

**Phd Biotechnology**  
**Syllabus**  
**Core subject**

**Unit I Biochemistry, Molecular & Cell Biology, Genomics**

Biomolecules, Metabolism, Membrane transport, Structure and regulation of prokaryotes and eukaryotes genes, Transcription, Translation, Post-transcriptional and Translational modifications, Molecular interaction, Phylogenetics, Molecular markers, Genetic and physical mapping, Gene interaction; Population genetics, Genetic engineering; Cloning and expression vectors, rDNA technology, Gene cloning approaches, Whole genome sequencing & annotation, High throughput gene expression and Function elucidation technologies, Signal transduction pathways and their elucidation, Primary and secondary metabolic pathways, Systems biology frameworks for metabolic engineering, Nanobiotechnology, Genomics and proteomics.

**Unit II Microbial & Plant Biotechnology**

Microbial taxonomy and diversity (bacteria, fungi, virus); Microbial nutrition, growth and control; Microbial metabolism; Microbial genetics; Microbial production and purification of fermented food and food products, recombinant proteins, industrial enzymes; Free and immobilized enzyme kinetics; Types of bioreactors; Bioseparation techniques; Concept of plant cellular totipotency; Clonal propagation; Organogenesis and somatic embryogenesis, artificial seed, somaclonal variation, embryo culture, *in vitro* fertilization; Plant products of industrial importance; Plant-microbe interactions.

**Unit III Medical Biotechnology**

Infectious diseases: Microbial (viral, bacterial, fungal) , Life style diseases, Cell & developmental biology, Cancer biology, Immunotechnology, Antigen antibody interactions, Antibody engineering, vaccines and the associated manufacturing processes, molecular and immuno diagnostics methods and their applications, Cell culture technologies, Regenerative medicine & transplantation technology, Hypersensitivity and autoimmune diseases, tolerance, animal biotechnology, Animal cell preservation, Stem cells and healthcare, Clinical trials

**Unit IV Environmental Biotechnology**

Biotransformation and biodegradation; Biofertilizers; Biosensors – living biosensors for the management and manipulation of microbial consortia; Role of biotechnology in energy production. Biofertilizers and biopesticides; solid wastes; sources and management (composting, vermiculture and methane production) . Single cell protein, Waste water treatment-physical, chemical and biological treatment processes; algal blooms and human health, biotechnological application of microbes from extreme environment.

**Unit V Analytical techniques**

Biochemical and Biophysical techniques, Microscopic techniques, Histology and histochemistry, Cell biology, molecular biology, Genetic engineering techniques. Techniques used for purification and characterization of biomolecules: Centrifugation, Ultrafiltration, Chromatography, electrophoresis, spectrophotometry, GC-MS, LCMS, NMR, X-ray crystallography, CD. Microscopic techniques including Fluorescence microscopy, Confocal microscopy, Atomic force microscopy. Histology and histochemistry: Fixation and sectioning of tissue, embryos and cells. Immunohistochemistry, immunofluorescence, histochemical staining for characterization of cell type. Real time PCR, DNA microarray, new generation DNA

sequencing, Protein Microarray, protein sequencing, Mass spectrometry based proteomics, mapping of protein interactions using mass spectrometry based approaches, Mass spectrometry based quantitative proteomics (ICAT, ITRAQ, SILAC approaches), Biomarker discovery using mass spectrometry based proteomics Blotting techniques, Gene transfer technologies, Protein-protein interactions