

Program Outcomes:

Biotechnology has grown, extensively in last couple of decades. This advanced ‘interdisciplinary’ life science branch encompasses areas *viz.* molecular biology, genetics, biochemistry, microbiology, immunology, virology, plant and animal tissue culture, chemistry and engineering. It is a fast emerging “cutting edge” science with distinctive advantages as it finds applications in practically all aspects of life. The subject offers exciting opportunities in various fields from basic research to industry oriented career. Global and local focus has slowly shifted to using knowledge of life Science for innovative technology development that is being used for betterment of human life. Many fundamental research fields from cell biology to molecular biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology and to biodiversity, from microbiology to bioprocess engineering, from bioremediation to *in silico* drug discovery etc. comes under the umbrella of Biotechnology.

Objectives to be achieved are as follows,

- To help the students to build interdisciplinary approach
- To empower students to excel in various research fields of Life Sciences
- To inculcate sense of scientific responsibilities for social and environment awareness.
- To acquaint the students with thrust areas of biotechnology
- To adapt the internationally acknowledged Choice Based Credit System (CBCS) that offers opportunities to learn core subjects and to explore additional avenues of learning beyond the core subjects for complete development of an individual.

Program Specific Outcome- M.Sc. Biotechnology

The M.Sc. Biotechnology program choice based credit curriculum and grading system will cater to the existing interdisciplinary nature of biotechnology can also offer many courses to the other branches of life science. The generative power of biological data is effectively harnessed by biotechnology like no other field. Economic and social renaissance is staged on biotechnology especially, since it's biomedical and cutting edge technological applications are tremendously powerful in shaping this century and exciting biofuture. Keeping in view the expanse and applications of Biotechnology in every field, there is going to be a perpetual demand for resource personnel with Biotechnology specialization. The post graduate program is aimed to cater to this ever increasing demand and to groom the students to excel in their future career. Education and research sectors require such interdisciplinary trained workforce to develop future generations of science leaders.

Master's in Biotechnology course syllabus is revised to cater to the needs of credit based semester and grading system. The changing scenario of higher education in India and abroad is taken into consideration while restructuring this syllabus and more oriented towards current need of modern research and industrial sectors. The syllabus encompasses the fundamental academics at one end and latest technologies in life science at the other. Theory courses will help students develop their knowledge sets on various topics of biotechnology, to which, they are introduced at the undergraduate level. Extensive practical courses are designed to supplement the theory courses with hands on experimentation in wet-lab and on fields. Empowerment of students to face research and industrial outlets is at the centre of this syllabus. Students having to select their own courses will develop the depth in specialization and also make them ready to face the upcoming scientific advances in the world without any further training.

M.Sc. syllabus has been prepared keeping in vision the undergraduate curriculum. At the undergraduate level, students were introduced to many fundamental topics in life sciences such as molecular biology, developmental biology, fermentation technology, biodiversity, bioinformatics and tissue culture etc. At the post graduate level they will be also be acquainted with the thrust/new areas of biotechnology like bioinformatics, clinical research, database management, IPR, Food Technology etc. to give the students the advantage of not only learning these subjects but also give them the edge over others in their employability. A research project/ industrial training modules are incorporated to provide a buffer zone for budding biotechnologists eager to enter the life science sector.

