

Department of Bioscience & Biotechnology

Banasthali Vidyapith, Banasthali

**Minutes of the Board of Studies held on December 26, 2018 at 3:00 p.m. in the
Conference Room, Department of Bioscience and Biotechnology, Banasthali Vidyapith**

Present

1. Prof. Arun Kumar Sharma	External Member
2. Prof. N. P. Singh	External Member
3. Dr. Afroz Alam	Internal Member
4. Shri Anand Prakash	Internal Member
5. Dr. Aneesh Goyal	Internal Member
6. Dr. Arindam Kuila	Internal Member
7. Dr. Arun Sharma	Internal Member
8. Prof. Dipjyoti Chakraborty	Convener (in the Chair)
9. Dr. Girish C. Pandey	Internal Member
10. Dr. Himani Kuntal	Internal Member
11. Dr. Jyoti Mathur	Internal Member
12. Dr. Kakoli Dutt	Internal Member
13. Dr. Laxmi Parwani	Internal Member
14. Dr. Monika Sharma	Internal Member
15. Dr. Nidhi Srivastava	Internal Member
16. Dr. Priyanka Singh	Internal Member
17. Dr. Rashmi Tripathi	Internal Member
18. Dr. Sangeeta Choudhary	Internal Member
19. Dr. Sarika Gupta	Internal Member
20. Dr. Sharad Vats	Internal Member
21. Dr. Surbhi Bajpai	Internal Member
22. Dr. Surya P Singh	Internal Member
23. Dr. Swati Paliwal	Internal Member
24. Dr. Teena Agarwal	Internal Member
25. Prof. Veena Sharma	Internal Member

Note: Prof. Partha Roy, Dr. Shashi Kumar and Dr. Anil Prakash, External Members and Prof. Veena Garg, Prof. Nilima Kumari, Dr. Suphiya Khan, Dr. Rupesh Kumar, Dr. Manisha Sharma, Internal Member could not attend the meeting.

The meeting started with a welcome of the members, by the convener of Board of Studies for Bioscience and Biotechnology, Prof. Dipjyoti Chakarborty, Head, Department of Bioscience and Biotechnology, Banasthali Vidyapith, Rajasthan.

1. The Board took up for confirmation of the minutes of its last meeting held on March 15, 2012.

The Board resolved that the minutes of its last meeting be confirmed.

2. The board updated the panel of examiners for various examinations of Bachelor's and Master's degree in accordance with the Bye-laws 15.3.02 of the Vidyapith. The existing panel will continue to be retained. The updated list of examiners is submitted.
3. The various courses running in the department viz., B.Sc. Bioscience, B.Sc. Biotechnology, B.Tech. Biotechnology, M.Sc. Bioscience (Animal Science), M.Sc. Bioscience (Plant Science), M.Sc. Applied Microbiology and Biotechnology, M.Sc. Biotechnology, M.Tech. Biotechnology, Certificate Course in Molecular Modeling and Drug Designing, Diploma in Computational Biology were placed before the board, thoroughly discussed and revision proposed as under:

3. Ia **B.Sc. Bioscience:** In the first semester of the B.Sc Bioscience Programme, phyla of the non chordates are proposed to be incorporated in the course ZOO 102: Taxonomy, Classification and Evolution for clear understanding. Modifications are proposed in the laboratory course ZOO 102L: Taxonomy, Classification and Evolution Lab viz., preparation of permanent slides is proposed to be shifted from the first semester to the second semester laboratory course; study of the microscopic slides of the phyla Protozoa - Nematelminthes is proposed to be retained in the ZOO 102L course and study of the microscopic slides of phyla Annelida - Protochordata is proposed to be shifted to the second semester lab course i.e. ZOO 101L as the theory course of second semester i.e. ZOO 101 includes the detailed study of the invertebrates; study of the museum specimens is proposed to be shifted from second semester lab course to the first semester lab course ZOO 102L.

The syllabus of the first semester course BOT 101: Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms is proposed to be modified.

In the second semester, the course ZOO 101: Non-Chordates and Proto-Chordates, is proposed to be modified. The nomenclature of the animals and their anatomical systems have been specified for clear understanding of the experiments to be covered; preparation of the permanent slides and the study of the microscopic slides is proposed to be included in the laboratory course ZOO 101L: Non-Chordates and Proto-Chordates Lab.

In the third semester, the course ZOO 201: Cell Biology, Molecular Biology, Histology and Genetics, Biochemistry is proposed to be modified with the contents of human genetics included in the genetics portion of the Unit-V. The Laboratory course ZOO 201L: Cell Biology, Molecular Biology, Histology and Genetics Lab is proposed to be modified.

In the third semester, the course BOT 201: Angiosperm Taxonomy and Economic Botany, is proposed to be modified with some topics from Unit-I elaborated for clear understanding. The laboratory course BOT 201L: Angiosperm Taxonomy and Economic Botany are proposed to be modified with inclusion of preparation of herbarium sheets which is an important component of taxonomy.

In the fourth semester, the course ZOO 202L: Comparative Anatomy and Embryology of Chordates Lab is proposed to be modified. The course BOT 202: Microbiology and Plant Pathology, is proposed to be modified viz., bacteriological section in Unit-I and virology section in Unit-II is proposed to be more elaborated and related topics placed together. The laboratory course BOT 202L: Microbiology and Plant Pathology Lab is proposed to be modified by elaborating the existing microbiological exercises and including certain more relevant experiments in microbiology.

In the fifth semester course 5.1: Environmental Biology, the topic i.e. 'pollution' which is already covered as such in the course 5.1: Plant Physiology and Ecology is proposed to be replaced by biostatistics. It will introduce the fundamental principles of biostatistics and its role in the data analysis which would help the students to apply the biostatistics tools. The nomenclature of the course is proposed to be renamed as 'Environmental Biology and Biostatistics'. The laboratory course 5.2: Environmental Biology Lab is proposed to be renamed as 'Environmental Biology and Biostatistics Lab'. The syllabus of the fifth semester courses 5.1: Plant Physiology and Ecology and 5.2: Plant Physiology and Ecology Lab are proposed to be modified.

In the sixth semester the course 6.1 Animal Physiology is proposed to be modified and certain topics elaborated. The sixth semester course 6.1: Introduction to Genetics and Genetic Engineering is proposed to be modified. Experiments of molecular biology and basic bio-safety laboratory guidelines are proposed to be incorporated in the laboratory course 6.2: Introduction to Genetics and Genetic Engineering Lab.

At present, in the fifth and sixth semester, three ALP courses (one each for botany, zoology and chemistry) are being conducted as a part of vocational course. It is proposed that the ALP courses be combined in a single ALP keeping the theme of vocational course (self employment). ALP-I course is proposed to run in the fifth semester with the experiments of chemistry and zoology while ALP-II course is proposed to run in the sixth Semester with the experiments of chemistry and botany. E-resources have been proposed for the theory courses and the list of recommended

books has been updated. The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabus is included and marked as **Appendix-IA** (page 14), **Appendix-IB** (page 15) and **Appendix-IC** (pages 16-63) respectively.

3. **Ib B.Sc. Biotechnology:** In the first semester of the B.Sc Biotechnology programme the course BOT 101L: Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms Lab, in the third semester BOT 201: Angiosperm Taxonomy and Economic Botany, BOT 201L: Angiosperm Taxonomy and Economic Botany Lab and in the fifth semester 5.1: Plant Physiology and Ecology, Lab 5.2: Plant Physiology and Ecology Lab which are running common with B.Sc. Bioscience programme are proposed to be modified as per the proposed changes in the same courses/ semester of B.Sc. Bioscience programme.

In the second semester of the, ZOO 101: Non-Chordates & Protochordates and ZOO 101L: Non-Chordates and Protochordates Lab courses are proposed to be modified as per the proposed changes in the same courses which are running common in second semester of B.Sc. Bioscience.

In the fourth semester, the course ZOO 202L: Comparative Anatomy and Embryology of Chordates Lab and in the sixth semester, the course 6.3: Animal Physiology are proposed to be modified according to the proposed changes in the same courses/semester of B.Sc. Bioscience programme. Some topics of the first semester course BT 102: Cell and Molecular Biology-I have been elaborated and specified for clear understanding of the topics to be covered.

In the first semester, laboratory exercises like study of cell organelles under microscope is proposed to be replaced by more relevant experiments in the BT 102L: Cell and Molecular Biology-I Lab course.

In the second semester, the contents of the course BT 101: Biostatistics, Bioinformatics and Instrumentation is proposed to be modified. Bioinformatics and biostatistics exercises have been elaborated and specified along with few modifications of existing practical exercises in the second semester course BT 101L: Biostatistics, Bioinformatics and Instrumentation Lab.

Relevant modifications in the contents of third semester course BT 202: Biochemistry, Biophysics and Enzymology and 202L: Biochemistry, Biophysics and Enzymology Lab is proposed. Enzymology exercises related to acid phosphatase extracted from moong is proposed to be replaced by the enzyme urease extracted from horse gram seeds.

In the fourth semester, genetics section in Unit-I is proposed to be extended by including some portion from the human genetics in the course BT 207: Genetics, Microbiology and Immunology. BT 207L: Genetics, Microbiology and Immunology Lab is proposed to be modified by introduction of new microbiological exercises.

In the fifth semester, the course 5.3: Genetic Engineering, rDNA Technology and Cell and Tissue Culture Technology is proposed to be modified. Few modifications are proposed to be included in the practical course 5.4: Genetic Engineering, rDNA Technology and Cell and Tissue Culture Technology Lab.

In the sixth semester course 6.1: Advances in Biotechnology, certain topics have been elaborated and specified. The elaboration is necessary for the better understanding. The bioinformatics exercise-1 & 2 from the laboratory course Lab 6.2: Advances in Biotechnology Lab is proposed to be replaced by more relevant exercises as per the course contents.

ALP courses in both the fifth and sixth semester of B.Sc. Biotechnology programme is common with the ALP course of B.Sc. Bioscience programme. At present, in the fifth and sixth semester, three ALP courses (one each for botany, zoology and chemistry) is being conducted as a part of vocational course. It is proposed that the ALP courses be combined in a single ALP keeping the theme of vocational course (self employment). ALP-I course is proposed to run in the fifth semester with the experiments of chemistry and zoology while ALP-II course is proposed to run in the sixth Semester with the experiments of chemistry and botany. E-resources have been proposed for the theory courses and the list of recommended books has been updated. The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabi is included and marked as **Appendix-IIA** (pages 64), **Appendix-IIB** (pages 65) and **Appendix-IIC** (pages 66-117) respectively.

3. II **B.Tech. Biotechnology**: In the first and second semester of the B.Tech Biotechnology programme, the contents of BIO101: Biology and ENGG 102L: Measurement Technique Lab is proposed to be revised by adding relevant topics/experiments.

