

## MSc BIOTECHNOLOGY

### Programme Specific Outcomes (PSO)

1. To familiarize with the concepts in associated subjects in Biotechnology such as Genetics, Microbiology, Molecular Biology, Immunology, Analytical techniques, Biochemistry etc
2. To identify, understand and analyze and problems related to biotechnology and finding valid conclusions with basic knowledge in related subjects
- 3: To gain In-depth knowledge in the chemical structure and function of biomolecules, metabolism in the cell, knowledge of the concepts of molecular genetics and biosynthesis of proteins, and a good theoretical and practical insight into methods used to obtain this knowledge.
- 4: To inculcate research aptitude in students through practical experience of laboratory experiments and mandatory in house project work
- 5: To get a solid foundation for future work in both academia and industry through theoretical and practical competence within the broad field of Biotechnology, both in the molecular level as well as with its applications
- 6: To create insight into the potential and limitations of biotechnology and its role in society and people's responsibility for how it is used among the various inter related disciplines.
- 7: To use critical analysis and problem solving skills; to develop, plan and implement innovative solutions within a diverse range of biotechnology industry sectors

Course Title: CELL BIOLOGY (Semester I-Biotechnology)

Course Outcomes (CO)

1. The students will be able to understand how the biomolecules transport mechanism across the membranes.
2. The students are able to analyse the structural features of organelles in cellular level, also about molecular sorting and vesicular traffic.
3. Students will be able to learn the maintenance of structural integrity of cells and intra cellular particle movements.
4. Students are familiarizing with the structural level organization of chromosomes.
5. Students will be able to learn the impact of cell division and its control measurements.
6. Students are able to connect with cell signalling and signal transduction process with receptors inside and outside the cell.

Course Title: GENERAL MICROBIOLOGY (Semester I-Biotechnology)

Course Outcomes (CO)

1. To understand and examine the microbial strains and to classify them.
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3. To relate various factors affecting the microbial growth and functions.
4. To understand the Biochemical pathways and metabolic processes of microorganisms.
5. To value the role of microorganisms in Ecology and Biogeochemical cycles.
6. To understand and examine the different diseases caused by microorganisms.
7. To relate and study the different types of medium used in the microbial culture and isolation and purification of the strains.

**Course Title: MOLEULAR GENETICS (Semester I-Biotechnology)**

**Course Outcomes (CO)**

1. The student will be able to analyse genetic inheritance of phenotypes and understand the genetic inheritance of sexual phenotypes also.
2. The student will gain knowledge about genes are organised in prokaryotic and eukaryotic cells and also the pattern of arrangement of DNA in chromosome.
3. The students will have an understanding of bacterial means of genetic material exchange and modification.
4. The student will be able to learn the impact of genetic recombination at molecular level.
5. The student will develop an analytical skill to connect phenotypic features with transposition of genes.
6. The student will able to approach logical explanation for questions related to mutation.
7. This will enable the students to understand and design experiments for detection of different types of mutations.

**Course Title: BIOMOLECULES AND ANALYTICAL TECHNIQUES (Semester I-Biotechnology)**

**Course Outcomes (CO)**

1. Students will have an understating of the structural organisation of proteins and the relevance of each amino acid in it.
2. Students will get an idea about the diverse form carbohydrate existing in the nature and their function.
3. Students will be able to understand the different forms lipids existing in the nature and their function.
4. Students will be able to analyse the structural and functional organisation of enzymes, explore their action mechanism, and their requirement in day-to-day functions in living systems.
5. Students will get an insight about the structure of the nucleotides and the kind of bonds they can form during different reaction.
6. Students will gain knowledge in the mechanisms of advanced techniques used in isolation and purification of biomolecule.
7. Students will gain knowledge about some of the basic techniques required frequently for analysis biomolecules like DNA, RNA and protein.

