

Syllabus: Biotechnology

a) Molecular and Cell Biology: Structure of atoms, molecules and chemical bonds; Composition, structure and function of biomolecules (nucleic acids, proteins, carbohydrates, lipids and vitamins); Enzymes, biological hierarchy, Organelles, Cell Membrane, Cell cycle and apoptosis, Cytoskeleton, Genome structure and organization, Fundamental processes in Life sciences: Central Dogma, Replication, Transcription, Translation, Post Translational Modifications, DNA damage and repair, RNA synthesis and processing Recombination and transposition, Control of gene expression. Prokaryotic and Eukaryotic cells: Microorganisms, Animal cells, plant cells, viruses.

b) Cellular Communication and Cell Signaling: Types of cellular communications, Cell signaling - Hormones and their receptors, cell surface receptor, signal transduction pathways, second messengers, regulation of signaling pathways, Cellular communication and regulation, Chemotaxis in bacteria, quorum sensing, light signaling in plants, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation, Protein-protein interactions.

c) Biochemistry, Microbiology and Virology: Enzymology, Metabolism, Bioenergetics, Thermodynamics, Macromolecular chemistry, secondary metabolites, Classification of plant and animal viruses, Classification of microorganisms, Microbial metabolism, antimicrobial agents, Morphology and ultrastructure of viruses, Replication of viruses Retroviruses, Viral vectors, Viral vaccines.

d) Immunology: Innate & Acquired Immune system, Types of immune cells: B cell, T cell, Antibody structure and classification, Antigen processing and presentation, MHC, Complement activation Hypersensitivity, Autoimmunity, Techniques in cellular Immunology.

e) Biochemical & Biophysical Techniques: Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Animal Tissue Culture, Plant Tissue Culture, rDNA Technology, Genomics and Proteomics, Genetic Engineering, Fluorescence and Absorbance Spectroscopy, Microscopy, Separation techniques.

f) Biostatistics & Ecological Principles: Hypothesis testing, T -test, Anova, Correlation and regression, Distribution, Mean, median, mode, standard deviation, error, Probability. Species interactions, population ecology, community ecology, conservation biology, biodiversity management.

g) Bioinformatics, Bioimaging and Modeling in Biology: Tools and resources and application.

h) Applied Biosciences: Biosensors, Transgenic animals and plants, Genomics and its application to health and agriculture, including gene therapy, Molecular Biology and Recombinant DNA methods, Isolation and purification of RNA, DNA (genomic and plasmid)

and proteins, different separation methods. Analysis of RNA, DNA and proteins by one and two-dimensional gel electrophoresis, Isoelectric focusing gels. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems Expression of recombinant proteins using bacterial, animal and plant vectors. DNA sequencing methods, strategies for genome sequencing. Methods for analysis of gene expression at RNA and protein level, large scale expressions.