In the third semester new experiments are proposed to be introduced in BT 204L: Biotechnology Lab-I. In the fourth semester course BT 203: Biophysics and Structural Biology is proposed to be revised and irrelevant portions removed. BT 205L: Biotechnology Lab-II is proposed to be modified. Seminar (BT 208S) is proposed to be shifted from the fifth semester to the third semester.

In the fifth semester, the course 'Probability and Statistics' is proposed to be introduced. Some practical's of the course BT 303L: Biotechnology Lab-III are proposed to be incorporated in the fourth semester laboratory course.

In the sixth semester, some modifications are proposed in the topics of the course BIN 301: Basic Bioinformatics. The course BT 305: Cell and Tissue Culture Technology is proposed to be dropped and contents incorporated in other relevant courses. The contents of the course BT 311: Recombinant DNA Technology, CHEM 301: Analytical Techniques and BT 304L: Biotechnology Lab-IV are proposed to be revised and updated. In the seventh semester, the reading electives BT 7.1.1: Plant Genetic Engineering and BT 7.1.2: Renewable Energy Resources are proposed to be replaced with three newly introduced and more relevant/updated courses viz., 'Molecular Diagnostics', 'Biodiversity and Conservation' and 'Emerging Trends in Biofuel', which will help in inculcating the habit of the self study/reading in students.

In the eighth semester, the courses 'Animal Biotechnology' and 'Plant Biotechnology' and laboratory course: Biotechnology Lab V are proposed to be revised. Moreover, the contents of elective course 'Food and Dairy Biotechnology' are proposed to be revised and updated and a course 'Geoinformatics' is proposed to be introduced. E-resources have been proposed for the theory courses and the list of recommended books has been updated. The BOS has recommended all the above mentioned modifications to the degree of B.Tech (Biotechnology). The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabi is included and marked as **Appendix-III A** (pages 118), **Appendix-III B** (pages 119) and **Appendix-III C** (pages 120-182) respectively.

3. IIIa **M.Sc. Bioscience (Animal Science)**: In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by "Biochemistry". The syllabi of the courses 'Cell & Molecular Biology', 'Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

In the second semester, the courses 'Biostatistics and Research Methodology', 'Genetics', 'Genetic Engineering' and 'Bioscience Lab-II' are proposed to be modified. The course BT 406 Enzymology and Enzyme technology is proposed to be dropped as the contents are repeated in other sections of the syllabi. In lieu of this course, BIO408: Environmental Biology and Toxicology is proposed to be shifted to the second semester from the third semester.

In the third semester, BIO 408: Environmental Biology & Toxicology is proposed to be shifted to second semester and a new course 'Biosystematics, Taxonomy and

Evolution' introduced. ZOO 503: Animal Diversity –I is proposed to be replaced by 'Biology of Non-Chordates'. The addition of these two courses will enhance the core Animal science component of the programme and provide much needed knowledge to the students in their preparations for various competitive examinations and also recruitment in various institutions where classical Zoology is in demand. ZOO 507: Ethology & Neurobiology is proposed to be shifted to semester IV and in its place, a paper common with M.Sc. Biotechnology, BT 507: Cell and Tissue Culture Technology is proposed to be included in the third semester. ZOO 508: Histology is discontinued and its relevant contents are proposed to be incorporated as a new course 'Biology of Chordates and Histology'. ZOO 505L: Animal Science Lab-I which is laboratory based course is being continued and relevant modifications have been proposed to cater to the proposed modification of the theory courses. Further, animal science specific elective courses: 'Insect Diversity, Morphology, Physiology and Ecology', 'Fish Biology' and 'Animal Biotechnology-I' are proposed to be introduced. BIO 503 Fundamentals of Bioentrepreneurship, BT 509 Environmental Biotechnology, BT 515 Genomics and Proteomics, BT 516 Immunotechnology and 'Biophysics-I' are proposed to be offered as common electives; 'Ecology and Environment'(c.w. M.Sc Environmental Science) is proposed to be introduced as an elective.

In the fourth semester, ZOO501: Advance Animal Physiology, ZOO 504: Animal Diversity-II, ZOO 510: Medical Pathology, ZOO 511: Reproductive Biology and Endocrinology is proposed to be discontinued, and relevant contents incorporated in new courses proposed to be introduced viz., 'Animal Physiology and Endocrinology', 'Biology of Chordates and Histology', 'Reproduction and Developmental Biology', 'Neurobiology and Animal Behavior'. ZOO 502: Animal Cell and Tissue Culture Techniques is proposed to be discontinued in this semester as BT 507: Cell and Tissue Culture Technology is proposed to be offered in the third semester. The laboratory based course, ZOO 506L: Animal Science Lab-II is proposed to be run with modified contents. The following electives courses are proposed to be introduced in the fourth semester. 'Applied Entomology and Pest Management', 'Capture Fishery', 'Animal Biotechnology-II', 'Immunotechnology-I' and 'Biophysics-II'. 'Biodiversity and Conservation' (c.w. M.Sc Environmental Science) is proposed to be introduced as an elective. The following reading electives are proposed to be offered in the fourth semester, viz., Drug Discovery, Human Genetics and Diseases, Intellectual Property Rights, Medical Microbiology, Molecular Plant Breeding and Protein Engineering. These courses will help in inculcating the habit of self study/ reading amongst students. The BOS has recommended all the above mentioned modifications to the degree of M.Sc. (Animal Science) for the third and fourth semester. E-resources have

been proposed for the theory courses and the list of recommended books has been updated. The proposed syllabus of M.Sc. (Animal Science) will fulfill the needs of students in terms of their acquaintance regarding both the basic and advanced concepts of the programme. The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabi is included and marked as **Appendix-IVA** (pages 183), **Appendix-IVB** (pages 184) and **Appendix-IVC** (pages 185-274) respectively.

3. IIIb **M.Sc. Bioscience (Plant Science)**: In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by "Biochemistry". The syllabi of the courses 'Cell & Molecular Biology', 'Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

In the second semester, the courses 'Biostatistics and Research Methodology', 'Genetics', 'Genetic Engineering' and 'Bioscience Lab-II' are proposed to be modified. The course BT 406 Enzymology and Enzyme technology is proposed to be dropped as the contents are repeated in other sections of the syllabi. In lieu of this course, BIO408: Environmental Biology and Toxicology is proposed to be shifted to the second semester from the third semester.

In the third semester of M.Sc. (Plant Science), BIO 408: Environmental Biology & Toxicology is proposed to be shifted to second semester. 'Phycology, Mycology and Lichenology' and 'Bryophyta, Pteridophyta and Gymnosperms' are proposed to be introduced as new courses. The addition of these two courses will enhance the core plant science component of the programme and provide much needed knowledge to the students in their preparations for various competitive examinations and also their recruitment in various institutions where classical botany is in demand. BOT 511: Plant Tissue Culture & Experimental Embryology is proposed to be replaced by 'Cell and Tissue Culture Technology.

BOT 507: Plant Pathology is proposed to be shifted to semester IV and in its place BT 507: Cell and Tissue Culture Technology is proposed to be introduced. BOT 509L which is laboratory based is proposed to be modified to cater to the courses introduced/ replaced.

'Phycology-I', 'Bryology-I', and 'Angiosperms Taxonomy and Biosystematics-I' is proposed to introduced as plant science specific electives while BT 521: Plant Biotechnology-I, BIO 503 Fundamentals of Bioentrepreneurship, BIO 505: Microbial Technology, BT 509 Environmental Biotechnology, BT 515 Genomics and Proteomics, 'Biophysics-I are proposed to be offered as common electives in the third

semester. Ecology and Environment'(c.w. M.Sc Env. Sci.) is proposed to be introduced as an elective

In the fourth semester BOT 501: Advanced Horticulture and Ethnobotany is proposed to be replaced by BOT: Angiosperms, while BOT 503: Current Trends in Plant Biotechnology is proposed to be dropped, as the content of this paper is already present in other courses. BOT 508: Plant Pathology is proposed to be shifted from third semester to the fourth semester. The laboratory based course, BOT 510L: Plant Science Lab has been modified.

In the fourth semester, Electives, viz., Phycology-II, Bryology-II, Angiosperms Taxonomy and Biosystematics-II are proposed to be included as plant science specific courses, while, Plant Biotechnology-Stress Biology, Biophysics-II courses are proposed as common electives. 'Biodiversity and Conservation' (c.w. M.Sc Env. Sci.) is proposed to be introduced as an elective

The following reading electives are proposed to be offered in the fourth semester, viz., Drug Discovery, Human Genetics and Diseases, Intellectual Property Rights, Medical Microbiology, Molecular Plant Breeding and Protein Engineering. These courses will help in inculcating the habit of self study/reading amongst students.

The BOS has recommended all the above mentioned modifications to the degree of M.Sc. (Plant Science) for the third and fourth semester.

The proposed syllabus of M.Sc. (Plant Science) fulfills the needs of students in terms of their acquaintance regarding classical botany, especially lower plant groups and also the recent advances in the subject.

The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabi is included and marked as **Appendix-VA** (pages 275), **Appendix-VB** (pages 276) and **Appendix-VC** (pages 277-360) respectively.

3. IIIc **M.Sc. Applied Microbiology and Biotechnology**: In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by "Biochemistry". The syllabi of the courses 'Cell & Molecular Biology', 'General Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

In the second semester, the courses 'Biostatistics and Research Methodology', 'Genetic Engineering' and 'Microbial Technology Lab-I' are proposed to be modified. The course BT 406 Enzymology and Enzyme technology is proposed to be dropped as the contents are repeated in other sections of the syllabi. In lieu of this course, BIO408: Environmental Biology and Toxicology presently running in M.Sc. Bioscience

programme is proposed to be introduced with modifications. The change was suggested to fulfil the need for emerging environmental concerns. The course BIO 411 Immunology is proposed to be introduced in the second semester and the course BIO 413 Medical Microbiology and Immunology is proposed to be dropped.

In third semester, the core courses 'Recombinant DNA Technology', 'Bioprocess Engineering and Technology', and 'Microbial Technology Lab-II' are proposed to be modified. BT 509: Environmental Biotechnology which is a core paper is proposed to be reintroduced as Elective. 'Critical Analysis of Classical Papers/ Landmark Discoveries' is proposed to be introduced in Seminar mode. The elective courses 'Fundamentals of Bioentrepreneurship', Genomics and Proteomics, 'Plant Biotechnology-I' are proposed to be modified and 'Animal Biotechnology-I' is proposed to be introduced. 'Ecology and Environment'(c.w. M.Sc Env. Sci.) is proposed to be introduced as an elective. The following reading electives are proposed to be offered in the third and the fourth semester, viz., Drug Discovery, Human Genetics and Diseases, Intellectual Property Rights, Medical Microbiology, Molecular Plant Breeding and Protein Engineering. These courses which will help in inculcating the habit of self study/ reading amongst students. E-resources have been proposed for the theory courses and the list of recommended books has been updated. All modifications have been done to suit the current requirements of various preparative exams and enhance the knowledge and skill component. The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabi is included and marked as **Appendix-VIA** (pages 361), **Appendix-VIB** (pages 362) and **Appendix-VIC** (pages 363-435) respectively.

