Course Name | L | T | P | C* |
|------------------------|---|-----------|----------|-----------|-----------|
| BVF 014/ BVF 011 | सामान्य हिन्दी /General English | 2 | 0 | 0 | 2 |
| | Core Foundation Course - II | 2 | 0 | 0 | 2 |
| CS 103 | Computer Architecture and Object Oriented Programming | 6 | 0 | 0 | 6 |
| CS 103L | Computer Architecture and Object Oriented Programming Lab | 0 | 0 | 6 | 3 |
| STAT 102 | Basic Statistics and Probability | 6 | 0 | 0 | 6 |
| STAT 102L | Basic Statistics and Probability Lab | 0 | 0 | 6 | 3 |
| MGMT 106 | Management Principles | 6 | 0 | 0 | 6 |
| Semester Total: | | 22 | 0 | 12 | 28 |

Second Year**Semester - III**

| Course Code | Course Name | L | T | P | C* |
|------------------------|---|-----------|----------|-----------|-----------|
| | Core Foundation Course - III | 2 | 0 | 0 | 2 |
| | Elective Foundation Course - I | 2 | 0 | 0 | 2 |
| CS 208 | Computer Oriented Numerical and Statistical Methods | 6 | 0 | 0 | 6 |
| CS 208L | Computer Oriented Numerical and Statistical Methods Lab | 0 | 0 | 4 | 2 |
| CS 211 | Data Structures | 6 | 0 | 0 | 6 |
| CS 211L | Data Structures Lab | 0 | 0 | 8 | 4 |
| MATH 204 | Mathematics - II | 6 | 0 | 0 | 6 |
| Semester Total: | | 22 | 0 | 12 | 28 |

Semester - IV

| Course Code | Course Name | L | T | P | C* |
|------------------------|---|-----------|----------|-----------|-----------|
| | Core Foundation Course - IV | 2 | 0 | 0 | 2 |
| | Elective Foundation Course - II | 2 | 0 | 0 | 2 |
| CS 201 | Application Software and Visual Computing | 6 | 0 | 0 | 6 |
| CS 217L | Application Software and Visual Computing Lab | 0 | 0 | 6 | 3 |
| CS 206 | Business Data Processing | 6 | 0 | 0 | 6 |
| CS 206L | Business Data Processing Lab | 0 | 0 | 6 | 3 |
| CS 215 | Systems Programming | 6 | 0 | 0 | 6 |
| Semester Total: | | 22 | 0 | 12 | 28 |

Third Year

Semester - V

| Course Code | Course Name | L | T | P | C* |
|------------------------|---|-----------|----------|-----------|-----------|
| | Vocational Course – I | 2 | 0 | 0 | 2 |
| | Core Foundation Course - V/ Elective Foundation Course - III | 2 | 0 | 0 | 2 |
| CS | 320 Programming in Java | 6 | 0 | 0 | 6 |
| CS | 321L Programming in Java Lab | 0 | 0 | 8 | 4 |
| MATH | 308 Quantitative Techniques (Math) | 6 | 0 | 0 | 6 |
| | Discipline Elective - I | 6 | 0 | 4 | 8 |
| Semester Total: | | 22 | 0 | 12 | 28 |

Semester - VI

| Course Code | Course Name | L | T | P | C* |
|------------------------|---|-----------|----------|-----------|-----------|
| | Vocational Course – II | 2 | 0 | 0 | 2 |
| | Elective Foundation Course - III/ Core Foundation Course - V | 2 | 0 | 0 | 2 |
| CS | 307 Multimedia and Web Designing | 6 | 0 | 0 | 6 |
| CS | 307L Multimedia and Web Designing Lab | 0 | 0 | 6 | 3 |
| MATH | 309 Introduction to Discrete Mathematics | 6 | 0 | 0 | 6 |
| CS | 310L Project Lab | 0 | 0 | 6 | 3 |
| | Discipline Elective - II | 6 | 0 | 0 | 6 |
| Semester Total: | | 22 | 0 | 12 | 28 |

List of Discipline Elective - I

| Course Code | Course Name | L | T | P | C* |
|-------------|--|---|---|---|----|
| CS | 319 Operating Systems | 6 | 0 | 0 | 6 |
| CS | 319L Operating Systems Lab | 0 | 0 | 4 | 2 |
| CS | 303 Database Management Systems | 6 | 0 | 0 | 6 |
| CS | 303L Database Management Systems Lab | 0 | 0 | 4 | 2 |
| CS | 323 Web Development and .NET Framework | 6 | 0 | 0 | 6 |
| CS | 323L Web Development and .NET Framework Lab | 0 | 0 | 4 | 2 |

List of Discipline Elective - II

| | | | | | | |
|----|-----|------------------------------|---|---|---|---|
| CS | 301 | Communication and Networking | 6 | 0 | 0 | 6 |
| CS | 322 | System Analysis and Design | 6 | 0 | 0 | 6 |
| CS | 318 | Cloud Computing | 6 | 0 | 0 | 6 |

List of Core Foundation Course

| Course Code | | Course Name | L | T | P | C* |
|-------------|-----|--------------------------------------|---|---|---|----|
| BVF | 002 | Environment Studies | 2 | 0 | 0 | 2 |
| BVF | 013 | Indian Cultural Heritage | 2 | 0 | 0 | 2 |
| BVF | 017 | Selected Writings of Great Authors-I | 2 | 0 | 0 | 2 |
| BVF | 020 | Women in Indian Society | 2 | 0 | 0 | 2 |
| BVF | 015 | Parenthood and Family Relation | 2 | 0 | 0 | 2 |

List of Elective Foundation Course

| Course Code | | Course Name | L | T | P | C* |
|-------------|-----|---------------------------------------|---|---|---|----|
| BVF | 010 | Design Thinking | 2 | 0 | 0 | 2 |
| BVF | 012 | Human Body and Health | 2 | 0 | 0 | 2 |
| BVF | 016 | Science of Happiness | 2 | 0 | 0 | 2 |
| BVF | 019 | Universal Human Values | 2 | 0 | 0 | 2 |
| BVF | 018 | Selected Writings of Great Authors-II | 2 | 0 | 0 | 2 |

