

PhD entrance syllabus (School of Biotechnology)

Biochemistry

Physicochemical properties of amino acids and proteins; Primary, Secondary, Tertiary and Quaternary Structures of proteins, Protein stability and denaturation. Determination of protein structure, vitamins; structure and functions, coenzymes forms and biochemical functions, Enzymes: Nomenclature, Enzyme catalytic mechanisms, Factors affecting enzyme activity, Michalis-Menten kinetics, Isozymes, regulation of enzyme activity, Enzyme inhibition kinetics, Structure organization and function of nucleic acids, carbohydrates and biomolecules, Metabolism, glycolysis, TCA metabolism of lipids nucleic acids and proteins, Various biochemical techniques, Centrifugation, electrophoresis, chromatography and spectroscopy.

Microbiology

Classification of Microorganisms, Classification systems: Numerical Taxonomy, Phylogenetic system, Bacterial taxonomy and Bergey's manual of Bacteriology, Diversity in Bacterial morphology, Structures external to cell wall: Flagella, Pili, Capsule, Sheath. Prosthecae and Stalk, Structure and chemical composition of cell wall, Structure internal to cell wall: Cytoplasmic membrane. Protoplast, Spheroplast, Cytoplasmic inclusions, Genetic material, Growth kinetics, Spores and Cysts, Major Characteristics used in Bacterial genetics (Conjugation, Transformation and Transduction), Metagenomics, Drug resistance, Virus, Protoza, Prions. Role of microorganisms in human health, agriculture and industry.

Molecular Biology

Chemical & physical structure of DNA (Watson Crick Model) as deduced from X-ray diffraction pattern, variability of DNA structure, structure of RNA, Super coiling, Multiplex structure of DNA & its relevance, Mutagenesis, DNA Damage and repair. Denaturation & Renaturation of nucleic acids, Replication, Transcription and Translation in Prokaryotes and Eukaryotes, Regulation of transcription, Chromatin remodeling, Operons, Promoters and transcription factors,. Constitutive and inducible promoters, Transcriptional regulation in bacteriophage lambda, Lytic and lysogenic switch, RNA Processing and RNA editing, post transcriptional gene regulation, miRNA, SiRNA, Genetic code, Essential components of translation, Post translational modification, Transport of bacterial proteins: Co translational and Post-translational

mechanisms, Control of gene expression at translational level, Techniques of RNA and protein expression profiling.

Cell Biology

Cells (types, diversity & specialization, role of bio-molecules in cell organization, cellular bioenergetics, metabolism and its regulation); Membrane structure and its functions, transport of micro and macro molecules across plasma membrane; plant cell wall (its composition and synthesis); Mitochondria and chloroplast structure and role in cellular bioenergetics; Nucleus and nuclear envelop, nuclear pore complex transport of RNA and proteins across nuclear membrane., chromosome packing and chromatin remodeling during cell cycle and gene expression ; Chromosomes (physical and chemical nature of gene, structure of viral/ bacterial/eukaryotic genome, genome stability); Structure and function of Endoplasmic reticulum; golgi complex; peroxisomes, lysosomes and ribosomes, ; Endo-membrane system and vesicular transport (endocytic and biosynthetic/ secretory pathways, types of vesicles, protein sorting); post translation protein uptake; Cell-cell interaction; cytoskeleton; Cell cycle and its control (MPF, CDKs, cyclin, check points), Cancer (DNA viruses and transforming agents, Human tumor viruses, Oncogene, proteins in carcinogenesis, Apoptosis), Cell signaling, Gene expression profiling, microscopy and centrifugation methods.

Immunology

The antigen and concept of self and non-self discrimination, Antigenicity and immunogenicity, Factors contributing to antigenicity, Epitope mapping Haptens, Humoral and Acquired Cellular Immune Response , The organs and cells involved in the immune response, Lymphocyte traffic, Immunological Methods in Biotechnology (ELISA, RIA etc), Monoclonal Antibodies and Hybridoma Technology, Advantages over polyclonal antibodies, Basics of animal Cell culture, Media constituents, Cell quantitation techniques, Cell lines, Transgenic animals, Reproductive Cloning etc.

Recombinant DNA Technology

Tools of genetic engineering, Restriction endonucleases, DNA polymerases, Ligases, Kinases Phosphatases, Reverse transcriptase, Exonucleases, Ribonucleases, Proteinases. Cloning Vectors, Plasmids & cosmids, Phages, BAC, YAC, transposons. Radioactive and non radioactive

labeling techniques, Gene cloning, Vectors for heterologous gene expression in bacteria, yeast, animal and plant cells, Expression and purification of recombinant proteins from bacterial and eukaryotic systems. Genomic and cDNA libraries, Chromosome walking, gene tagging, subtraction hybridization, Southern blotting, Northern blotting and western Blotting. Latest techniques in rDNA technology, DNA Fingerprinting, AFP, RFLP, RAPD. DNAFoot printing, PCR and its applications, Sequencing of DNA and proteins, Site-directed mutagenesis, Method of genetic transformation for bacteria, plants and animal cells Protein and nucleic acid gel electrophoresis, Phage display, Two hybrid system.

Ecology, Evolution and Environmental Biotechnology

Concepts of Ecology and Ecosystem, Components of ecosystem, Food chain, Food web, Trophic level and Energy flow, Characteristic features, structure and function of the Forest, Grassland, Desert and Aquatic ecosystem, Structure and function of some Indian ecosystems Population ecology, Species interactions, Community ecology, Ecological succession, Applied ecology, Biodiversity and Conservation biology, The Mechanism: Population genetics-population, gene pool, gene frequency, Hardy- Weinberg law, concepts and rate of change in gene frequency through natural selection, migration and random genetic drift, Emergence of evolutionary thoughts, Origin of cells and unicellular evolution, Paleontology and evolutionary history, adaptive radiation and modifications, isolating mechanism, speciation, allopatricity and sympatricity, convergent evolution, sexual selection, co- evolution, Molecular evolution, Centre of evolution of economically important plant and animals. Fermentation technology, Vermiculture technology, Biofertilizer technology, Bioremediation and Phytoremediation, Biosensors.

Basics of bioinformatics and biostatistics