3. III d **M.Sc. Biotechnology**: In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by "Biochemistry". The syllabi of the courses 'Cell & Molecular Biology', 'Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

In the second semester, the courses 'Biostatistics and Research Methodology', 'Genetics', 'Genetic Engineering' and 'Bioscience Lab-II' are proposed to be modified. The course BT 406 Enzymology and Enzyme technology is proposed to be dropped as the contents are repeated in other sections of the syllabi. In lieu of this course, BIO 408: Environmental Biology and Toxicology already running in M.Sc. Bioscience is proposed to be introduced with modifications. The change was suggested to fulfil the need for emerging environmental concerns.

In third semester, the core courses 'Recombinant DNA Technology', 'Bioprocess Engineering and Technology', 'Cell and Tissue Culture Technology' and 'Biotechnology Lab-I' are proposed to be modified. BT 509: Environmental Biotechnology which is a core paper is proposed to be reintroduced as Elective. 'Critical Analysis of Classical Papers/ Landmark Discoveries' is proposed to be introduced in Seminar mode. The elective courses 'Fundamentals of Bioentrepreneurship', Genomics and Proteomics, 'Plant Biotechnology' are proposed to be modified; 'Animal Biotechnology-I' and 'Biophysics-I' is proposed to be introduced. 'Ecology and Environment' (c.w. M.Sc Environmental Science) is proposed to be introduced as an elective. The following reading electives are proposed to be offered in the third and the fourth semester, viz., Drug Discovery, Human Genetics and Diseases, Intellectual Property Rights, Medical Microbiology, Molecular Plant Breeding and Protein Engineering. These courses will help in inculcating the habit of self study/reading amongst students. E-resources have been proposed for the theory courses and the list of recommended books has been updated. All modifications have been done to suit the current requirements of various preparative exams and enhance the knowledge and skill component. The board also reviewed the Programme Educational Objectives, Programme outcomes of the programme and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabi is included and marked as **Appendix-VIIA** (pages 436), **Appendix-VIIB** (pages 437) and **Appendix-VIIC** (pages 438-509) respectively.

3. IV **M.Tech. Biotechnology**: In the first semester, the courses 'Biological Databases and Computational Biology', 'Advanced Cell Biology', 'Bioprocess Engineering-I', 'Biotechnology Lab – I' are proposed to be updated with more relevant topics.

In the second semester, the contents of the course 'Bioprocess Engineering-II' have been rearranged. In the course 'Genetic Manipulation Technology', the contents are proposed to be rearranged in all the sections with incorporation of new and relevant topics. In the course 'Biotechnology Lab – II', the modification in the practical exercises are proposed to properly categorize and introduce relevant experiments. The contents of the elective paper 'Food Biotechnology', is proposed to be updated with removal of some repetitive portions.

The reading electives viz., BIO 601R: Biodiversity and Conservation, BIO 602R: Bioethics, Biosafety and IPR and BT 604R: Renewable Energy Sources, which were offered in the third and fourth semesters are proposed to be replaced with newly introduced and more relevant reading electives viz., Drug Discovery, Human Genetics

and Diseases, Intellectual Property Rights, Medical Microbiology, Molecular Plant Breeding and Protein Engineering, which will help in inculcating the habit of self study/reading in students. Moreover, the books of all the theory and practical papers have been updated following same format and e-resources have been introduced. E-resources have been proposed for the theory courses and the list of recommended books has been updated. The BOS has recommended all the above mentioned modifications to the degree of M.Tech Biotechnology. The proposed syllabus of M.Tech Biotechnology would fulfill the needs of students in terms of their knowledge of fundamental concepts and latest developments in the field of biotechnology. The board also reviewed the Programme Educational Objectives, Programme outcomes of the programme and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes and modified syllabi is included and marked as **Appendix-VIIIA** (pages 510), **Appendix-VIIIB** (pages 511) and **Appendix-VIIIC** (pages 512-558) respectively.

3. V Certificate Course in Molecular Modeling and Drug Designing

The Convener briefed the board of the objectives for introducing the Certificate Course in Molecular Modeling and Drug Designing in the department. The Course is structured to provide theoretical and practical knowledge of computational methods used in biomolecular studies and the drug discovery programs to the students with background in biology, chemistry and pharmaceutical sciences. Further, this course also include computer programming in order to enable the students to solve complex biological problems computationally. Theoretical introduction to drugable targets and biomolecular structures helps in understanding the complexities in drug discovery process. The hands on experiences with software and programming further augment the skills to take on the challenges of drug discovery. The external experts appreciated the proposed certificate course and mentioned that the students trained could have better placement opputunity in the pharmaceutical industries as well as in research programmes. The proposed syllabus is included and marked as **Appendix –IX** (pages 559-563).

3. VI Diploma in Computational Biology

The Convener briefed the board of the objectives for introducing the Diploma Course in Computational Biology in the department. The course has been structured to provide theoretical and practical knowledge of computational methods, used in the era of molecular biology, to the students without any prior knowledge of Bioinformatics. Theoretical introduction to computational biology methods will help in understanding the complexities in drug discovery process, sequence analysis and phylogenetic

reconstruction. The hands on experiences with relevant software and programming further augment the skills to take on the current challenges of molecular biology research and pharmaceutical industries. The external experts appreciated the proposed certificate course and were of the opinion that that the students trained could have better placement opportunity in the pharmaceutical industries as well be absorbed in various research programmes. The proposed syllabus is included and marked as **Appendix –X** (pages 564-570).

4. The Board noted the Curriculum for the courses running in the other programmes of the Vidyapith. The courses which are proposed to be modified/ updated/ discontinued are reviewed under point number 3 above.

5. The board considered the reports of examiners in various examinations of 2017-2018. Most of the examiners found the content of answers satisfactory or good and overall were quite satisfied with the performance of the students. In a few cases, wherever necessary, the reports were brought to the notice of concerned teachers so that corrective measures could be taken.

6. In view of the note of the Vice-Chancellor regarding the standard of the question papers, the Board examined the question papers of periodical test and annual examinations of the session 2017-18. These were thoroughly studied by the various subject teachers and the following observations were made:

The analysis of the question papers summarized in **Appendix XIA** (page 571-572) and details given in various tables and figures **Appendix XIB** (UG, page 573-597), and **Appendix XIC** (PG, page 598-606).

It was found that quality of question papers has not deteriorated in the session 2017-18 vis-à-vis the previous years. At UG level, on an average, more than 80% questions belong to either High (Excellent) or Medium (Good) category. Similarly, at PG level too, the results are nearly same.

The meeting ended with vote of thanks.



Dy. Registrar
Banasthali Vidyapith
(Rajasthan)

Department of Bioscience & Biotechnology

Banasthali Vidyapith, Banasthali

**Minutes of the Board of Studies held on December 26, 2018 at 3:00 p.m. in the
Conference Room, Department of Bioscience and Biotechnology, Banasthali Vidyapith**

Present

1. Prof. Arun Kumar Sharma	External Member
2. Dr. Asheesh Shanker	External Member
3. Prof. N. P. Singh	External Member
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8. Dr. Arun Sharma	Internal Member
9. Prof. Dipjyoti Chakraborty	Convener (in the Chair)
10. Dr. Girish C. Pandey	Internal Member
11. Dr. Himani Kuntal	Internal Member
12. Dr. Jyoti Mathur	Internal Member
13. Dr. Kakoli Dutt	Internal Member
14. Dr. Laxmi Parwani	Internal Member
15. Dr. Monika Sharma	Internal Member
16. Dr. Nidhi Srivastava	Internal Member
17. Dr. Priyanka Singh	Internal Member
18. Dr. Rashmi Tripathi	Internal Member
19. Dr. Sangeeta Choudhary	Internal Member
20. Dr. Sarika Gupta	Internal Member
21. Dr. Sharad Vats	Internal Member
22. Dr. Surbhi Bajpai	Internal Member
23. Dr. Surya P Singh	Internal Member
24. Mr. Sushil Buriya	Internal Member (Special Invitee)
25. Dr. Swati Paliwal	Internal Member
26. Dr. Teena Agarwal	Internal Member
27. Prof. Veena Sharma	Internal Member
28. Prof. Chandra Kumar Jha	Internal Member (Special Invitee)

Note: Prof. Partha Roy, Dr. Shashi Kumar, Dr. Anil Prakash and Dr. Ashok Sharma, External Members and Prof. Veena Garg, Prof. Nilima Kumari, Dr. Suphiya Khan, Dr. Rupesh Kumar, Dr. Manisha Sharma, Internal Member could not attend the meeting.

The meeting started with a welcome of the members, by the convener of Board of Studies for Bioscience and Biotechnology, Prof. Dipjyoti Chakarborty, Head, Department of Bioscience and Biotechnology, Banasthali Vidyapith, Rajasthan.

1. The Board took up for confirmation of the minutes of its last meeting held on 04th May, 2013.

The Board resolved that the minutes of its last meeting be confirmed.

2. The board updated the panel of examiners for various examinations of Bachelor's and Master's degree in accordance with the Bye-laws 15.3.02 of the Vidyapith. The existing panel will continue to be retained. The updated list of examiners is submitted.
3. The Board discussed M. Tech. Bioinformatics programme and after considerable deliberations, it was suggested to discontinue the programme from the academic session 2018-19.
4. The various courses running in the department viz., B.Sc. Bioscience, B.Sc. Biotechnology, B.Tech. Biotechnology, M.Sc. Bioscience (Animal Science), M.Sc. Bioscience (Plant Science), M.Sc. Applied Microbiology and Biotechnology, M.Sc. Biotechnology, M.Sc. Bioinformatics, M.Tech. Biotechnology, Certificate Course in Molecular Modeling and Drug Designing, Diploma in Computational Biology were placed before the board, thoroughly discussed and revision proposed as under:

3. IA. B.Sc. Bioscience (Botany and Zoology):

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b
iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^d
v.	Fifth Semester Examination, December, 2021	Change ^e
vi.	Sixth Semester Examination, April/May, 2022	Change ^f

- (a) In the first semester of B.Sc. Bioscience programme, laboratory course ZOO 102L is proposed to be modified by including the five major exercises: study of museum specimens, study of prepared slides, preparation of permanent mount, anatomical study of selected animals and collection & culture methods. Animals of invertebrate phyla (protozoa to protochordata) are included in these exercises. In the “anatomical study exercise”, the name of the animals and their anatomical systems have been specified for clear understanding. In addition to that, exercise related to study of

microscope, evolution & permanent mount preparation of mosquito are also proposed to be included in the revised syllabus.

Zoology course ZOO 102: Taxonomy, Classification and Evolution is proposed to be modified by inclusion of phyla of the non chordates for clear understanding of the topics to be covered.

The contents of the Botany course BOT 101: Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms and its laboratory course BOT 101L: Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms Lab are proposed to be revised and updated.