List of Vocational Course I

| Course Code | | Course Name | L | T | P | C* |
|-------------|------|---|---|---|---|----|
| VOC | 011L | Basic Dress Making | 0 | 0 | 4 | 2 |
| VOC | 005L | Dress Designing | 0 | 0 | 4 | 2 |
| VOC | 014 | Entrepreneurship - I | 2 | 0 | 0 | 2 |
| VOC | 015 | Entrepreneurship - II | 2 | 0 | 0 | 2 |
| VOC | 020 | Radio Production - I | 2 | 0 | 0 | 2 |
| VOC | 021 | Radio Production - II | 2 | 0 | 0 | 2 |
| VOC | 022 | Web Designing and Internet Technology-I | 1 | 0 | 0 | 1 |
| VOC | 022L | Web Designing and Internet Technology-I Lab | 0 | 0 | 2 | 1 |
| VOC | 023 | Web Designing and Internet Technology-II | 1 | 0 | 0 | 1 |

| | | | | | | |
|-----|------|---|---|---|---|---|
| VOC | 023L | Web Designing and Internet Technology-II Lab | 0 | 0 | 2 | 1 |
| VOC | 009 | Library Science - I | 1 | 0 | 0 | 1 |
| VOC | 009L | Library Science - I Lab | 0 | 0 | 2 | 1 |
| VOC | 010 | Library Science - II | 1 | 0 | 0 | 1 |
| VOC | 010L | Library Science - II Lab | 0 | 0 | 2 | 1 |
| VOC | 018 | Photography - I | 0 | 0 | 4 | 2 |
| VOC | 019 | Photography - II | 0 | 0 | 4 | 2 |
| VOC | 016 | Introduction to Artificial Intelligence-I | 2 | 0 | 0 | 2 |
| VOC | 017 | Introduction to Artificial Intelligence-II | 2 | 0 | 0 | 2 |
| VOC | 012 | Computer Assisted Learning and Teaching | 1 | 0 | 0 | 1 |
| VOC | 012L | Computer Assisted Learning and Teaching Lab | 0 | 0 | 2 | 1 |
| VOC | 013 | Emerging Technologies for Learning & Teaching | 2 | 0 | 0 | 2 |

1. Student can opt for at most 2 additional Open (Generic) audit/credit Elective from other disciplines opting at most 1 per semester from Semesters III onwards with prior permission of respective heads and time table permitting.
2. Every Student shall also opt for:
 Five Fold Education: Physical Education I, Physical Education II,
 Five Fold Education: Aesthetic Education I, Aesthetic Education II,
 Five Fold Education: Practical Education I, Practical Education II
 one each semester

* **L - Lecture hrs/week ; T - Tutorial hrs/week;**
P - Project/Practical/Lab/All other non-classroom academic activities,
etc. hrs/week; C- Credit Points of the Course

Note: Syllabus of Foundation and Vocational courses are available in separate booklet, "Curriculum Structure and Syllabus Foundation and Vocational Courses"

Five Fold Activities

| Fine Arts | | Physical Education and Sports | |
|--|--|-------------------------------|---|
| BVFF 101 | Classical Dance (Bharatnatyam) | BVFF 201 | Aerobics |
| BVFF 102 | Classical Dance (Kathak) | BVFF 202 | Archery |
| BVFF 103 | Classical Dance (Manipuri) | BVFF 203 | Athletics |
| BVFF 104 | Creative Art | BVFF 204 | Badminton |
| BVFF 105 | Folk Dance | BVFF 205 | Basketball |
| BVFF 106 | Music-Instrumental (Guitar) | BVFF 206 | Cricket |
| BVFF 107 | Music-Instrumental (Orchestra) | BVFF 207 | Equestrian |
| BVFF 108 | Music-Instrumental (Sarod) | BVFF 208 | Flying - Flight Radio Telephone Operator's Licence (Restricted) |
| BVFF 109 | Music-Instrumental (Sitar) | BVFF 209 | Flying - Student Pilot's Licence |
| BVFF 110 | Music-Instrumental (Tabla) | BVFF 229 | Aeromodelling |
| BVFF 111 | Music-Instrumental (Violin) | BVFF 210 | Football |
| BVFF 112 | Music-Vocal | BVFF 211 | Gymnastics |
| BVFF 113 | Theatre | BVFF 212 | Handball |
| | | BVFF 213 | Hockey |
| Social Service and Extension Activities | | BVFF 214 | Judo |
| BVFF 301 | BanasthaliSewa Dal | BVFF 215 | Kabaddi |
| BVFF 302 | Extension Programs for Women Empowerment | BVFF 216 | Karate – Do |
| BVFF 303 | FM Radio | BVFF 217 | Kho-Kho |
| BVFF 304 | Informal Education | BVFF 218 | Net Ball |
| BVFF 305 | National Service Scheme | BVFF 219 | Rope Mallakhamb |
| BVFF 306 | National Cadet Corps | BVFF 220 | Shooting |
| | | BVFF 221 | Soft Ball |
| | | BVFF 222 | Swimming |
| | | BVFF 223 | Table Tennis |
| | | BVFF 224 | Tennis |
| | | BVFF 225 | Throwball |
| | | BVFF 226 | Volleyball |
| | | BVFF 227 | Weight Training |
| | | BVFF 228 | Yoga |

Evaluation Scheme and Grading System

| Continuous Assessment (CA) (Max. Marks) | | | | | End-Semester Assessment (ESA) (Max. Marks) | Grand Total (Max. Marks) |
|--|----|-----------------|----|---------------|---|-----------------------------|
| Assignment | | Periodical Test | | Total (CA) | | |
| I | II | I | II | | | |
| 10 | 10 | 10 | 10 | | | |

In all theory, laboratory and other non classroom activities (project, dissertation, seminar, etc.), the Continuous and End-semester assessment will be of 40 and 60 marks respectively. However, for Reading Elective, only End semester exam of 100 marks will be held. Wherever desired, the detailed breakup of continuous assessment marks (40), for project, practical, dissertation, seminar, etc shall be announced by respective departments in respective student handouts.

Based on the cumulative performance in the continuous and end-semester assessments, the grade obtained by the student in each course shall be awarded. The classification of grades is as under:

| Letter Grade | Grade Point | Narration |
|--------------|-------------|---------------|
| O | 10 | Outstanding |
| A+ | 9 | Excellent |
| A | 8 | Very Good |
| B+ | 7 | Good |
| B | 6 | Above Average |
| C+ | 5 | Average |
| C | 4 | Below Average |
| D | 3 | Marginal |
| E | 2 | Exposed |
| NC | 0 | Not Cleared |

Based on the obtained grades, the Semester Grade Point Average shall be computed as under:

$$SGPA = \frac{CC_1 * GP_1 + CC_2 * GP_2 + CC_3 * GP_3 + \dots + CC_n * GP_n}{CC_1 + CC_2 + CC_3 + \dots + CC_n} = \frac{\sum_{i=1}^n CC_i * GP_i}{\sum_{i=1}^n CC_i}$$

Where n is the number of courses (with letter grading) registered in the semester, CC_i are the course credits attached to the i^{th} course with letter grading and GP_i is the letter grade point obtained in the i^{th} course. The courses which are given Non-Letter Grades are not considered in the calculation of SGPA.

