**MEDI-CAPS UNIVERSITY**

**FACULTY OF SCIENCE**

**DEPARTMENT OF BIOTECHNOLOGY**

**Ph.D – BIOTECHNOLOGY**

**ENTRANCE EXAM SYLLABUS (w.e.f – Dec 2023)**

**Cell Biology:**- Membrane biology: Cell wall & cell membrane - structure, composition, function & transport mechanism, electrical properties. Cellular organelles: Nucleus, endoplasmic reticulum, Golgi bodies, ribosomes, lysosomes, peroxisomes, mitochondria, chloroplast, plastids, vacuoles, cytoskeleton & cytoplasm. Cell communication and Cell signalling: cell adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation; signal transduction and secondary messengers. Cell division and cell cycle. Cell death, aging and senescence.

**Biochemistry:**- Biophysical chemistry - pH, buffer, thermodynamics, properties of water and their role in biology. Biomolecules - structure and function. Metabolism of carbohydrates, lipids, amino acids and nucleic acids. Photosynthesis, respiration and electron transport chain. Enzymes - Classification, catalytic and regulatory strategies; Enzyme kinetics - Michaelis-Menten equation, Lineweaver Burk plot ; Enzyme inhibition - competitive, non-competitive and uncompetitive inhibition. Vitamins, minerals and hormones.

**Molecular Biology:**- Chromosome – structure, types & organisation. DNA replication, repair and recombination. RNA synthesis and processing. Protein synthesis and processing. Gene expression and regulation.

**Microbiology:-** Bacterial classification and diversity. Basic concepts of fungi and algae. Microbial interactions. Viruses - structure and classification. Methods in microbiology. Microbial growth and nutrition. Nitrogen fixation. Microbial genetics - Microbial diseases and host-pathogen interactions. Antibiotics and antimicrobial resistance.

**Biotechnology:-** Microbial fermentation. Bioreactors. Upstream and downstream processing. Tissue and cell culture methods for plants and animals. Transgenic animals and plants. Genomics and proteomics – concepts and their application in health and agriculture. Bioresource management. Bioremediation and phytoremediation. Biosensors.

**Immunology** - Immunity – types & immune responses. Cell and organs of the immune systems. Antigens, antigenicity & immunogenicity. Antibody – structure, functions & diversity. Antigen-antibody interaction. MHC, Antigen processing & presentation. Disorders of the immune system – hypersensitivity, autoimmunity & immunodeficiency disorders. Vaccines & immunotherapeutics.

**Inheritance Biology -** Mendelian inheritance. Extension of Mendelian inheritance. Extrachromosomal inheritance. Linkage, recombination & chromosome mapping. Chromosome variations & genetic disorders. Pedigree analysis. Population genetics.

**Methods in Biology:-** Separation techniques. Chromatography – Paper, TLC, adsorption, affinity & ion-exchange, GC, HPLC. Centrifugation. Microscopy. Spectroscopy – UV-VIS, IR, NMR. Mass spectrometry. Circular dichroism. X-ray diffraction. Electrophoresis & isoelectrofocussing. PCR. Blotting techniques. In situ hybridization. DNA fingerprinting. Gene transfer technologies. DNA sequencing methods & genome sequencing. Analysis of DNA polymorphism - RFLP, RAPD and AFLP techniques. Microarray. Immunotechniques – ELISA, RIA, immunofluorescence, immunoblotting, flow cytometry.