- (b)** In the second semester of B.Sc. Bioscience programme, laboratory course ZOO 101L is proposed to be modified by including the five major exercises as discussed in the first semester laboratory course ZOO 102L. These five major exercises are proposed to be included in laboratory courses of first (ZOO 102L) and second semester (ZOO 101L) because theory courses in these semesters deals with the study of invertebrates. Therefore, specimens of protozoa to protochordata phyla are placed in these five major exercises and are equally distributed in the first (ZOO 102L) and second semester (ZOO 101L) laboratory course. In addition to these five major exercises, permanent mount preparation of house fly is also proposed to be included.

In the second semester, the Zoology course ZOO 101: Non-Chordates and Proto-Chordates, is proposed to be modified.

- (c)** In the third semester, the Zoology course ZOO 201: Cell Biology, Molecular Biology, Histology and Genetics, Biochemistry is proposed to be modified with the contents of human genetics included in Unit-V.

The Laboratory course ZOO 201L: Cell Biology, Molecular Biology, Histology and Genetics Lab is proposed to be revised and updated.

The Botany course, BOT 201: Angiosperm Taxonomy and Economic Botany, is proposed to be modified with some topics from Unit-I elaborated for clear understanding.

The laboratory course BOT 201L: Angiosperm Taxonomy and Economic Botany is proposed to be modified with inclusion of preparation of herbarium sheets which is an important component of taxonomy.

- (d)** In the fourth semester, the course ZOO 202L: Comparative Anatomy and Embryology of Chordates Lab is proposed to be modified.

The course BOT 202: Microbiology and Plant Pathology, is proposed to be modified viz., bacteriological section in Unit-I and virology section in Unit-II is proposed to be more elaborated and related topics placed together. The laboratory course BOT 202L: Microbiology and Plant Pathology Lab is proposed to be modified by elaborating the

existing microbiological exercises and including certain more relevant experiments in microbiology.

(e) In the fifth semester, discipline electives are proposed to be offered in the fifth semester. For Botany discipline, four elective courses along with their practical exercises are proposed. The courses “Introduction to Genetics and Genetic Engineering” and “Plant Physiology and Ecology” are offered as core courses in the existing syllabus but now these two courses are proposed to be offered as a discipline electives along with the two newly introduced discipline elective courses “Ethnobotany” and “Horticulture”.

The complete list of elective courses of Botany discipline offered in the fifth semester are as follows

- Introduction to Genetics and Genetic Engineering
- Plant Physiology and Ecology
- Ethnobotany (Newly introduced)
- Horticulture (Newly introduced)

Similarly, for Zoology discipline, four elective courses along with their practical exercises are proposed to be offered in the fifth and sixth semesters. Out of these four courses, two courses “Animal Physiology” and “Environmental Biology and Biostatistics” are offered as core courses in the existing syllabus but now these two courses are proposed to be offered as discipline electives. In the Zoology discipline, two elective courses “Developmental Biology” and “Applied Zoology” are newly introduced.

These four elective courses are as follows

- Animal Physiology
- Environmental Biology and Biostatistics
- Developmental Biology (Newly introduced)
- Applied Zoology (Newly introduced)

The elective courses of Botany and Zoology disciplines are common with B.Sc. Biotechnology Programme.

The benefit of offering the discipline elective courses in stead of the core courses in the fifth and sixth semester is that the students can choose the course of their interest. Student has to opt one elective course from Botany discipline and one elective course from Zoology discipline in the fifth semester.

In the fifth semester, the course ZOO 302: Environmental Biology, the topic - 'pollution' which is already covered as such in the course BOT 303: Plant Physiology and Ecology is proposed to be replaced by biostatistics. It will introduce the fundamental principles of biostatistics and its role in the data analysis which would

help the students to apply the biostatistics tools for better presentation of the research data. The course is proposed to be renamed as 'Environmental Biology and Biostatistics'.

The laboratory course ZOO 302L: Environmental Biology Lab is proposed to be renamed as 'Environmental Biology and Biostatistics Lab'.

The syllabus of the Botany courses BOT 303: Plant Physiology and Ecology and BOT 303L: Plant Physiology and Ecology Lab are proposed to be revised and updated.

The vocational course, Analytical Lab Practice-I from fifth semester is proposed to be discontinued in the revised syllabus.

- (f) In the sixth semester, the elective courses of Botany and Zoology disciplines as mentioned above in the fifth semester minutes are also proposed to be offered in the sixth semester of B.Sc. Bioscience programme. Student has to opt one elective course from Botany discipline and one elective course from Zoology discipline in the sixth semester.

In the sixth semester, the course ZOO 301: Animal Physiology is proposed to be modified and certain topics elaborated. The sixth semester course BOT 302: Introduction to Genetics and Genetic Engineering is proposed to be modified. Experiments of molecular biology and basic bio-safety laboratory guidelines are proposed to be incorporated in the laboratory course BOT 302L: Introduction to Genetics and Genetic Engineering Lab.

The vocational course Analytical Lab Practice-II is proposed to be discontinued from the sixth semester.

Additionally, it is proposed that a student can opt for at most 2 additional Open (Generic) audit/credit Elective from other disciplines opting at most 1 per semester in Semesters III, IV, V or VI with prior permission of respective heads and time table permitting.

E-resources have been proposed for the theory courses and the list of recommended books has been updated. The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed Programme Educational Objectives, Programme outcomes and modified syllabus are included and marked as **Appendix-IA** (page 30), **Appendix-IB** (page 31) and **Appendix-IC** (pages 32-87) respectively.

3. IB. B.Sc. Biotechnology:

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b

iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^d
v.	Fifth Semester Examination, December, 2021	Change ^e
vi.	Sixth Semester Examination, April/May, 2022	Change ^f

(a) In the first semester of the B.Sc Biotechnology programme, the Botany course BOT 101: Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms and its laboratory course BOT 101L: Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperms Lab are proposed to be modified as per the proposed changes in B.Sc. Bioscience programme. Some topics of the Biotechnology course BT 102: Cell and Molecular Biology-I have been elaborated and specified for clear understanding of the topics to be covered. Some of the outdated laboratory experiments such as study of cell organelles under microscope are proposed to be replaced by more relevant experiments in the BT 102L: Cell and Molecular Biology-I Lab course.

(b) In the second semester, ZOO 101: Non-Chordates & Protochordates and ZOO 101L: Non-Chordates and Protochordates Lab courses are proposed to be modified as per the proposed changes in the same courses which are running common in second semester of B.Sc. Bioscience.

The contents of the course BT 101: Biostatistics, Bioinformatics and Instrumentation are proposed to be modified as per the present need of the course. Bioinformatics and biostatistics exercises have been elaborated and specified along with few modifications of existing practical exercises in the second semester course BT 101L: Biostatistics, Bioinformatics and Instrumentation Lab.

(c) In the third semester, the botany course BOT 201: Angiosperm Taxonomy and Economic Botany and its laboratory course i.e. BOT 201L: Angiosperm Taxonomy and Economic Botany Lab are proposed to be modified as per the proposed changes in the B.Sc. Bioscience programme.

Relevant modifications in the contents of Biotechnology course BT 202: Biochemistry, Biophysics and Enzymology and 202L: Biochemistry, Biophysics and Enzymology Lab are proposed. Enzymology exercises related to acid phosphatase extracted from moong is proposed to be replaced by the enzyme urease extracted from horse gram seeds.

(d) In the fourth semester, some experiments of the laboratory course ZOO 202L: Comparative Anatomy and Embryology of Chordates Lab are proposed to be more specified for clear understanding. The Genetics section in Unit-I is proposed to be extended by inclusion of some portion from the human genetics in the course BT 207: Genetics, Microbiology and Immunology. BT 207L: Genetics, Microbiology and

Immunology Lab is proposed to be modified by introduction of new microbiological exercises.

- (e) In the fifth semester, elective courses along with their practical exercises specific to Botany and Biotechnology disciplines are proposed to be offered as “Discipline Elective”. The course “Plant Physiology and Ecology” is already offered as a core course in the fifth semester but now it is proposed to be offered as a discipline elective course. Three elective courses of Botany discipline “Introduction to Genetics and Genetic Engineering”, “Ethnobotany” and “Horticulture” are proposed to be included for the first time in B.Sc Biotechnology programme.

The four elective courses of Botany discipline which are proposed to be offered common with B.Sc. Bioscience programme are as follows

- Introduction to Genetics and Genetic Engineering (Newly introduced)
- Plant Physiology and Ecology
- Ethnobotany (Newly introduced)
- Horticulture (Newly introduced)

Similarly, for Biotechnology discipline, four elective courses along with their laboratory components are proposed to be offered in the fifth semester. Among these, the courses “Genetic Engineering, rDNA Technology and Cell & Tissue Culture Technology” and “Advances in Biotechnology” which are already offered as core courses in the fifth and sixth semester are proposed to be offered as discipline elective courses. Two elective courses “Animal and Plant Biotechnology” and “Environmental Biotechnology” are proposed to be offered for the first time in B.Sc. Biotechnology programme.

The list of Biotechnology elective courses are as follows

- Genetic Engineering, rDNA Technology and Cell & Tissue Culture Technology
- Advances in Biotechnology
- Animal and Plant Biotechnology (Newly introduced)
- Environmental Biotechnology (Newly introduced)

The student has to opt one elective course from Botany discipline and another elective course from Biotechnology discipline.

Botany course BOT 303: Plant Physiology and Ecology and its laboratory course BOT 303L: Plant Physiology and Ecology Lab which are running common with B.Sc. Bioscience programme are proposed to be modified as per the proposed changes in the same courses/ semester of B.Sc. Bioscience programme.

The Biotechnology course BT 307: Genetic Engineering, rDNA Technology and Cell and Tissue Culture Technology is proposed to be modified as per the present need and advancement of the topic. Few modifications are proposed to be included in the

practical course BT 307L: Genetic Engineering, rDNA Technology and Cell and Tissue Culture Technology Lab.

The vocational course Analytical Lab Practice-I is proposed to be discontinued from the fifth semester.

- (f) In the sixth semester, elective courses along with their laboratory components specific to Zoology and Biotechnology disciplines are proposed to be offered as “Discipline Elective”. Four elective courses of Biotechnology discipline as mentioned above in the fifth semester minutes are also proposed to be offered in the sixth semester. The course “Animal Physiology” is already running in the sixth semester as core course but now it is proposed to be offered as discipline elective course. Three elective courses of Zoology discipline “Environmental Biology and Biostatistics”, “Developmental Biology” and “Applied Zoology” are proposed to be included for the first time in the B.Sc. Biotechnology programme.

The four elective courses of Zoology discipline which are proposed to be offered common with B.Sc. Bioscience programme are as follows

- Animal Physiology
- Environmental Biology and Biostatistics (Newly introduced)
- Developmental Biology (Newly introduced)
- Applied Zoology (Newly introduced)

The student has to opt one elective course from Botany discipline and another elective course from Biotechnology discipline.