The Cumulative Grade Point Average (CGPA) at the end of each semester shall be computed as under:

$$CGPA = \frac{CC_1 * GP_1 + CC_2 * GP_2 + CC_3 * GP_3 + \dots + CC_n * GP_n}{CC_1 + CC_2 + CC_3 + \dots + CC_n} = \frac{\sum_{i=1}^n CC_i * GP_i}{\sum_{i=1}^n CC_i}$$

Where n is the number of all the courses (with letter grading) that a student has taken up to the previous semester.

Student shall be required to maintain a minimum of 4.00 CGPA at the end of each semester. If a student's CGPA remains below 4.00 in two consecutive semesters, then the student will be placed under probation and the case will be referred to Academic Performance Review Committee (APRC) which will decide the course load of the student for successive semester till the student comes out of the probationary clause.

To clear a course of a degree program, a student should obtain letter grade C and above. However, D/E grade in two/one of the courses throughout the UG/PG degree program respectively shall be deemed to have cleared the respective course(s). The excess of two/one D/E course(s) in UG/PG degree program shall become the backlog course(s) and the student will be required to repeat and clear them in successive semester(s) by obtaining grade C or above.

After successfully clearing all the courses of the degree program, the student shall be awarded division as per following table.

| Division | CGPA |
|-----------------|----------------|
| Distinction | 7.50 and above |
| First Division | 6.00 to 7.49 |
| Second Division | 5.00 to 5.99 |
| Pass | 4.00 to 4.99 |

CGPA to % Conversion Formula: % of Marks Obtained = CGPA * 10

First Semester

CS 107 Computer Fundamentals and Programming

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Sinha, P. K., & Sinha, P. BPP Publication. *Computer Fundamental*, Third Edition-2005, 12..
2. Mano, M. M. (2003). *Computer system architecture*. Prentice-Hall of India.
3. Norton, P. (1989). *Peter Norton's DOS guide*. Brady.
4. Balagurusamy, E. (2012). *programming in ANSI C*. Tata McGraw-Hill Education.
5. Venugopal K.R., *Programming with C*, Tata McGraw-Hill Publishing Company Limited.
6. Hayes John P., *Computer Architecture and Organization*, Tata McGraw Hill, New Delhi, 1998.
7. RAM B., *Computer Fundamentals*, Architecture & Organization, New Age International, New Delhi.

8. Kernighan Brian W., Ritchie Dennis M., *The C Programming Language*, Pearson Education, 2nd Edition, New Delhi Prentice Hall.
9. Kanetkar, Y. P. (2016). *Let us C*. BPB publications..
10. Gottfried, B. (1996). *Programming with C*, Schaum's Outlines

Suggested E-Resources:

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/>

CS 114L Computer Fundamentals and Programming Lab

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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.

MATH 108 Mathematics – I

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:

- Solve mathematics problems related to integration, differentiation, Binomial theorem.
- Solve problems related to fundamentals of logarithms,
- Understand the concept of sets, relation and function and apply them for simple problems.
- Explain the concept of Boolean algebra.

Unit-I Number system: GCD, Fibonacci Numbers, Sequences and series: AP, GP & HP, Sum of n Terms, Arithmetic-Geometric-Harmonic Means between Two Numbers (Excluding Arithmetic- Geometric Series), Logarithms: Definition, Laws regarding Product, Quotient, Exponent and Changes of Base.

Unit-II Sets: Definition, Operations on Sets (Union, Intersection, and Complement), De Morgan's laws, Inclusion-Exclusion Principle and its Applications, Relations: Binary Relation, Equivalence Relations, Equivalence Classes, Partitioning of a Set, Partial Order Relations, Boolean Algebra: Axioms, Properties, Simple Problems, Introduction to Switching Circuits. Introduction to Mathematical Induction.

Unit-III Geometrical Interpretation of Some Functions: Concept of a Function, Graph of Function, Graphs of Some Special Functions; Linear Function (Straight Line, Concept of Slope, Parallel and Perpendicular Lines, Point of Intersection of Two Lines), Quadratic Function; Circle, Conic Section (Concept of Eccentricity, Focus, Directrix, Axis, Double Foci), Trigonometric, Exponential (Exponential Curves), Logarithmic, Hyperbolic Functions (Specify Diagrams), Step Function.

Unit-IV Functions: Definition, Different Types, Limit: Analytical & Mathematical Definition, Continuity and Continuous Functions, Differentiation of Simple Function (Polynomial, Trigonometric, Logarithmic, Exponential) and Composite Functions
Simple Integration as Anti-Derivative, Techniques of Integration, Definite Integral.

Unit-V Binomial Theorem for Positive Integral Index and any Index; Binomial Coefficients, Application of Binomial Theorem in Summation of an Infinite Series, Application of Exponential series and Logarithmic Series in Summation of Infinite Series, Permutations (Simple and under Restrictions), Combinations (Selections with and without Replacement).

Suggested Text Book:

1. G.C. Sharma and M. Jain, *Mathematics for BCA*, Galgotia Publication Pvt. Ltd., New Delhi, 2001.

Suggested Reference Books:

1. Pulsinelli, Linda and Patricia Hooper, *Essential Mathematics*, McMillan New York, 1991.
2. S.K. Mittal and D.C. Agarwal, *Basic Mathematics*, 3rd edition, Pragati Prakashan.
3. P. Lerro Joseph, *Baic Mathematics*, Cahners Books, Boston, 1977.

Suggested E-learning material:

1. What do you want to learn in Class 11?:
<https://www.khanacademy.org/>
2. What do you want to learn in Class 12?:
<https://www.khanacademy.org/>
3. Class 11 math (India): <https://www.khanacademy.org/math/in-math-by-grade#in-in-grade-11-ncert>

Class 12 math (India):

<https://www.khanacademy.org/math/in-math-by-grade#in-in-grade-12-ncert>

MGMT 101 Accounting and Financial Management

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

6 0 0 6

Learning Outcomes:

Upon completion of the course student will be able to:

- Have knowledge of book-keeping and financial accounting.
- Maintain the basic books of accounts and prepare various statements.
- Process and prepare final accounts i.e. trading, profit and loss accounts and balance sheet.

