Syllabus for Ph.D. entrance test Biotechnology

UNIT- I

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-II

Methods in Biology Recombinant DNA techniques:

Isolation and purification of RNA and DNA, PCR, Restriction enzyme analysis, Molecular cloning, DNA sequencing, next generation sequencing (NGS), Generation of Genomic and cDNA libraries, Blotting techniques, DNA markers, use in diagnostics, genetic and genome engineering tools (CRISPR). Biophysical techniques: Centrifugation, Electrophoresis, Chromatography, Spectroscopy-UV-Visible, Fluorescence, IR, Mass Spectrometry, Protein sequencing. Microscopic techniques: Light microscopy, Scanning electron microscopy, Transmission electron microscopy. Immunological techniques: ELISA, RIA, Immunoprecipitation, Methods for detection of molecules in living cells.

UNIT-III

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, Phyllogenetics, 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, Gene transfer technologies, Protein-protein interactions, , Signal transduction pathways and their elucidation, Primary and secondary metabolic pathways, Systems biology frameworks for metabolic engineering, Nanobiotechnology, Genomics and proteomics.

UNIT-IV

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-V

Environmental Biotechnology

Biotransformation and biodegradation; Biofertilizers; Biosensors – living biosensors for the management and manipulation of microbial consortia; Role of biotechnology in energy production.

UNIT-VI

Bioinformatics/Statistics

Major bioinformatics resources (NCBI, EBI, ExPASy); Sequence and structure databases and analysis, Sequence analysis, Phylogeny, Comparative genomics; Molecular modeling and simulations. Overview and functions of a computer system; Basics of database management system- Conceptual Schema, ER diagrams, normalisation and SQL. Basics of programming; Statistics: Descriptive statistics, Correlation and regression, Hypothesis Testing, Probability theory.