SYLLABI FOR THE ENTRANCE TEST

PART-III

10. BIOTECHNOLOGY

Bioprocess Engineering:

Microbial growth and enzyme kinetics, stoichiometry of growth and yield. Design and operation of batch, fed-batch, and continuous (CSTR/Chemostat) reactors, including sterilization kinetics. Fluid mechanics, heat transfer, and oxygen mass transfer coefficients. Upstream media formulation and downstream processing, including cell disruption, centrifugation, filtration, chromatography and other analytical techniques (HPLC, Mass-spectroscopy). Design of bioreactors and downstream unit operations and scale-up strategies. Process instrumentation, feedback/feed-forward control systems. Industrial production of metabolites, vaccines, biofuels, and biological wastewater treatment processes.

Cell and Molecular Biology: Cells, Cell lines, Cell culture, Cell Organelles and its functions, types of Cell divisions, cell cycle and its regulation mechanism. Cell cycle abnormalities and development of cancers, epidemiology of cancers. Transport mechanism (passive, Active, ATPase pumps and Na_+/K_+ pumps), receptors, signal Transduction, models of signal Amplification Secondary messengers, Structure of Nucleic Acids, Replication, Transcription, Translation and DNA repair mechanism in Prokaryotes and Eukaryotes. Promoters, Enhancers and Transcription factors. Genetic Codes and Lac & trp operons.

Biochemistry and Microbiology: Structure, function and metabolism of carbohydrates**,** lipids, Nucleic Acids and proteins. Enzymes and its mechanism. Electron Transport Chain system, High energy compound and reducing equivalents. History of Microbiology, Classification of Microorganism, structural organization and multiplication of microorganism. Physical and chemical control of microorganisms, Primary and Secondary metabolites and their applications.

Genetic Engineering: Genes, Control of gene expression, Restriction enzymes, Vectors (prokaryotic and Eukaryotic) construction of cDNA and genomic Library. Screening of DNA libraries, PCR and its types, RAPD, RFLP, AFLP, site directed mutagenesis, Methods of Nucleic acid sequencing. Methods of transformation – Heat shock &electroporation, PEG mediated, Agrobacterium mediated, Gene gun. Transgenic and Knockout animals. Plant tissue culture and transgenic plants. Applications of genetic engineering.

Immunology: Immune system, immunity, lymphoid organs, antigens, adjutants, types of immune response. Activation and different ion of T-cells and B –cells, Antibodies, Genes and generation of diversity, monoclonal antibodies. MHC, APC, regulation of T-cell and B-cell responses. Immunity to viruses, Bacteria fungi and parasites, cytokines, complements, immunosuppression, allergy and hypersensitivity. Vaccines, Transplantation, Tumor Immunology, Autoimmunity and Autoimmune disorders. Gene therapy.

Bioinformatics: Search engines and algorithms, data management, data technology, biological databases and their uses. Pair-wise sequence alignment (local and global), multiple sequence alignment, dot matrix, dynamic programming and Bayesian methods. BLAST, machine learning and Hidden Markov models. Phylogenetic tree analysis. Bimolecular and cellular computing, Basics of system Biology- data-mining & analytical tools for genomics and proteomics.