**Course Title: BASIC BIOINFORMATICS (Semester I-Biotechnology)**

**Course Outcomes (CO)**

1. To understand important Biological Databases and to articulate the biological data.
2. To examine and relate various computational methods to analyse protein sequences.
3. To deconstruct the methods of Phylogenetic analysis.
4. To predict the structure of proteins using various computational tools.

Course Title: BIOCHEMISTRY (Semester II-Biotechnology)

Course Outcomes (CO)

1. To understand and explain the Bioenergetics concepts of energy production and transmission in a living system.
2. To examine the basis of Protein metabolism in living system.
3. To understand the concepts of Carbohydrate production and its use in the living system.
4. To evaluate the process of Lipids production and its importance in the living system.
5. To study the concepts and importance of photosynthesis in plants and other living systems.
6. To understand and explain the mechanism of synthesis of nitrogen bases.

Course Title: MOLECULAR BIOLOGY (Semester II-Biotechnology)

Course Outcomes (CO)

1. Students will get an insight about some of the important discoveries and inventions in molecular biology.
2. The student will obtain knowledge about the structure, function and types of nucleic acids in a cell.
3. The students will have an understanding about the various modes of DNA replication possible in a cell.
4. The student will be able to approach analytical questions related to transcription of a gene and post transcriptional modifications.
5. The student will be able to connect the importance of synthesis of proteins by translation.
6. The student will be able to learn the impact of DNA mutation on diseased conditions and the importance of DNA repair system in a cell. They will also be able to think logically the regulation of gene expression in various cellular conditions in prokaryotes and eukaryotes.
- 7 Students will be able to understand different techniques of hybridisation and their applications in appropriate situations.
8. The student understands the importance of genes and their expression in a disease condition like cancer.

**Course Title: IMMUNOLOGY (Semester II-Biotechnology)**

**Course Outcomes (CO)**

1. Helps to demonstrate the basic knowledge of immunological processes at a cellular and molecular level and also have insights to central immunological principles and concepts.
2. Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses.
3. Provide students with the basic knowledge about the functioning of the immune system, inflammation, immune response against infectious agents.
4. Outline key events and cellular players in antigen antibody interaction, and how the nature of the antigen antibody reaction will shape resulting effector responses.
5. Understand and explain the basis of immunological tolerance, autoimmunity and transplantation.
6. Understand and explain the basis of allergy and allergic diseases processes governing graft rejection and therapeutic modalities for immune suppression in transplantation
7. Describe immune mechanisms related to vaccine function and Assess the efficacy and efficiency of currently available vaccines.

**Course Title: BIOPHYSICS (Semester II-Biotechnology)**

**Course Outcomes (CO)**

1. To understand the basis of physical characteristics and the bonds formed in a living system.
2. To analyse and apply the radioactive methods in biological sciences.
3. To evaluate and determine the protein structure.
4. To understand the physical concepts of ligand binding sites in a protein.
5. To understand the physical concepts of structural proteins.
6. To understand the concepts of electrophysiology and to examine the electrical behaviour of cell membranes.
7. To be able to analyse different biomolecules using analytical methods.

**Course Title: ADVANCED BIOINFORMATICS (Semester II-Biotechnology)**

**Course Outcomes (CO)**

1. To provide an insight into the inherent structure of protein molecules through molecular visualization.
2. To analyse and study the computational approaches towards predicting the protein structure using molecular docking.
3. To study the structure-function relationships.

Course Title: ANIMAL BIOTECHNOLOGY (Semester III-Biotechnology)

Course Outcomes (CO)

1. Gain knowledge about the practical skills to culture animal cells and tissues and familiarize with the tissue culture lab facilities.
2. Equip with the knowledge on physiological and nutritional requirements of cell types and analyze the properties of normal and tumoregenic cells also gaining competence and skill development in studying and characterizing cancer cells.
3. Understand that aseptic technique is a fundamental and important laboratory skill in the field of animal tissue culture
4. Gain knowledge about the genetic studies on cultured cells and applications of cell hybridization in formal genetics
5. Learn the in vitro culturing and manipulation techniques in assisted conception and gain competent knowledge on the concepts of assisted reproductive technology
6. Analyze the micromanipulation techniques to carryout somatic cell nuclear transfer and competence and skill development in studying the applications of cloning technology in research and development.
7. To help understand methods of developing transgenic animals and genetic engineering skills with respect to animals and their industrial applications.