The Zoology course ZOO 301: Animal Physiology is proposed to be modified according to the proposed changes in the same courses/semester of the B.Sc. Bioscience programme.

The Biotechnology course BT 301: Advances in Biotechnology is proposed to be modified by elaboration of some topics. The elaboration is necessary for the better understanding.

The Bioinformatics exercise-1 & 2 from the laboratory course BT 301L: Advances in Biotechnology Lab is proposed to be replaced by more relevant exercises as per the course contents.

The vocational course “Analytical Lab Practice-II” is proposed to be discontinued from the sixth semester.

Additionally, it is proposed that a student can opt for at most 2 additional Open (Generic) audit/credit Elective from other disciplines opting at most 1 per semester in Semesters III, IV, V or VI with prior permission of respective heads and time table permitting.

E-resources have been proposed for the theory courses and the list of recommended books has been updated. The board also reviewed the Programme Educational

Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed Programme Educational Objectives, Programme outcomes and modified syllabi are included and marked as **Appendix-IIA** (pages 88), **Appendix-IIB** (pages 89) and **Appendix-IIC** (pages 90-162) respectively.

3. II. B.Tech. Biotechnology:

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^a
iii.	Third Semester Examination, December, 2020	Change ^b
iv.	Fourth Semester Examination, April/May, 2021	Change ^c
v.	Fifth Semester Examination, December, 2021	Change ^d
vi.	Sixth Semester Examination, April/May, 2022	Change ^e
vii.	Seventh Semester Examination, December, 2022	Change ^f
viii.	Eighth Semester Examination, April/May, 2023	Change ^g

(a) In the first and second semester of the B. Tech Biotechnology programme, the contents of BIO101: Biology and ENGG 102L: Measurement Technique Lab is proposed to be revised by adding relevant topics/experiments.

(b) In the third semester new experiments are proposed to be introduced in BT 204L: Biotechnology Lab-I.

(c) The fourth semester course BT 203: Biophysics and Structural Biology is proposed to be revised and irrelevant portions removed. BT 205L: Biotechnology Lab-II is proposed to be modified. Seminar (BT 208S) is proposed to be shifted from the fifth semester to the third semester.

(d) In the fifth semester, the course 'Probability and Statistics' is proposed to be introduced. Some practical's of the course BT 303L: Biotechnology Lab-III are proposed to be incorporated in the fourth semester laboratory course.

The course BT 306: Enzyme Engineering and Technology which is running as a core course is now proposed as an Elective in the eighth semester.

(e) In the sixth semester, some modifications are proposed in the topics of the course BIN 301: Basic Bioinformatics. The course BT 305: Cell and Tissue Culture Technology is proposed to be dropped and contents incorporated in other relevant courses. The contents of the course BT 311: Recombinant DNA Technology, CHEM 301: Analytical Techniques and BT 304L: Biotechnology Lab-IV are proposed to be revised and updated.

(f) In the seventh semester, the reading electives BT 7.1.1: Plant Genetic Engineering and BT 7.1.2: Renewable Energy Resources are proposed to be replaced with following three newly introduced and more relevant/updated reading electives:

- Molecular Diagnostics,
- Biodiversity and Conservation,
- Emerging Trends in Biofuel Technology

These courses will help in inculcating the habit of self study/reading in students.

Additionally, the following online reading elective courses are also proposed to be offered in the seventh semester:

- Drug Discovery
<https://www.coursera.org/learn/drug-discovery>
- Proteins and Gel-Based Proteomics
<https://swayam.gov.in/course/1386-proteins-and-gel-based-proteomics>
- Online course on IPR
<http://www.ili.ac.in/e-learnIPR.htm>

(g) In the eighth semester, the courses ‘Animal Biotechnology’ and ‘Plant Biotechnology’ and laboratory course: Biotechnology Lab V are proposed to be revised.

The course Bioethics and Biosafety which is running as a core course is now proposed as an Elective.

Moreover, the contents of discipline elective course ‘Food and Dairy Biotechnology’ are proposed to be revised and updated, and a course ‘Geoinformatics’ is proposed to be introduced.

Additionally, it is proposed that students can opt for at most 2 additional Open (Generic) audit/credit Elective from other disciplines opting at most 1 per semester in Semesters III-VI with prior permission of respective heads and time table permitting.

E-resources have been proposed for the theory courses and the list of recommended books has been updated. The BOS has recommended all the above mentioned modifications to the degree of B. Tech. (Biotechnology).

The complete list of electives proposed to be offered in the eighth semester are as follows:

- Biomedical Engineering
- Food and Dairy Biotechnology
- Genomics and Proteomics
- Immunotechnology
- Microbial Technology
- Molecular Modelling and Drug Designing

- Nanotechnology
- Plant Secondary Metabolites
- Bioethics and Biosafety
- Enzyme Engineering and Technology
- Geoinformatics (Newly proposed)

Additionally, the following online elective courses are also proposed to be offered in the eighth semester:

- Bioreactor
<https://swayam.gov.in/course/1339-bioreactors>
- Principles of Downstream Techniques in Bioprocess
<http://nptel.ac.in/syllabus/102106048/>
- Industrial Biotechnology
<https://www.coursera.org/learn/industrial-biotech>

The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed Programme Educational Objectives, Programme outcomes, modified syllabi and details of the online courses offered are included and marked as **Appendix-III A** (pages 163), **Appendix-III B** (pages 164) and **Appendix-III C** (pages 165-228) and **Appendix-III D** (pages 229) respectively.

3. IIIA. M.Sc. Bioscience (Animal Science):

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b
iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^d

(a) In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by 'Biochemistry' as the subject needs to be dealt in more detail. The topics in enzymology are also proposed to be incorporated in this course from the course BT 406 Enzymology and Enzyme Technology running in the third semester which is proposed to be discontinued in its present form.

The syllabi of the courses 'Cell and Molecular Biology', 'Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

(b) In the second semester, the courses 'Genetics', 'Genetic Engineering' and 'Bioscience Lab-II' are proposed to be modified.

The course BT 406 Enzymology and Enzyme Technology is proposed to be discontinued in its present form. The course contents are proposed to be incorporated in the newly proposed course 'Biochemistry' in the first semester and 'Enzyme Technology', a newly proposed elective course in the third semester.

A new course 'Environmental Biology and Biotechnology' is proposed to be included as a core course. The syllabus of this new course is designed by updating the contents of the existing third semester course BIO 408: Environmental Biology and Toxicology and shifting it from the third semester in M.Sc. Bioscience and incorporating as a common course in M.Sc. Biotechnology, AMBT and Bioscience in the second semester. This proposed new course also incorporated some contents of the M.Sc. Biotechnology third semester core course BT 509 Environmental Biotechnology which is proposed to be discontinued.

Relevant modification are proposed to be included in the course BIO 411: Immunology.

- (c) In the third semester, BIO 408: Environmental Biology and Toxicology is proposed to be discontinued in the present form and with some updation it is proposed to be included as a core course in the second semester and named as 'Environmental Biology and Biotechnology'.

A new core course 'Biosystematics, Taxonomy and Evolution' is proposed to be introduced.

ZOO 503: Animal Diversity –I is proposed to be replaced by a new course 'Biology of Non-Chordates'.

The addition of these two courses will enhance the core Animal science component of the programme and provide much needed knowledge to the students in their preparations for various competitive examinations and also recruitment in various institutions where classical Zoology is in demand.

The course ZOO 507: Ethology and Neurobiology is proposed to be shifted to the fourth semester.

A course common with M.Sc. Biotechnology, BT 507: Cell and Tissue Culture Technology is proposed to be included in the third semester.

The course ZOO 508: Histology, is proposed to be discontinued and its relevant contents are proposed to be incorporated in a new course 'Biology of Chordates and Histology' in the fourth semester.

In the course ZOO 505L: Animal Science Lab-I which is laboratory based course, relevant modifications have been proposed to cater to the proposed modification in the theory courses.

Further, the discipline elective courses are proposed to be offered in the third semester. Discipline elective course provides the opportunity to the students to select

and study any discipline specific course of their choice from a pool of elective courses. The complete list of the elective courses are given in point (d).

- (d) In the fourth semester, ZOO501: Advance Animal Physiology, ZOO 504: Animal Diversity-II, ZOO 510: Medical Pathology, ZOO 511: Reproductive Biology and Endocrinology is proposed to be discontinued, and relevant contents incorporated in new courses proposed to be introduced viz., ‘Animal Physiology and Endocrinology’, ‘Biology of Chordates and Histology’, ‘Reproduction and Developmental Biology’, ‘Neurobiology and Animal Behavior’.

ZOO 502: Animal Cell and Tissue Culture Techniques is proposed to be discontinued as the course BT 507: Cell and Tissue Culture Technology (c.w. M.Sc. Biotechnology) is proposed to be offered in the third semester.

The laboratory based course, ZOO 506L: Animal Science Lab-II is proposed to be run with modified contents.

Reading elective courses are proposed to be introduced for in the fourth semester.

The following discipline elective courses are proposed to be introduced:

- Insect Diversity, Morphology, Physiology and Ecology
- Fish Biology
- Animal Biotechnology-I
- Applied Entomology and Pest Management
- Capture Fishery
- Animal Biotechnology-II
- Immunotechnology-I
- Immunotechnology (c.w. M.Sc. Biotechnology/ AMBT)
- Biophysics-I (newly introduced, c.w. M.Sc. Biotechnology/ AMBT/ Plant Science / Physics)
- Ecology and Environment (c.w. M.Sc. Plant Science, Environmental Science)
- Biophysics-II (c.w. M.Sc. Plant Science/ Physics)
- Biodiversity and Conservation (c.w. M.Sc. Plant Science, Environmental Science)
- Fundamentals of Ecology for Sustainable Ecosystem (online elective, c.w. M.Sc. Plant Science)

<https://www.extension.harvard.edu/academics/courses/fundamentals-ecology/12779>

The following reading elective courses are proposed to be newly offered in the fourth semester, viz.,

- Drug Discovery
- Human Genetics and Diseases
- Intellectual Property Rights

- Medical Microbiology
- Molecular Plant Breeding
- Protein Engineering

Additionally, the following online reading elective courses are also proposed to be offered in the fourth semester:

- Bio- organic Chemistry
<http://nptel.ac.in/courses/104103018/#>
- Enzyme Science and Engineering
<http://freevidelectures.com/Course/85/Enzyme-Science-and-Engineering/1>
- Biocatalysis in organic synthesis
<http://nptel.ac.in/courses/104105032/>
- Comprehensive Disaster Risk Management Framework
www.nidm.gov.in/online.asp
- General Course on Intellectual Property
<https://welc.wipo.int/acc/index.jsf?page=courseCatalog.xhtml>
- Environmental Management - An Introduction
<http://www.algonquincollege.com/ccol/courses/environmental-management-an-introduction/>

Students can opt for any one reading elective course (either in regular mode or in online mode) as per the above-mentioned lists in the IV semester.