Course Specific Outcome

M.Sc. Biotechnology Part-I

- **Advanced Biological Chemistry:** This course enables students to learn the basic concepts and principles of protein chemistry, enzymes, metabolomics, phytochemistry etc.
- **Cell & Molecular Biology:** This course enable students to learn fundamental principles of various cellular and molecular biology concepts such as cell structure and transport, Cell communication, cell cycle and cell death pathway, information flow in biological systems, genome structure and gene family, mechanism of replication, gene expression in prokaryotes and eukaryotes etc.
- **Genetics and Immunology:** In this course students will learn the basic concepts and principles of Mendelian genetics, population genetics and genetics of evolution, human genetics and methodologies, genetic mapping, immunology: fundamental concepts and overview of the immune system, immune responses generated by B and T lymphocytes, antigen-antibody interactions and vaccinology.
- **Environmental Biotechnology:** this course will orient students to various aspects of environment and life forms that includes energy and environment, pollution and environment, waste management, bioremediation removing pollutants from environments, environment monitoring and informatics, and environmental laws and policies.
- **Food Biotechnology:** In this course students will learns various aspects of biotechnology in food industry and processing that includes microbial biotechnology, enzyme in food technology, nanobiotechnology, prebiotics and probiotics, nutraceuticals, QC and QA quality, quality improvement, and food laws.
- **Genetic Engineering:** This course deals with applications of tools and techniques of biotechnology such as different types of vectors, PCR techniques, methods for protein-DNA interactions, gene silencing and genome editing technologies.
- **Bacteriology and Virology:** In this course students will learns various aspects taxonomy and diversity of bacteria, ultrastructure of bacteria, extremophiles, applied bacteriology, classification of viruses, replication of viruses, bacteriophages, cultivation of viruses, viral diagnosis, animal, plant and poultry viruses.
- **Plant Biotechnology:** In this course students will learn the basic concepts and principles of *in vitro* propagation methods, cryopreservation, genetic transformation methods, genetic manipulation, marker assisted plant breeding and QTL mapping.
- **Clinical Research, Data Management and IPR:** This course deals with introduction to clinical research drug development process, protocol designing, good clinical practice (GCP), drug regulatory affairs (clinical trial), clinical safety & pharmacovigilance, monitoring of clinical trials, concept of database and clinical data management, general regime of intellectual property rights, patents, copyright and neighboring rights, protection of plant varieties and plant breeders' rights etc.
- **Medical Biotechnology:** This course will introduce students with molecular basis of disease, diagnosis, therapies, stem cell therapy and nanotechnology.

* Practically related to these topics are conducted to gain the practical knowledge and hands- on experiences.

M.Sc. Biotechnology Part-II

- **Animal and Stem Cell Technology:** This course enables students to learn basic of animal cell and tissue culture, various systems of tissue cultures, organ culture, growth studies, application of animal cell culture, stem cells technology, transgenic animals, animal husbandry and reproductive biotechnology, biosafety issues and bioethics.
- **Bioprocess Engineering:** This course deals with bioprocess development, types of fermentations, design of fermenter/ bioreactors, isolation, screening and maintenance of strains, strain improvement, inoculum development, media for industrial fermentations, monitoring of process variables, scale up and scale down, mass transfer, aeration and agitation of fermentation broth, downstream processing, industrial production and recovery process, quality control (QC) and quality assurance (QA).
- **Bioinformatics and Biostatistics:** This course enables students to learn basic of major bioinformatics resources and biological databases, basic concepts in biological sequence analysis, structural bioinformatics, pharmacophore modelling and chemoinformatics, molecular modeling, introduction to biostatistics, sampling, distribution and presentation, hypothesis testing, design, correlation and regression analysis, statistical methods.
- **Nanobiotechnology:** This course introduces various aspects of nanobiotechnology, methods for synthesis of nanomaterials, physiochemical characterization of nanomaterials, applications of nanomaterials, nanomaterials and diagnostics/drug delivery and therapeutics, applications of nanobiotechnology, concerns of nanomaterials/nanobiotechnology.
- **Agricultural Biotechnology:** This course enables students to learn basic of agricultural biotechnology, crop improvement, development and formulation (with various carrier materials) of bioinoculants, for better agricultural productivity.
- **Genomics and Proteomics:** This course enables students to learn basic of genomics, transcriptomics and microarray, applications of genomics, proteomics, types of proteomics, techniques in proteomics, applications of proteomics.
- **Advanced Bio-analytical Techniques:** This course introduces various microscopic techniques, histochemical and immune-techniques, advanced application of spectroscopy, advanced chromatography and electrophoretic techniques, advanced bio-analytical techniques and automated systems.
- **Bio-entrepreneurship & Start up Designing:** This course deals with introduction to entrepreneurship, an entrepreneur and an entrepreneurship journey, starting the venture, preparing a business plan, entrepreneurship as problem solving, dimensions of entrepreneurship, strategic frameworks for decision.
- **Pharmaceutical Biotechnology & Drug Designing:** This course deals with introduction to drug action and resistance, process of drug development, biopharmaceuticals, computer aided drug design, structure based drug design, ligand based drug design, role of regulatory authorities in drug approvals.
- **Research Methodology & Scientific Communication:** This course enables students to learn research methods, scientific methodology, data collection and analysis, research data organization, data analysis, research in practice, research ethics, scientific communication, different modes of scientific communication.

• **Quality Control, Biosafety & Bioethics:** This course enables students to learn basics of quality standard & quality assurances, essential documents & regulatory submission, compliance and audits, bioethics, ethical issues, biosafety guidelines.

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