Course Content:

Unit-I Introduction to Financial accounting meaning and scope, difference between financial accounting and management accounting. General accepted Accounting principles (GAAP), Rules of debit and credit.

Unit-II Journalizing, posting and preparation of final accounts- trial balances, trading account, profit & loss A/C & Balance sheet without adjustments.

Unit-III Cost accounting: meaning and importance, difference between cost and financial accounting and management accounting, cost concept, classification of costs and determination of cost.

Unit -IV Management accounting meaning and scope, Budgeting- meaning and preparation of budgets, Cost volume profit analysis.

Unit-V Financial management meaning, objective and role of financial manager in business, financial decisions and sources for raising funds for organization.

Suggested Readings:

1. D.K. Goel, Rajesh Goel & Shally Goel. (2017) *Accounting* (16ed). New Delhi: Arya Publications
2. T.S. Grewal. (2017) *Introduction to Accountancy* (18ed). New Delhi: Sultan Chand
3. Lal J. and Shrivastava, S. (2009) *Cost Accounting* (4 ed.), New Delhi: Tata Mcgraw Hill.
4. Khan M.Y. and Jain P.K. (2017), *Management Accounting* (7 ed.). New Delhi: Tata Mcgraw Hill.

Suggested E Learning Materials:

1. 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>
2. MSG. (2018). *What is Accounting*. Retrieved from Management Study Guide: <https://www.managementstudyguide.com/financial-accounting-articles.htm>
3. Kumar, S. (2017, May 6). *Basic Concept of Accounting*. Retrieved from Youtube: <https://www.youtube.com/watch?v=eaJosm9Y5dQ>.
4. Badlani, D. (2014, Sep 5). *Financial Statement of Companies*. Retrieved from Youtube: <https://www.youtube.com/watch?v=TzBGN1OJS1E>.

ELE 101L Basic Digital Electronics Lab**Max. Marks : 100****L T P C****(CA: 40 + ESA: 60)****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).

Second Semester

CS 103 Computer Architecture and Object Oriented Programming

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Mano, M. M. (2002). *Digital design*. EBSCO Publishing, Inc...
2. Mano, M. M. (2003). *Computer system architecture*. Prentice-Hall of India.
3. Balagurusamy, E. (2001). *Object Oriented Programming with C++, 6e*. Tata McGraw-Hill Education.
4. Schildt, H. (2003). *C++: The complete reference*. McGraw-Hill..
5. Hafez, A. A. (1988). *Computer architecture and organization*
6. Venugopal, K. R. (2013). *Mastering C++*. Tata McGraw-Hill Education.
7. Lafore, R. (2001). *Object-oriented programming in Turbo C++*. Galgotia publications.
8. Stroustrup, B. (2000). *The C++ programming language*. Pearson Education India..
9. Kumar K., *Programming with C++ Made Simple*.

Suggested E-Resources:

1. Programming in C++
<https://nptel.ac.in/courses/106105151/>
2. Computer Organizations and Architecture
<https://nptel.ac.in/courses/106103068/>
3. Stallings, W. (2003). *Computer organization and architecture: designing for performance*. Pearson Education India.
<http://williamstallings.com/ComputerOrganization/>

CS 103L Computer Architecture and Object Oriented Programming Lab

Max. Marks : 100**L T P C****(CA: 40 + ESA: 60)****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.

STAT 102 Basic Statistics and Probability

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

6 0 0 6

Learning Outcomes:

On completion of the course, the student will be able to,

- Learn the nature of statistics and how it plays an important role in our daily lives.
- Organize and summarize data, and represent graphically the important information contained in a data set.
- 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.
- Understand and apply the basic concepts of statistical inference.

Unit-I Introduction to Statistics - Arranging data, frequency distribution, graphing frequency distribution. Measures of central tendency - definition and objective, types, mean, median, mode, geometric mean, harmonic mean (their characteristics and applications), Measures of dispersion - range, standard deviation and variance, coefficient of variation, moments, skewness and kurtosis.

Unit-II Probability & random variable - basic concepts of probability, Multiplication and Addition theorem of probability. Joint, Marginal and Conditional probability. Baye's theorem. Random variable - definition, distribution function, probability mass function and probability density function.

Unit-III Probability distribution - discrete and continuous variables, Binomial, Normal and Poisson distributions, probability density functions.

Unit-IV Curve fitting by the principle of least square. Correlation and simple regression, the concept of covariance and correlation, cause and effect of correlation, the scatter diagram, correlation analysis, rank correlation. Regression coefficient, lines of regression.

Unit-V Sampling and Testing of hypothesis - Basic concept of sampling - population, sampling distribution and standard error. Sampling procedures; simple random sampling and stratified random sampling, (principles and procedures only), Large sample test for proportion, mean, and variance.

Note : Use of scientific calculator is permissible.

Text Books:

1. Gupta, S.C. and Kapoor, V. K: *Fundamentals of Mathematical Statistics*; Sultan Chand and sons.
2. Gupta, S.P. *Statistical Method*; Sultan Chand and sons.
3. Agrawal, B.L.; *Basic Statistics*, New Age International Publication.

Reference Books:

1. Yule, G.U. and Kendall, M.G: *An Introduction to the Theory of Statistics*, Universal Book Stall
2. Freund John E.; *Modern Elementary Statistics*, Prentice Hall of India.
3. Agarwal, N.P. , Tailor, R.K.: *Statistical Methods*, Malik & Company, Jaipur.

Suggested E-learning material

1. Probability and Mathematical Statistics; Platform:
<http://www.math.louisville.edu/~pksaho01/teaching/Math662TB-09S.pdf>

STAT 102L Basic Statistics and Probability Lab

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

0 0 6 3

Learning Outcomes:

On completion of the course, the student 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.
- Fit the linear regression equation for real data sets arising in various fields of the populations.