These courses will help in inculcating the habit of self study/ reading amongst students.

Additionally, it is proposed that a students can opt for 1 Open (Generic) Elective as a credit course from any disciplines in Semester IV with prior permission of respective heads and time table permitting.

E-resources have been proposed for the theory courses and the list of recommended books has been updated. The proposed syllabus of M.Sc. Bioscience (Animal Science) will fulfill the needs of students in terms of their acquaintance regarding both the basic and advanced concepts of the programme.

The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed Programme Educational Objectives, Programme outcomes, modified syllabi and details of the online courses offered are included and marked as **Appendix-IVA** (pages 230), **Appendix-IVB** (pages 231), **Appendix-IVC** (pages 232-323) and **Appendix-IV D** (pages 324-325) respectively.

3. IIIB. M.Sc. Bioscience (Plant Science):

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b
iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^d

(a) In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by "Biochemistry".

The syllabi of the courses 'Cell and Molecular Biology', 'Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

(b) In the second semester, the courses 'Genetics', 'Genetic Engineering' and 'Bioscience Lab-II' are proposed to be modified.

The course BT 406 Enzymology and Enzyme technology is proposed to be discontinued as the contents are repeated in other sections of the syllabi.

A new course 'Environmental Biology and Biotechnology' is proposed to be included as a core course. The syllabus of this new course is designed by updating the contents of the existing third semester course BIO 408: Environmental Biology and Toxicology and shifting it from the third semester in M.Sc. Bioscience and incorporating as a common course in M.Sc. Biotechnology, AMBT and Bioscience in the second semester. This proposed new course also incorporated some contents of the M.Sc. Biotechnology third semester core course BT 509 Environmental Biotechnology which is proposed to be discontinued. The contents of the course BIO 411: Immunology are proposed to be modified and revised.

(c) In the third semester, BIO 408: Environmental Biology and Toxicology is proposed to be discontinued in the present form and with some updation it is proposed to be included as a core course in the second semester renamed as 'Environmental Biology and Biotechnology'.

'Phycology, Mycology and Lichenology' and 'Bryophyta, Pteridophyta and Gymnosperms' are proposed to be introduced as new core courses. The addition of these two courses will enhance the core plant science component of the programme and provide much needed knowledge to the students in their preparations for various competitive examinations and also their recruitment in various institutions where classical botany is in demand.

The course BOT 511: Plant Tissue Culture & Experimental Embryology is proposed to be replaced by 'Cell and Tissue Culture Technology'.

BOT 507: Plant Pathology is proposed to be shifted to semester IV and in its place BT 507: Cell and Tissue Culture Technology is proposed to be introduced. BOT 509L

which is laboratory based is proposed to be modified to cater to the courses introduced/ replaced.

Further, the discipline elective courses are proposed to be offered for the first time in the third semester. Discipline elective course provides the opportunity to the students to select and study any discipline specific course of their choice from a pool of elective courses. The complete list of the discipline elective courses are given below in the point (d).

(d) In the fourth semester BOT 501: Advanced Horticulture and Ethnobotany is proposed to be replaced by BOT: Angiosperms, while BOT 503: Current Trends in Plant Biotechnology is proposed to be dropped, as the content of this paper is already present in other courses.

BOT 506: Plant Ecology and Biodiversity Conservation is proposed to be discontinued as the contents of this course will be covered in the proposed electives, ENVS 402 course of Elective-I and ENVS 502 course of Elective-II. BOT 508:

An online course, 'Plant Physiology and Taxonomy', (URL-<https://www.acs.edu.au/courses/botany-i-plant-physiology-and-taxonomy-199.aspx>) offered by ACS distance education is proposed as an alternative for the core course - BOT 508 Plant Physiology.

Plant Pathology is proposed to be shifted from third semester to the fourth semester. The laboratory based course, BOT 510L: Plant Science Lab is proposed to be modified.

Reading elective courses are proposed to be introduced for the first time in the fourth semester.

The following discipline elective courses are proposed to be introduced.

- Phycology-I
- Bryology-I
- Angiosperms Taxonomy and Systematics-I
- Phycology-II,
- Bryology-II,
- Angiosperms Taxonomy and Biosystematics-II
- Advanced Plant Biotechnology
- Plant Biotechnology (c.w. M.Sc. Biotechnology/ AMBT)
- Biophysics-I (Newly introduced c.w. M.Sc. Biotechnology/ AMBT/Animal Science / Physics)
- Ecology and Environment (c.w. M.Sc Env. Sci./M.Sc. Animal Science)
- Biophysics-II (c.w. M.Sc. Physics / Animal Science)

- Biodiversity and Conservation (c.w. M.Sc. Animal Science, Environmental Science)
- Fundamentals of Ecology for Sustainable Ecosystem (Online elective, c.w. M.Sc. Biotechnology/ AMBT/Animal Science)
<https://www.extension.harvard.edu/academics/courses/fundamentals-ecology/12779>.

The following reading elective courses are proposed to be offered in the fourth semester, viz.,

- Drug Discovery
- Human Genetics and Diseases
- Intellectual Property Rights
- Medical Microbiology
- Molecular Plant Breeding
- Protein Engineering

Additionally, the following online reading elective courses are also proposed to be offered in the fourth semester:

- Bio- organic Chemistry
<http://nptel.ac.in/courses/104103018/#>
- Enzyme Science and Engineering
<http://freevidelectures.com/Course/85/Enzyme-Science-and-Engineering/1>
- Biocatalysis in organic synthesis
<http://nptel.ac.in/courses/104105032/>
- Comprehensive Disaster Risk Management Framework
www.nidm.gov.in/online.asp
- General Course on Intellectual Property
<https://welc.wipo.int/acc/index.jsf?page=courseCatalog.xhtml>
- Environmental Management - An Introduction
<http://www.algonquincollege.com/ccol/courses/environmental-management-an-introduction/>

Students can opt for any one reading elective course (either in regular mode or in online mode) as per the above-mentioned lists in the IV semester.

These courses will help in inculcating the habit of self study/reading amongst students.

Additionally, it is proposed that a students can opt for 1 Open (Generic) Elective as a credit course from any disciplines in Semester IV with prior permission of respective heads and time table permitting.

E-resources have been proposed for the theory courses and the list of recommended books has been updated. The BOS has recommended all the above mentioned modifications to the degree of M.Sc. Bioscience (Plant Science) for the third and fourth semester.

The proposed syllabus of M.Sc. Bioscience (Plant Science) fulfills the needs of students in terms of their acquaintance regarding classical botany, especially lower plant groups and also the recent advances in the subject.

The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed Programme Educational Objectives, Programme outcomes, modified syllabi and details of the online courses offered are included and marked as **Appendix-VA** (pages 326), **Appendix-VB** (pages 327), **Appendix-VC** (pages 328-413) and **Appendix -VD** (pages 414-415) respectively.

3. IIIC. M.Sc. Applied Microbiology and Biotechnology:

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b
iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^c

(a) In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by 'Biochemistry'.

The syllabi of the courses 'Cell and Molecular Biology', 'General Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

(b) In the second semester, the courses 'Microbial Physiology' and Genetics', 'Genetic Engineering' and 'Microbial Technology Lab-I' are proposed to be modified.

BT 406 Enzymology and Enzyme technology is proposed to be discontinued in the present form. Some relevant portions of the syllabus of the course BT 406 Enzymology and Enzyme technology is proposed to be integrated with first semester core course 'Biochemistry'. Remaining part of the syllabus of course is updated and proposed to be offered in the third semester as an elective course named as 'Enzyme Technology'.

A new course 'Environmental Biology and Biotechnology' is proposed to be included as a core course. The syllabus of this new course is designed by updating the contents of the existing third semester course BIO 408: Environmental Biology and Toxicology and shifting it from the third semester in M.Sc. Bioscience and

incorporating as a common course in M.Sc. Biotechnology, AMBT and Bioscience in the second semester. This proposed new course also incorporated some contents of the M.Sc. Biotechnology third semester core course BT 509 Environmental Biotechnology which is proposed to be discontinued.

The change was suggested to fulfil the need for emerging environmental concerns. The course BIO 411 Immunology which is running in the second semester of M.Sc. Biotechnology programme is proposed to be introduced in the second semester. The contents of the course BIO 411: Immunology are proposed to be modified and revised. The course BIO 413 Medical Microbiology and Immunology is proposed to be discontinued as the course content will be covered in the proposed 'Immunology' course.

- (c) In the third semester, the course BT 522: Recombinant DNA Technology which is offered as a core course in the existing syllabus but now this course is proposed to be offered as an elective course. “Discipline Elective” course is proposed to be introduced in the third semester. Discipline elective course provides the opportunity to the students to select and study any discipline specific course of their choice from a pool of elective courses.

The core courses 'Bioprocess Engineering and Technology', and 'Microbial Ecology and Diversity' are proposed to be modified and updated.

BT507: Cell and Tissue Culture Technology is proposed to be discontinued.

'Critical Analysis of Classical Papers/ Landmark Discoveries' is proposed to be introduced in Seminar mode.

A new elective course 'Enzyme Technology' is proposed to be introduced incorporating relevant portions of the syllabus of the second semester course BT 406 “Enzymology and Enzyme Technology which is proposed to be discontinued.

The following list of elective courses is proposed to be offered in the third semester:

- Fundamentals of Bioentrepreneurship (Modified)
- Microbial Technology
- Food Process and Biotechnology (Modified)
- Genomics and Proteomics (Modified)
- Immunotechnology (Modified)
- Plant Biotechnology (Modified)
- Recombinant DNA Technology (Modified)
- Enzyme Technology (Newly introduced)
- Animal Biotechnology-I (Newly introduced)
- Biophysics-I (Newly introduced c.w. M.Sc. Biotechnology/ Animal Science /Plant Science/ Physics)

Additionally, the following online elective courses are also proposed to be offered in the third semester:

- Forensic Biology and Serology
<https://swayam.gov.in/course/264-forensic-biology-and-serology>
- Water and Waste Treatment Engineering: Biochemical Technology
<https://www.edx.org/course/water-wastewater-treatment-engineering-tsinghuax-40050455-2x-0>
- Industrial Biotechnology
https://onlinecourses.nptel.ac.in/noc17_bt23/preview
<https://swayam.gov.in/search?keyword=Industrial%20Biotechnology>
- Fundamentals of Ecology for Sustainable Ecosystem
<https://www.extension.harvard.edu/academics/courses/fundamentals-ecology/12779>

Students can opt for any one elective course (either in regular mode or in online mode) as per the above mentioned lists.