Course Title: PLANT BIOTECHNOLOGY (Semester III-Biotechnology)

Course Outcomes (CO)

1. Provides students with basic knowledge of instrumentation for sterilization procedures and media preparations.
2. Students are able to learn theoretical knowledge about different cultures which they will extend in practicals.
3. The student is able to connect the making of plant clones and production of secondary metabolites.
4. The students are able to analyze developmental pathways.
5. The students are acquiring knowledge of genetic organization and model systems in plants
6. The student is able to approach cloning and transfection methods in plants to obtain transgenics and apply the knowledge in designing their project work.
7. The students will be familiarize with the applications of transgenic plants in different fields.



Course Title: GENETIC ENGINEERING (Semester III-Biotechnology)

Course Outcomes (CO)

1. Students will get an idea about the importance of genetic engineering and will get familiarise with different methods of gene transfer.
2. Students will get knowledge about the enzymes that are frequently used in genetic engineering.
3. Students will be informed about different types of vectors that can be used for gene cloning and they will be able to decide the relevance of each type of vector.
4. Students will be able to understand the basic procedure for cloning and the different types of DNA - library.
5. Students will develop an analytical skill on different crucial techniques frequently used in genetic engineering like PCR and next generation Sequencing
6. Students will develop an understanding about the technologies recently being used in the industries

Course Title: FOOD BIOTECHNOLOGY (Semester III-Biotechnology)

Course Outcomes (CO)

1. Students will be able to highlight the concept of functional foods and different fermented foods.
2. Students are familiarizing with the production and use of enzymes in food processing.
3. The students are able to learn the commercial value of different types of microbial proteins used as food supplements.
4. The students will be analyzing the advanced methods in food analysis.
5. Students will be able to connect with improving the nutritional quality of different foods.
6. Students will be able to interpret the role of microorganisms in various food formulations.
7. Students will be able to infer the newer developments in food industries

Course Title: ENVIRONMENTAL BIOTECHNOLOGY (Semester III-Biotechnology)

Course Outcomes (CO)

1. Gain knowledge understanding of the scientific principles (atmospheric, hydrological, geomorphological and ecological) that underpin current environmental issues and describes existing and emerging technologies that are important in the area of environmental biotechnology.
2. Analyze the types of environmental monitoring to create a baseline for the impact of industrial pollutants in the air, land and water. Gain knowledge on the biomolecular computer based approach for environmental issues including pollution
3. Competence and skill development in the methods for monitoring environmental pollution
4. Learn the importance and impact of biodiversity on human life, health and environment. Apply the practice of Wildlife conservation, an attempt to protect endangered animal and plant species, along with their natural habitat. Evaluate the reasons for loss of biodiversity and its significant impacts on human health and the spread of disease.
5. Analyse the factors posing threat to the environment and Knowledge on the basic steps in Environmental risk assessment.
6. Gain competent knowledge on the current Water conservation and Management strategies also suggest biotechnological solutions to address environmental issues including pollution, mineral resource mining, renewable energy and water recycling.
7. Analyse the Novel Methods for Environment protection and apply the practice of protecting the natural environment on individual, organization controlled or governmental levels, for the benefit of both the environment and humans.

Course Title: DEVELOPMENTAL BIOLOGY (Semester III-Biotechnology)

Course Outcomes (CO)

1. Students will be aware of the history and terminologies of developmental biology.
2. Students will be able to analyse the stages of animal development.
3. Students will be able to connect the cellular and molecular mechanisms underlying human and animal development.
4. Students will be acquiring deep knowledge in the process of fertilization and development of gametes.
5. The students will be familiarize and demonstrate a broad understanding of the key cellular and molecular mechanisms underlying human and animal development.
6. Students will be able to apply the concept of genetic and environmental impact to an understanding of congenital abnormalities and predisposition to adult disease.