Lab No. Problems

- L1-L5 Preparation of frequency table by using exclusive and inclusive method of classification for continuous/discrete variable.
- L6-L10 Tabulation of data.
- L12 Diagrammatic representation of data by :
Simple Bar, Sub-divided Bar and Multiple Bar diagrams.
Squares, Circles and Pie-diagrams.
- L13-L20 Simple Bar, Sub-divided Bar and Multiple Bar diagrams.
- L21-L25 Squares, Circles and Pie-diagrams.
- L26-L30 Graphical representation of data by :
(i) Histogram (ii) Frequency polygon
(iii) Frequency Curve (iv) O gives
- L31-L35 Determination of Mean, Median, Mode, G.M., H.M., Quartiles, Deciles and Percentiles.
- L36-L38 Computation of :
(i) Range, Standard deviation, Mean deviation, Quartile deviation and Coefficient of variation.
(ii) Combined mean and combined standard deviation.
- L39-L40 Computation of first four moments with sheppard's correction, Measures of Skewness and kurtosis.
- L41-L42 Fitting of the following curves by the method of least squares :
(i) Straight line (ii) Parabola
(iii) Exponential Curve (iv) Power Curve
- L43-L44 Computation of coefficients of correlation and rank correlation.
- L44-L45 Fitting of regression lines.
- L46-L47 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 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, spreadsheet, package or programming.

MGMT 106 Management Principles

| | | | | |
|---------------------------|----------|----------|----------|----------|
| Max. Marks : 100 | L | T | P | C |
| (CA: 40 + ESA: 60) | 6 | 0 | 0 | 6 |

Learning Outcomes:

Upon completion of the course student will be able to:

- Evaluate the global context for taking managerial actions.
- Understand conflict resolution, motivation and leadership
- Understand various theories and management principles.

Course Content:

Unit-I Importance, Definition and Nature of Management. Evolution of Management Thought : Scientific, Administrative, Human relations, Systems.

Unit-II Planning : concept, purpose, process. Objectives and Goals. Policies, Strategies, Decision Making, MBO. Organising: concept, purpose process, Organizational Structure, Departmentation, Delegation, Decentralization, Span of management.

Unit-III Leading : concept and importance. Theories of Leadership - Trait, Behavioral, Situational. Communicating: concept, purpose, process, and principles. Types of communication and barriers of communication.

Unit-IV Motivation-importance, theories of motivation Maslow, McClland and Herzberg theory. Controlling : concept, purpose, process and types.

Unit-V Cultural context, practices and work ethics of American, Japanese and Indian organizations and their comparative analysis. Indian ethos : 9 M model for management - Feminine dimensions.

Suggested Reading:

1. Tripathi, P. C., & Reddy, P. N. (2017) *Principles of Business Management*, (22ed.) Tata McGraw Hill, New Delhi
2. Robbins & D. Cenzo. *Fundamentals of Management*(10ed), New Delhi, Pearson Education Asia
3. Prasad,L.M.*Principles and Practice of Management*(9ed). Sultan Chand & sons, New Delhi
4. Weihrich&Koonts. *Management-A Global Perspective*(13ed), Tata McGraw Hill, New Delhi

Suggested E-Learning Materials:

1. Prachi, J. (2016). *Planning Function of Management*. Retrieved from Management Study Guide: https://www.managementstudyguide.com/planning_function.htm
2. Amit,L. (2018, December). *Controlling: Features, Process and Types*. Retrieved from: <https://www.youtube.com/watch?v=JRVXfaFrMEM>
3. Brian, T. (2017, May 11). *Different Types of Leadership Styles*. Retrieved from: <https://www.youtube.com/watch?v=vilZazhIjoc>
4. Chandan,P (2017, September 26). *Organising:Meaning,Process and Types*. Retrieved from https://www.youtube.com/watch?v=XrmJG_8d9Cg

Third Semester

CS 208 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:

1. Rajaraman, V. (2004) *Computer Oriented Numerical Methods*.
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.
5. Grewal, B. S. (2018). *Numerical Methods in Engineering and Science: (C, and C++, and MATLAB)*. Stylus Publishing, LLC.
6. Krishnamurthy, E. V., & Sen, S. K. *Numerical Algorithms: Computations in Science and Engineering*. 2001. Affiliated East-West Press, New Delhi.
7. GovilR., *Kamputer se sankhyatmak Reetiyen*, et.al. Pitamber Publications, New Delhi
8. Krishnamurthy, E. V., & Sen, S. K. (1976). *Computer-based numerical algorithms*. East-West Press.
9. Rao, K. S. (2017). *Numerical methods for scientists and engineers*. PHI Learning Pvt. Ltd..
10. Yule, G. U., & Kendall, M. G. (1987). *An Introduction to the Theory of Statistics* Universal Book Stall. New Delhi.

11. Agarwal, B. L. (2006). *Basic statistics*. New Age International.
12. Govil R. *Kamputer se sankhyatmak Reetiyan*, et.al. Pitamber Publications, New Delhi

Suggested E-Resources:

1. Numerical methods and programming
<https://nptel.ac.in/courses/122106033/>

CS 208L Computer Oriented Numerical and Statistical Methods Lab

| | | | | |
|---------------------------|----------|----------|----------|----------|
| Max. Marks : 100 | L | T | P | C |
| (CA: 40 + ESA: 60) | 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. |

CS 211 Data Structures

| | | | | |
|---------------------------|----------|----------|----------|----------|
| Max. Marks : 100 | L | T | P | C |
| (CA: 40 + ESA: 60) | 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:

1. Ullman, J. D., Aho, A. V., & Hopcroft, J. E. (1974). *The design and analysis of computer algorithms*. Addison-Wesley, Reading, 4, 1-2.
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..
3. Knuth D.E., *Fundamental Algorithms (The Art of Comp. Prog. Vol. 1)*, Narosa Publishing House, New Delhi

4. Horowitz, E. (2006). *Fundamentals of data structures in C++*. Galgotia Publications.
5. Tenenbaum, A. M. (1990). *Data structures using C*. Pearson Education India.
6. Kruse, R., & Tondo, C. L. (2007). *Data structures and program design in C*. Pearson Education India.
7. Lipschutz, S. (1987). *Schaum's Outline of Data Structure*. McGraw-Hill, Inc...

Suggested E-Resources:

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/>

CS 211L Data Structures Lab

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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. |

MATH 204 Mathematics - II

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

6 0 0 6

Learning Outcomes:

On completion of the course, the student will be able to,

- Solve linear Equations by matrix Methods
- Understand the importance of LPP in daily life
- Recognize the connections between different branches of mathematics
- Recognize and appreciate the connections between theory and applications
- Appreciate the role of mathematical proof as a means of conveying mathematical knowledge

Unit I Higher order derivatives, functions of two variables and partial differentiation. Multiple integration, Beta and Gamma functions and their relationship.

Unit II Application of derivative: geometrical, dynamical, optimization (maxima-minima of a function of single variable, two variables introduction only).