The following reading electives are proposed to be newly offered in the third and fourth semesters, viz.,

- Drug Discovery
- Human Genetics and Diseases
- Intellectual Property Rights
- Medical Microbiology
- Molecular Plant Breeding
- Protein Engineering

Additionally, the following online reading elective courses are also proposed to be offered in the third and fourth semesters:

- Bio- organic Chemistry
<http://nptel.ac.in/courses/104103018/#>
- Enzyme Science and Engineering
<http://freevideolectures.com/Course/85/Enzyme-Science-and-Engineering/1>
- Biocatalysis in organic synthesis
<http://nptel.ac.in/courses/104105032/>
- Comprehensive Disaster Risk Management Framework
www.nidm.gov.in/online.asp
- General Course on Intellectual Property
<https://welc.wipo.int/acc/index.jsf?page=courseCatalog.xhtml>
- Environmental Management - An Introduction

<http://www.algonquincollege.com/ccol/courses/environmental-management-an-introduction/>

The reading electives are common for third and fourth semester. Students can opt for any one reading elective course (either in regular mode or in online mode) as per the above-mentioned lists in each of the III /IV semester.

These courses which will help in inculcating the habit of self study/ reading amongst students.

Additionally, it is proposed that a students can opt for 1 Open (Generic) Elective as a credit course from any disciplines in Semester III with prior permission of respective heads and time table permitting. E-resources have been proposed for the theory courses and the list of recommended books has been updated. All modifications have been done to suit the current requirements of various preparative exams and enhance the knowledge and skill component.

The board also reviewed the Programme Educational Objectives, Programme outcomes and the Learning outcomes of the courses keeping in view the proposed modifications. The proposed Programme Educational Objectives, Programme outcomes, modified syllabi and details of the online courses offered are included and marked as **Appendix-VIA** (pages 416), **Appendix-VIB** (pages 417) , **Appendix-VIC** (pages 418-486) and **Appendix VID** (pages 487-489) respectively.

3. IID M.Sc. Biotechnology:

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b
iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^d

(a) In the first semester, the course BIO 403: Biochemistry and Biophysics is proposed to be replaced by 'Biochemistry'.

The syllabi of the courses 'Cell and Molecular Biology', 'Microbiology', 'Bioinformatics', 'Analytical Techniques-I' and 'Bioscience Lab-I' are proposed to be updated.

(b) In the second semester, the courses 'Genetics', 'Genetic Engineering' and 'Bioscience Lab-II' are proposed to be modified.

BT 406: Enzymology and Enzyme technology is proposed to be discontinued in the present form. Some relevant portions of the syllabus of the course BT 406 Enzymology and Enzyme technology is proposed to be integrated with first semester core course 'Biochemistry'. Remaining part of the syllabus of course is updated and

proposed to be offered in the third semester as an elective course named as 'Enzyme Technology'.

A new course 'Environmental Biology and Biotechnology' is proposed to be included as a core course. The syllabus of this new course is designed by updating the contents of the existing third semester course BIO 408: Environmental Biology and Toxicology and shifting it from the third semester in M.Sc. Bioscience and incorporating as a common course in M.Sc. Biotechnology, AMBT and Bioscience in the second semester. This proposed new course also incorporated some contents of the M.Sc. Biotechnology third semester core course BT 509 Environmental Biotechnology which is proposed to be discontinued. The change was suggested to fulfil the need for emerging environmental concerns. The contents of the course BIO 411: Immunology are proposed to be updated.

- (c) In the third semester, the course BT 522: Recombinant DNA Technology which is offered as a core course in the existing syllabus but now contents of this course have been modified and proposed to be offered as an elective course. "Discipline Elective" course is proposed to be introduced in the third semester. Discipline elective course provides the opportunity to the students to select and study any discipline specific course of their choice from a pool of elective courses.

The core courses 'Bioprocess Engineering and Technology', and 'Biotechnology Lab-I' are proposed to be modified. BT 509: Environmental Biotechnology which is a core course is proposed to be discontinued in the present form and with some updation it is proposed to be reintroduced as a core course 'Environmental Biology and Biotechnology' in the second semester.

'Critical Analysis of Classical Papers/ Landmark Discoveries' is proposed to be introduced in Seminar mode.

The following is the list of elective courses that are proposed to be offered in the third semester:

- Fundamentals of Bioentrepreneurship (Modified)
- Microbial Technology
- Food Process and Biotechnology (Modified)
- Genomics and Proteomics (Modified)
- Immunotechnology (Modified)
- Plant Biotechnology (Modified)
- Recombinant DNA Technology (Modified)
- Enzyme Technology (Newly introduced)
- Animal Biotechnology-I (Newly introduced)
- Biophysics-I (Newly introduced c.w. M.Sc. AMBT/ Animal Science /Plant Science/ Physics)

Additionally, the following online elective courses are also proposed to be offered in the third semester:

- Forensic Biology and Serology
<https://swayam.gov.in/course/264-forensic-biology-and-serology>
- Water and waste treatment engineering: Biochemical Technology
<https://www.edx.org/course/water-wastewater-treatment-engineering-tsinghuax-40050455-2x-0>
- Industrial Biotechnology
https://onlinecourses.nptel.ac.in/noc17_bt23/preview
<https://swayam.gov.in/search?keyword=Industrial%20Biotechnology>
- Fundamentals of Ecology for Sustainable Ecosystem
<https://www.extension.harvard.edu/academics/courses/fundamentals-ecology/12779>

Students can opt for any one elective course (either in regular mode or in online mode) as per the above mentioned lists.

(d) The following reading electives are proposed to be newly offered in the third and the fourth semesters, viz.,

- Drug Discovery
- Human Genetics and Diseases
- Intellectual Property Rights
- Medical Microbiology
- Molecular Plant Breeding
- Protein Engineering

Additionally, the following online reading elective courses are also proposed to be offered in the third and fourth semester:

- Bio- organic Chemistry
<http://nptel.ac.in/courses/104103018/#>
- Enzyme Science and Engineering
<http://freevideolectures.com/Course/85/Enzyme-Science-and-Engineering/1>
- Biocatalysis in organic synthesis
<http://nptel.ac.in/courses/104105032/>
- Comprehensive Disaster Risk Management Framework
www.nidm.gov.in/online.asp
- General Course on Intellectual Property
<https://welc.wipo.int/acc/index.jsf?page=courseCatalog.xhtml>
- Environmental Management - An Introduction

<http://www.algonquincollege.com/ccol/courses/environmental-management-an-introduction/>

The reading electives are common for third and fourth semester. Students can opt for any one reading elective course (either in regular mode or in online mode) as per the above-mentioned lists in each of the III /IV semester.

These courses will help in inculcating the habit of self study/reading amongst students.

Additionally, it is proposed that a students can opt for 1 Open (Generic) Elective as a credit course from any disciplines in Semester III with prior permission of respective heads and time table permitting. E-resources have been proposed for the theory courses and the list of recommended books has been updated. All modifications have been done to suit the current requirements of various preparative exams and enhance the knowledge and skill component. The board also reviewed the Programme Educational Objectives, Programme outcomes of the programme and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed Programme Educational Objectives, Programme outcomes, modified syllabi and details of the online courses offered are included and marked as **Appendix-VIIA** (pages 490), **Appendix-VIIB** (pages 491), **Appendix-VIIC** (pages 492-568) **Appendix-VIID** (pages 569-571) respectively.

3. IIIE M.Sc. Bioinformatics:

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b
iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^d

(a) In the first semester, the course BIO 402: Basic Cell, molecular Biology and Biological Database is proposed to be replaced by BIO407: Cell and Molecular Biology (c.w.: M.Sc. BT/ AMBT/ Bioscience. I sem).

The course of MATH406: Introductory Mathematic' is proposed to be modified with inclusion of relevant content of Statistics.

The course STAT405: Statistical Techniques is proposed to be discontinued. 'Biological Databases' is proposed as new core course.

The course CS410: Computer Fundamentals and Perl Programming is proposed to be discontinued and a new course - 'Fundamentals of Computer and Programming' is proposed to be introduced.

The course STAT405L: Statistical Techniques Lab is proposed to be discontinued.

To provide wet lab training, the course BIO404L: Bioscience Lab I (c.w. MSc. BT/AMBT/Bioscience I sem) is proposed to be introduced.

The syllabi of the courses 'Structural Biology' and 'Computer Fundamentals and Programming Lab' is proposed to be updated.

- (b)** In the second semester, the courses BIN402: Computational Biology and Molecular Modeling', 'BIN403: Proteomics, Sequence Analysis and Systems Biology' 'CS412: Computer Networks and Web Technologies' and 'BIO413: Medical Microbiology and Immunology' are proposed to be discontinued.

The courses 'Algorithms in Computational Biology', 'Sequence Analysis and Phylogenetics', 'Programming with Perl and R' and 'Genetic Engineering (c.w. MSc. BT/AMBT/Biosc. II sem) ' are being proposed to be introduced and some of the relevant portions of the discontinued courses have been incorporated with suitable updates into these newly proposed courses. The modifications are suggested to fulfill the need for emerging technologies in bioinformatics.

- (c)** In third semester, the core courses BIN504: Evolutionary Computing, 'BIN502: Computer Aided Drug Designing', 'BIN505: Functional and Comparative Genomics', 'BIN508: Molecular Structure Prediction and Visualization' and 'BIN508L: Molecular Structure Prediction and Visualization Lab' are proposed to be discontinued.

The courses 'Biomolecular Modelling and Computational Drug Design' is proposed to be newly introduced.

The course 'Genomics and Proteomics' currently offered as a elective course in the IIIrd sem. in M.Sc. Biotechnology and M.Sc AMBT is proposed to be offered as a core course.

The courses 'RNA Structure Function and Transcriptomics' 'Biomolecular Modelling and Computational Drug Design Lab' are proposed to be newly introduced and some of the relevant portions of the discontinued courses have been incorporated with suitable updates into these newly proposed courses.

'Python Programming' and 'Python Programming Lab' are proposed as new core courses to meet the current demands of Bioinformatics in academia and industry.

The core course 'BIN507: Mining and Warehousing of Biological Data' is being proposed as to be run as an elective course.

The courses 'CS512: Cloud Computing', 'CS530: Neural Networks' and 'Systems Biology' are proposed to be retained as elective courses.

- (d)** In the fourth semester the course 'CS427: Parallel Computing' is proposed to be discontinued.

A full semester ‘Project Dissertation’ is proposed to be introduced to develop in depth knowledge of the subject and skill development for writing projects and reports among students.

The following reading electives are proposed to be introduced:

- BIN601R:Chemoinformatics’ (previously run in M.Tech. Bioinformatics)
- BIN602:Immunoinformatics’ (previously run in M.Tech. Bioinformatics)
- Human Genetics and Diseases (c.w. M.Tech. BT, M.Sc. AMBT, BT, Biosci)
- Drug Discovery (c.w. M.Tech. BT, M.Sc. AMBT, BT, Biosci)
- Protein Engineering (c.w. M.Tech. BT, M.Sc. AMBT, BT, Biosci).

These courses will help in inculcating the habit of self study/reading amongst students. E-resources have been proposed for the theory courses and the list of recommended books has been updated. All modifications have been done to suit the current requirements of various preparative exams and enhance the knowledge and skill component.