Course Title: INDUSTRIAL BIOTECHNOLOGY\_OPEN ELECTIVE (Semester III-Biotechnology)

**Course Outcomes (CO)**

1. To throw light on nonconventional fuels and their environment friendly advantage.
2. To familiarize the biochemical pathway and possible process mechanisms to utilize microorganisms for microbial product synthesis.
3. To understand the basic concept of biopolymers and bioplastic.
4. To understand the mechanism of purposeful transformation of raw materials into a consumable food products.
5. It will provide an overview of the key enzymes currently used in large scale industrial processes.

Course Title: BIOPROCESS ENGINEERING AND ENZYME TECHNOLOGY (Semester IV-  
Biotechnology)

Course Outcomes (CO)

1. Students are familiarizing with the concepts in bioprocess and also acquire knowledge about the industrially relevant strains sterilization techniques.
2. Students will be able to describe the basic configuration and parts of a fermentor.
3. Student will be able to apply the basics of microbial kinetics in batch, fed-batch and continuous mode of operation.
4. Students will be developing a fundamental understanding process and product optimization, also be able to produce, analyse and interpret data from bioprocesses.
5. Students are able to understand the basic laws and terminologies in enzymology and also able to connect with enzymatic assays.
6. Students are able to approach the catalytic mechanisms in detail and the impact of coenzymes and cofactors in enzyme catalyzed reactions.
7. Students gaining a deep knowledge about enzyme catalyzed reactions metabolic reactions.
8. Students will be able to learn the impact of enzyme inhibitors in metabolic reactions.

Course Title: MEDICAL BIOTECHNOLOGY, BIOETHICS AND BIOSAFETY (Semester IV-  
Biotechnology)

Course Outcomes (CO)

1. Gain knowledge about the practical skills to carry out DNA assays and familiarize with the methods of DNA analysis and its importance in disease diagnosis.
2. Analyze the types of human disorders, competence and skill development in probe based diagnosis of diseases.
3. Gain knowledge about the tissue compatibility and graft rejection and applications of regenerative medicine.
4. Analyze the role of drug delivery systems in nanomedicine, competence and skill development in drug designing and pharmacokinetics.
5. Learn the principles and scope of bioethics and biosafety, understand the legal, social, economic, health and environmental impacts on research.
6. Help to understand the types of IPR and critical in helping new ventures transform their innovation potential and creativity into market value and competitiveness.
7. Skill development in ethical evaluation of diagnostics and therapeutics.

**Course Title: CLINICAL BIOTECHNOLOGY (Semester IV-Biotechnology)**

**Course Outcomes (CO)**

1. Analyse the types of human disorders, competence and skill development in diagnosis of diseases.
2. To develop an ability to use skills and modern technological tools necessary.
3. Explore the area of stem cell technology as it represents an exciting area in medicine because of its potential to regenerate and repair damaged tissue and gain an insight into the future of regenerative medicine.
4. Equip students with the knowledge of genetic and molecular basis of conditions.
5. Gain knowledge about the practical skills to carry out gene transfer and methods of DNA injection and its importance in therapeutics.
6. Explore the concepts of bioethical evaluation in medical genetics.

**Course Title: CANCER BIOLOGY (Semester IV-Biotechnology)**

**Course Outcomes (CO)**

1. Students will get familiarized about the fundamental aspects of molecular aspects of cancer.
2. Students will learn various causes of cancer.
3. This unit will help the students in understanding the role of various oncogenes in cancer and proliferation.
4. Students will be able to understand the role of different types of growth factors and receptors in promoting cancerous condition.
5. Students will be able to understand metastasis of cancerous cells.
6. Students will learn about the treatment of cancer and may be able to apply knowledge in development of useful drugs.