Application of integration- rectification of curves, area under curves, volume and surface of solids of revolution (simple curves).

Unit III Differential equation: order and degree of a differential equation, solution of differential equations of first order and first order and first degree: (i) separation of variables (ii) homogeneous equation (iii) Linear differential equation (including Bernoulli's form), Solution of second order differential equation, complementary functions and particular integral (simple problems).

Unit IV Matrix: Definition, order, types (rectangular, square, row, column, triangular, diagonal, unit, null), conjugate, transpose, symmetric and skew- symmetric, hermitian and skew- hermitian, matrix addition, subtraction and multiplication, Non-singular matrix, inverse of a non-singular matrix (by adjoint matrix method) rank, determinant, properties of determinants (without proof), evaluation of determinant, up to third order. Simultaneous equations: homogenous and non-homogeneous equation, use of determinants and matrices in solving linear equations.

Unit V Linear programming: formulation, graphical, the simplex method, two phase method & Charne's M- Technique.

Suggested Text Books:

1. G.C. Sharma and M. Jain, Mathematics for BCA, Galgotia Publication Pvt. Ltd., New Delhi, 2001.
2. Shantinarian, Differential Calculus, S. Chand and Co., Delhi, 1987.
3. Shantinarian, Integral Calculus, S. Chand and Co., Delhi, 1987.
4. Bansal & Dhama, Differential Equation Vol I, JPH, 2005
5. S.D. Sharma, Operation Research, Kedar Nath and Ram Nath, Meerut 2005.

Suggested Reference Books:

1. Manmohan, Swarup and Gupta, Operations research, S. Chand and Co., Delhi, 2003.
2. Shantinarian, A Course of Mathematical Analysis, S. Chand and Co. Delhi 1987.

Suggested E-learning material

1. Matrix: <https://www.askiitians.com/iit-jee-algebra/matrices-and-determinants>
2. Higher Order Derivatives, Multiple Integration, Applications of Differentiation, Applications of Integration: <https://www.cliffsnotes.com/study-guides/calculus/...derivative/higher-order-derivative>.
3. LPP: <https://www.analyticsvidhya.com/.../introductory-guide-on-linear-programming-explain>

Fourth Semester

CS 201 Application Software and Visual Computing

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Govil R. et al, *PC Software*, New Delhi:BPB
2. Robinson, C. (1999). *Access 2000: No Experience Required*. SYBEX Inc..
3. Deitel, H. M., Deitel, P. J., & Nieto, T. R. (2001). *Visual Basic.Net with Cdrom*. Prentice Hall PTR.
4. Platt, D. S. (2002). *Introducing Microsoft. Net*. Microsoft press.
5. Esposito, D. (2011). *Programming Microsoft ASP.net 4*. Pearson Education.
6. *Developing XML Web Services Using Microsoft® ASP.NET - Microsoft-* Microsoft Press
7. Reilly, D. J. (2002). *Designing microsoft asp. net applications*. Microsoft Press.
8. 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:

1. W3Schools website
<https://www.w3schools.com/asp/>
2. Grundgeiger, D. (2018). *Programming Visual Basic. NET*. O'Reilly.
N/vbNet_programming.pdf

CS 217L Application Software and Visual Computing Lab**Max. Marks : 100****L T P C****(CA: 40 + ESA: 60)****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.)

CS 206 Business Data Processing

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Clifton, H. D. (1974). *Systems analysis for business data processing*.
2. Orilla, An Introduction to Business Data Processing, Mc Graw Hill
3. Roy, M. K., & Dastidar, D. G. (1989). *COBOL Programming*. Tata McGraw-Hill Education.
4. Awad, E. M. (1985). *Systems Analysis and Design*.
5. Irwin, R. D., .Stern, N. B., & Stern, R. A. (1985). *Structured COBOL Programming*. John Wiley & Sons.

Suggested E-Resources:

1. COBOL Programming
<http://www.csis.ul.ie/cobol/course/Default.htm>
2. Norton, P. (2002). *Introduction to computers*. McGraw Hill.
<https://onlinestudy4u.files.wordpress.com/2012/10/introduction-to-computers-by-peter-norton-6th-ed.pdf>

CS 206L Business Data Processing Lab

Max. Marks : 100
L T P C
(CA: 40 + ESA: 60)
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 : <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - Creation - Insertion - Deletion - Modification |
| L27-L30 | Program for SORT, MERGE and INPUT-OUTPUT procedure |
| L31-L34 | Program for performing following operations on Relative file <ul style="list-style-type: none"> - 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.

CS 215 System Programming

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Donovan, J.J., & International Student edition. (1972). *Systems programming* (Vol. 3, No. 5). New York: McGraw-Hill.
2. Das, S. (2005). *Your UNIX: The ultimate guide*. McGraw-Hill, Inc..
3. Duncan, R. (1988). *Advanced MS-DOS Programming* (p. 309). Redmond, WA: Microsoft Press.
4. Ellzee, *System Software*, Science Research Association.
5. Bose, S. K. (1996). *Hardware and Software of Personal Computers*. New Age International..
6. Biggerstaff T.J., *System Software Tools*, Pentrice - Hall..
7. 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.,
8. Kanetkar, Y. P. (1996). *Unix shell programming*. BPB Publ...
9. Dhamdhare, D. M. (1999). *Systems Programming and Operating Systems*. Tata McGraw-Hill.
10. Beck, L. L. (1997). *System software: an introduction to systems programming*. Addison-Wesley.

Suggested E-Resources:

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

Fifth Semester

CS 320 Programming in Java

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 Object oriented features to program design and implementation.
- Explain object-oriented concepts and describe how Java including identifying the features and peculiarities of the Java programming language supports them.
- Use Java to demonstrate practical experience in developing object-oriented solutions using graphical components.

Syllabus

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)

Suggested Books:

1. Bhawe, M. P., & Patekar, S. A. (2009). *Programming with Java*. Pearson Education.
2. Kahate, *Java Programming*. Oxford
3. Balagurusamy, E., & Hirshfield, S. (2000). *Programming with java*. Tata McGraw-Hill.
4. Mughal, K. A., & Rasmussen, R. W. (2016). *A Programmer's Guide to Java SE 8 Oracle Certified Associate (OCA)*. Addison-Wesley Professional.
5. Arnold, K., Gosling, J., & Holmes, D. (2005). *The Java programming language*. Addison Wesley Professional.
6. Zukowski, J. (1998). *Mastering Java 2*. SYBEX Inc..
7. Deitel, P., & Deitel, H. (2011). *Java How to program*. Prentice Hall Press.
8. Horstmann, C. S., & Cornell, G. (2002). *Core Java 2: Volume I, Fundamentals*. Pearson Education.
9. Schildt, H. (2007). *Java: the complete reference*. McGraw-Hill.