The board also reviewed the Programme Educational Objectives (**Appendix-VIIIA**, page no.572), Programme outcomes (**Appendix-VIIIB**, page no. 573) and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed course of study, curricula and scheme of examination of the M. Sc. Bioinformatics (2019-2020) programme is attached and marked as **Appendix-VIIIC**, page no. 574-633.

3. IV M.Tech. Biotechnology:

i.	First Semester Examination, December, 2019	Change ^a
ii.	Second Semester Examination, April/May, 2020	Change ^b
iii.	Third Semester Examination, December, 2020	Change ^c
iv.	Fourth Semester Examination, April/May, 2021	Change ^c

(a) In the first semester, the courses ‘Biological Databases and Computational Biology’, ‘Advanced Cell Biology’, ‘Biotechnology Lab – I’ are proposed to be updated with more relevant topics.

The course “Bioprocess Engineering-I” is proposed to be discontinued.

An elective course ‘Elective-I’ is proposed to be introduced.

Term paper-I/Minor project is proposed to be introduced in the first semester. The term paper essentially will help to enhance the critical thinking, writing and communication skills of the students. The core course BT 511: ‘Enzyme Technology’ of the first semester is proposed to be offered as an elective course.

(b) The contents of the second semester core course BT 503: “Bioprocess Engineering-II” and first semester core course BT 502: “Bioprocess engineering-I” are proposed to be merged and modified, and offered as new course named as “Bioprocess engineering” in the second semester of the programme.

Another elective course named as ‘Elective-II’ is proposed to be introduced. Term paper-II/Minor project is also proposed to be introduced in the second semester. The course BT 516: ‘Immunotechnology’ is proposed to be offered as an elective course. In the second semester, core course BT 520: ‘Plant and Animal Cell Culture Technology’ is proposed to be discontinued.

The contents of the course ‘Genetic Manipulation Technology’ are proposed to be rearranged in all the sections with incorporation of new and relevant topics. In the course ‘Biotechnology Lab – II’, the modifications in the practical exercises are proposed to properly categorize and introduce relevant experiments. The contents of the elective paper ‘Food Biotechnology’, is proposed to be updated with the removal of some repetitive portions.

The complete lists of elective courses proposed to be offered in the first and second semester are as follows:

- Computer Aided Drug Designing
- Elements of Bioinformatics
- Structural Biology
- Bioentrepreneurship
- Cancer Biology
- Environmental Biotechnology
- Food Biotechnology (Modified)
- Medical Biotechnology
- Nanobiotechnology
- Enzyme Technology (Newly introduced)
- Immunotechnology (Newly introduced)

Additionally, it is proposed that a student can opt for 1 Open (Generic) Elective as a credit course from any disciplines in Semester II with prior permission of respective heads and time table permitting.

(c) The reading electives viz., BIO 601R: Biodiversity and Conservation, BIO 602R: Bioethics, Biosafety and IPR and BT 604R: Renewable Energy Sources, which were offered in the third and fourth semesters are proposed to be replaced with newly introduced and more relevant reading electives viz.:

- Drug Discovery,
- Human Genetics and Diseases,
- Intellectual Property Rights,

- Medical Microbiology,
- Molecular Plant Breeding and
- Protein Engineering.

Additionally, the following online reading elective courses are also proposed to be offered in the third and fourth semester:

- Downstream Processing
<http://nptel.ac.in/syllabus/102106022>
- Mass Spectrometry based Proteomics
https://onlinecourses.nptel.ac.in/noc15_bt05/preview
<https://swayam.gov.in/search?keyword=Mass%20spectrometry%20based%20proteomics>
- Bioreactor
<https://swayam.gov.in/course/1339-bioreactors>

The above courses will help in inculcating the habit of self study/reading in students. Moreover, the books of all the theory and practical papers have been updated following same format and e-resources have been introduced. E-resources have been proposed for the theory courses and the list of recommended books has been updated. The BOS has recommended all the above mentioned modifications to the degree of M. Tech. Biotechnology. The proposed syllabus of M. Tech. Biotechnology would fulfill the needs of students in terms of their knowledge of fundamental concepts and latest developments in the field of biotechnology. The board also reviewed the Programme Educational Objectives, Programme outcomes of the programme and the Learning outcomes of the courses keeping in view the proposed modifications.

The proposed Programme Educational Objectives, Programme outcomes, modified syllabi and details of the online courses offered are included and marked as **Appendix-VIIIA** (pages 572), **Appendix-VIIIB** (pages 573), **Appendix-VIIIC** (pages 574-621), **Appendix-VIIID** (pages 622) respectively.

3. V Certificate Course in Molecular Modeling and Drug Designing

The Convener briefed the board of the objectives for introducing the Certificate Course in Molecular Modeling and Drug Designing in the department. The Course is structured to provide theoretical and practical knowledge of computational methods used in biomolecular studies and the drug discovery programs to the students with background in biology, chemistry and pharmaceutical sciences. Further, this course also includes computer programming in order to enable the students to solve complex

biological problems computationally. Theoretical introduction to drugable targets and biomolecular structures helps in understanding the complexities in drug discovery process. The hands on experiences with software and programming further augment the skills to take on the challenges of drug discovery. The external experts appreciated the proposed certificate course and mentioned that the students trained could have better placement opportunity in the pharmaceutical industries as well as in research programmes. The proposed syllabus is included and marked as **Appendix –X** (pages –685-689).

3. VI Diploma in Computational Biology

The Convener briefed the board of the objectives for introducing the Diploma Course in Computational Biology in the department. The course has been structured to provide theoretical and practical knowledge of computational methods, used in the era of molecular biology, to the students without any prior knowledge of Bioinformatics. Theoretical introduction to computational biology methods will help in understanding the complexities in drug discovery process, sequence analysis and phylogenetic reconstruction. The hands on experiences with relevant software and programming further augment the skills to take on the current challenges of molecular biology research and pharmaceutical industries. The external experts appreciated the proposed certificate course and were of the opinion that the students trained could have better placement opportunity in the pharmaceutical industries as well be absorbed in various research programmes. The proposed syllabus is included and marked as **Appendix – XI** (pages 690-696).

A complete list of newly proposed online courses in the abovementioned courses viz., B.Tech. Biotechnology, M.Sc. Bioscience (Animal Science), M.Sc. Bioscience (Plant Science), M.Sc. Applied Microbiology and Biotechnology, M.Sc. Biotechnology, M.Tech. Biotechnology is enlisted below:

Table-1: List of proposed online elective courses

S. No	Online Course Name	URL
B.Tech. Biotechnology VIII Semester		
1.	Bioreactor	https://swayam.gov.in/course/1339-bioreactors
2.	Principles of Downstream techniques in Bioprocess	http://nptel.ac.in/syllabus/102106048/
3.	Industrial Biotechnology	https://www.coursera.org/learn/industrial-biotech
M.Sc. Bioscience (Animal Science, Plant Science) III Semester		
1.	Fundamentals of Ecology for Sustainable Ecosystem	https://www.extension.harvard.edu/academics/courses/fundamentals-ecology/12779

S. No	Online Course Name	URL
M.Sc. Applied Microbiology and Biotechnology, Biotechnology III Semester		
1.	Forensic Biology and Serology	https://swayam.gov.in/course/264-forensic-biology-and-serology
2.	Water and waste treatment engineering: Biochemical Technology	https://www.edx.org/course/water-wastewater-treatment-engineering-tsinghuax-40050455-2x-0
3.	Industrial Biotechnology	https://onlinecourses.nptel.ac.in/noc17_bt23/preview https://swayam.gov.in/search?keyword=Industrial%20Biotechnology
4.	Fundamentals of Ecology for Sustainable Ecosystem	https://www.extension.harvard.edu/academics/courses/fundamentals-ecology/12779

Table-2: List of proposed online reading elective courses

S. No.	Online Course Name	URL
B.Tech. Biotechnology VII Semester		
1.	Drug Discovery	https://www.coursera.org/learn/drug-discovery
2.	Proteins and Gel-Based Proteomics	https://swayam.gov.in/course/1386-proteins-and-gel-based-proteomics
3.	Online course on IPR	http://www.ili.ac.in/e-learnIPR.htm
M.Sc. Bioscience (Animal Science, Plant Science), Applied Microbiology and Biotechnology, Biotechnology - IV Semester		
1.	Bio- organic Chemistry	http://nptel.ac.in/courses/104103018/#
2.	Enzyme Science and Engineering	http://freevideolectures.com/Course/85/Enzyme-Science-and-Engineering/1
3.	Biocatalysis in organic synthesis	http://nptel.ac.in/courses/104105032/
4.	Comprehensive Disaster Risk Management Framework	www.nidm.gov.in/online.asp
5.	DL101E - DL-101 General Course on Intellectual Property	https://welc.wipo.int/acc/index.jsf?page=courseCatalog.xhtml
6.	Environmental Management - An Introduction	http://www.algonquincollege.com/ccol/courses/environmental-management-an-i
M.Tech. Biotechnology III & IV Semester		
1.	Downstream Processing	http://nptel.ac.in/syllabus/102106022/
2.	Mass spectrometry based proteomics	https://onlinecourses.nptel.ac.in/noc15_bt05/preview https://swayam.gov.in/search?keyword=Mass%20spectrometry%20based%20proteomics
3.	Bioreactor	https://swayam.gov.in/course/1339-bioreactors

Table-3: List of proposed online alternative core courses

S.No.	Online Course Name	URL
IIIB. M.Sc. Bioscience-Plant Science IV Semester - BOT 508: Plant Physiology		
1.	Plant Physiology and Taxonomy	https://www.acs.edu.au/courses/botany-i-plant-physiology-and-taxonomy-199.aspx

5. The Board noted the Curriculum for the courses running in the other programmes of the Vidyapith. The courses which are proposed to be modified/ updated/ discontinued are reviewed under point number 3 above.

6. The board considered the reports of examiners in various examinations of 2017-2018. Most of the examiners found the content of answers satisfactory or good and overall were quite satisfied with the performance of the students. In a few cases, wherever necessary, the reports were brought to the notice of concerned teachers so that corrective measures could be taken.

7. In view of the note of the Vice-Chancellor regarding the standard of the question papers, the Board examined the question papers of periodical test and annual examinations of the session 2017-18.

The question papers were thoroughly studied by the various subject teachers and it was observed that quality of question papers has not deteriorated in the session 2017-18 vis-à-vis the previous years. At UG level, on an average, more than 80% questions belong to either High (Excellent) or Medium (Good) category. Similarly, at PG level too, the results are nearly same.

The analysis of the question papers summarized in **Appendix XIII A** (pages 697-698) and details given in various tables and figures **Appendix XIIB** (UG, pages 699-723), **Appendix XIIC** (PG, pages 724-732) and **Appendix XIID** (PG Bioinformatics, pages 733-736).

The meeting ended with vote of thanks.



Dy. Registrar
Banasthali Vidyapith
(Rajasthan)