Suggested E-Resources:

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>

CS 321L Programming in Java Lab**Max. Marks : 100****L T P C****(CA: 40 + ESA: 60)****0 0 8 4**

| 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 |

MATH 308 Quantitative Techniques (Math)

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

6 0 0 6

Learning Outcomes:

On completion of the course, the student will be able to,

- Formulate and solve problems as networks and graphs.
- Define and formulate linear programming problems and appreciate their limitations.
- Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
- Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.
- Develop abilities to think critically and analytically to address more challenging optimization problems.

Unit 1 Calculus revisited, first and second order derivatives, applications: marginal revenue, marginal cost, marginal product, marginal utility, concept of elasticity, optimization through calculus. Application of integration: total revenue, total cost, total product, total utility.

Unit 2 Linear programming revisited, applications in optimization of profit, production etc. Limitation of LPP methods.

Unit 3 Transportation problems : Introduction, North-West corner method (NWCM), Least Cost Method (LCM), Vogel's Approximation method (VAM), The modified distribution method (MODI).

Assignment problem : Hungarian method.

Unit 4 Graph theory revisited : Weighted graphs, Directed graphs and networks, PERT and CPM network, computation of CPM, Distinction between PERT and CPM.

Unit 5 Simulation : Introduction, Steps in simulation process, Monte Carlo Simulation, Generation of Random Numbers for Monte Carlo Simulation, Applications of Simulation in PERT and CPM.

Text Books:

1. Vohra, N.D: Quantitative techniques in Management ;Tata Mcgraw Hill Publishing company limited.

2. Sharma, S.D. Operation Research , Kedar Nath Ram Nath and company

Reference Books:

1. Kapoor, V. K: Operation Research ; Sultan Chand and Sons
2. Tulsian,P.C. and Pandey, V: Quantitative techniques, Pearson Education
3. Srivastava, Shenoy and Sharma: Quantitative techniques for Managerial Decision Making; New Age International Pvt. Ltd

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/>

Sixth Semester

CS 307 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:

1. Ray, D. S. *Mastering HTML 4.0*, 1997. Sybex, San Francisco, CA, USA
2. Bayross, I. *Web Enabled Commercial Application Development by using HTML, Java Script, DHTML and PHP*
3. Reinhardt, R. (2004). *Flash Mx 2004 Action Script Bible*. John Wiley & Sons.
4. Bangia, R. (2004). *Multimedia and Web Technology*. Firewall Media.
5. Alexis, L., & Mathews, L. (1997). *Internet for everyone*
6. Wirasinha, A. (2002). *Flash in a Flash: Web Development*. Prentice-Hall of India.
7. Jeffcoate, J. (1995). *Multimedia in practice: technology and applications*. Prentice-Hall, Inc..
8. Holzner, S. (2007). *PHP: the complete reference*. Tata McGraw-Hill Education.

Suggested E-Learning Materials:

1. W3Schools website
<https://www.w3schools.com/>
2. Internet Technology
<https://nptel.ac.in/courses/106105084/13>

CS 307L Multimedia and Web Designing Lab

Max. Marks : 100
L T P C
(CA: 40 + ESA: 60)
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 |

MATH 309 Introduction to Discrete Mathematics

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Notes on Graph Theory: <https://www.geeksforgeeks.org/engineering-mathematics-tutorials/>
2. Discrete Mathematics: <http://mathworld.wolfram.com/DiscreteMathematics.html>

CS 310L Project Lab**Max. Marks : 100****L T P C****(CA: 40 + ESA: 60)****0 0 6 3**

The students have to design & develop a software project following SDLC approach in groups (not executing three/four)

- Problem Definition & Requirement analysis report
- Design
- Implementation
- Documentation (report)

Discipline Electives**CS 319 Operating Systems****Max. Marks : 100****L T P C****(CA: 40 + ESA: 60)****6 0 0 6****Learning Outcomes:**

On 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
- Learn Case study of Unix OS.

- Unit I** Operating system 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, Operating Systems for Embedded Devices, Introduction to popular operating systems like UNIX, DOS, Windows, etc.
- Unit II** Parallel processing and distributed processing: concept, differences, OS. Process management: Process status, schedulers, scheduling algorithms, Inter process communication: Shared memory and message passing, Process Synchronization.
- Unit III** Critical Section problem and its hardware, software and semaphore solutions, classical problems in concurrent programming. Memory management: partition, paging and segmentation demand paging, virtual memory, page replacement algorithms, thrashing.
- Unit IV** Secondary storage: Disks, disk space management, Scheduling algorithms. Management file supports, access methods, allocation methods, contiguous, linked and indexed allocation, directory Systems I/O processor management: I/O traffic controller, I/O scheduler, I/O device handlers.
- Unit V** Deadlock: Prevention, Avoidance, Detection and recovery. Protection and Security - Accessibility and Capability Lists UNIX: File System, Inode, Types of shells, Commands (basic, file mgmt, process mgmt, pipelines), vi editor, shell programming.

Suggested Books:

1. Silberschatz, A., Gagne, G., & Galvin, P. B. (2003). *Operating System Concepts* (6th ed.). Addison Wiley Publications.
2. Godbole, A. S. (1995). *Operating Systems with Case Studies in Unix, Netware, Windows NT*. Tata McGraw-Hill Education.
3. Kanetkar, Y. P. (1997). *Unix Shell Programming*. BPB Publications.
4. Tanenbaum, A. S. (2009). *Modern Operating System* (3rd ed.). Pearson Education.
5. Dietel, H. M. (2003). *Operating Systems* (2nd ed.). Pearson Education.

Suggested E-Resources:

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

CS 319L Operating Systems Lab

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

0 0 4 2

UNIX Shell Programming Assignment Lab

1. Shell script to perform various arithmetic operations.
2. Shell script to find the factorial of a number.
3. Shell script to reverse a no. and check for the no. to be palindrome or not.
4. Shell script to find whether no. is prime or not.
5. Shell script to generate Fibonacci series.
6. Shell script to generate table of a given no.
7. Shell script to generate star pattern.

```

      *
    *   *
  *   *   *
    *   *
      *
  
```

8. Shell script to search a particular login entered by you. This program should continuously run on background to let you know about when that user has logged in.
9. Shell program for sorting a set of nos. The set of no. are to be entered through file.
10. Shell script to Generation and summation of natural numbers (and their various forms) e.g. $12 + 32 + 52 + \dots$
11. A shell script for binary to decimal conversion.
- 12-14. Shell program to generate and sum all prime numbers between any two given numbers.
- 15-17. Shell program for equivalent effect of the DOS command TYPE.
- 18-20. Shell script to protect a file through password. Password should be displayed in encrypted form.

CS 303 Database Management Systems

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Silberschatz, A., Korth, H. F., & Sudarshan, S. (1997). *Database system concepts* (Vol. 4). New York: McGraw-Hill.
2. Date C.J, An Introduction to Database systems, Addison Wesley
3. Elmasri, R., & Navathe, S. (2003). *Fundamentals of Database Systems* Addison Wesley. Reading, MA.
4. Majumdar & Bhattacharya, *Database Management System*, Tata McGraw-Hill
5. Ramakrishna, Gehkre, *Database Management System*, Tata McGraw-Hill
6. Leon, A., & Leon, M. (2010). *Database management systems*. Vikas Publishing House Pvt. Limited
7. Ullman, J. D. (1984). *Principles of database systems*. Galgotia publications
8. Shah, N. (2016). *Database Systems Using Oracle*. Pearson Education India
9. Gupta, P. K. D., & KRISHNA, P. R. (2013). *Database management system Oracle SQL and PL/SQL*. PHI Learning Pvt. Ltd
10. Martin, J. (1977). *Computer database organization*. Prentice Hall PTR.

Suggested E-Resources:

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>

CS 303L Database Management Systems Lab

Max. Marks : 100
L T P C
(CA: 40 + ESA: 60)
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. |

CS 323 Web Development and .NET Framework

Max. Marks : 100
L T P C
(CA: 40 + ESA: 60)
6 0 0 6

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
- Use of XML in ADO.NET and SQL server.

Unit-I 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.

Unit-II Object Oriented Programming in C#, Classes and Objects, Encapsulation, Polymorphism, Inheritance, Interfaces and

Collections, Properties, Exceptions Handling, Garbage Collector, Operator Overload Conversions Operators.

Advance C#: Delegates, Events. Advance C# type Construction, Indexers, Generics, Threading, File Handling.

Unit-III 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.

Unit-IV 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.

Unit-V 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*. Apèss Publication, 2007

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
<https://nptel.ac.in/courses/106105084/>

CS 323L Web Development and .NET Framework Lab

Max. Marks : 100
L T P C
(CA: 40 + ESA: 60)
0 0 4 2

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 |

List of Discipline Elective - II

CS 301 Communication and Networking

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

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:

1. Stallings, W. (2007). *Data and computer communications*. Pearson Education India.
2. Forouzan, A. B. (2007). *Data communications & networking*. Tata McGraw-Hill Education.
3. Tanenbaum, A. S., & Wetherall, D. (2014). *Computer networks*. Harlow, Essex: Pearson,.
4. Martin, J. (1978). *Computer networks and distributed processing*.

Suggested E-Resources:

1. 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
2. Data Communication
<https://nptel.ac.in/courses/106105082/>

CS 322 System Analysis and Design

Max. Marks : 100

L T P C

(CA: 40 + ESA: 60)

6 0 0 6

Learning Outcomes:

On successful completion of the course students will be able to

- Understand the need of system Analysis.
- Design different tools associated with system analysis
- Design understand the requirement of computer center management.

Unit I Overview of System Analysis and Design (SAD): Developing Systems and System Development Life Cycle (SDLC) , Traditional SDLC, Structured Analysis and Structured Design, System concepts and Information System environment (the system concepts, characteristics, elements, types). Management Organization theory and System Approach. Need for System Analysis, Role of System Analyst.

Unit II Structured Analysis: Planning & initial investigation, information gathering. Tools of structured Analysis – Process Modeling Tools [Context Diagrams, Data Flow Diagrams (DFD)], Conceptual Data Modeling (ERD, Data Dictionary), Process Logic Modeling (Decision Tables, Decision Trees, Structured English), Feasibility study, Cost/Benefit Analysis.

Unit III System Design : Logical Design, Physical Design, The Process and Stages of System Design, Designing databases, Designing Input/Output Forms and Reports, Designing user Interfaces and Dialogues, Finalizing design specifications, Designing Distributed and Internet Systems.

Unit IV System Testing (procedure and types) and Quality Assurance (Goals and levels of QA), Control Audit and Security, System Implementation/Conversion: various methods (Direct, Parallel, Single Location (Pilot), Phased Installation) and criteria/ factors for the selection of best one, Documenting the system, Training and supporting users, Post Implementation and Maintenance-procedure and types. Case Studies.

Different Approaches to Improving System Development : Prototyping and Joint Application Design, Concept of Object Oriented Analysis and Design.

Risk Management, System Security- Threats and Plans for Disaster Recovery

Unit V The Meaning and Role of Management Information System (MIS), Information Systems for Decision Making (DSS, GDSS), MIS development Cycle : Planning for designing and implementing the MIS, Pitfalls in MIS development. Applications of MIS to E-Business - Applications in manufacturing and Service sector.

Suggested Books:

1. Awad Elias, *System Analysis and Design*, second edition, Galgotia Publications.
2. Murdick & Others, *Information Systems for Modern Management*, third edition, PHI
3. Jawadekar, W.S, *Management Information System*, fourth edition Tata McGraw Hill.
4. Rajaraman V., *Analysis and Design of Information Systems*, second edition PHI

5. Hawryszkiewicz I, *Introduction to System Analysis & Design*, Fourth edition, PHI
6. Kendal and Kendal, *System Analysis and Design*, Seventh Edition, Pearson Education.

CS 318 Cloud 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

- Apply cloud computing model in real application.
- Use programming paradigms like Map Reduce 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.

Unit I 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).

Unit II Virtualization Technology: Overview, Architecture, Virtual machine technology, Virtual Machine Provisioning & Migration, Fault Tolerance Mechanisms. virtualization of data centers.

Resource Management and Load Balancing: Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization, Resource dynamic reconfiguration,

Unit III 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.

Unit IV 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).

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.

Unit V 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:

1. Cloud Computing
<https://nptel.ac.in/courses/106105167/1>
2. Cloud Computing Specialization
<https://www.coursera.org/specializations/cloud-computing>