M.Sc. BIOCHEMISTRY

III SEMESTER

BC 3.1: PLANT BIOCHEMISTRY AND HUMAN NUTRITION

Unit-1

Unit-2:

Unit-3:

Unit-4:
BC 3.2: IMMUNOLOGY

Unit-1


Unit-2


Unit-3


Unit-4

Immune effector mechanisms – Hypersensitivity: immediate (type I, type II, type III) and delayed hypersensitivity reactions, Immunodeficiencies - SCID and AIDS. Autoimmunity - organ specific (Hashimoto’s thyroiditis) and systemic (Rheumatoid arthritis) diseases. Tissue transplantation - auto, allo, iso and xenograft, tissue matching, transplantation rejection, mechanism and control, immunosuppressive agents. Cancer immunology – Tumor associated antigens, Immunological surveillance of cancer.
BC 3.3: REGULATION OF GENE EXPRESSION AND GENETIC ENGINEERING

Unit-1:
Structure and function of lac operon, Induction of lac operon – a negative control system, Catabolite repression – a positive control system, Function and regulation of trp operon, Attenuation of trp operon, ara operon: dual functions of the repressor, Diversity of sigma factor - Bacterial sporulation and Phage infection in Bacillus subtilis, Heat-shock response in E.coli, Regulation of phage variation in Salmonella. Regulation of lytic phase and lysogenic phase of Bacteriophage λ.

Unit-2:
Structural changes in the eukaryotic active chromatin - hypersensitive sites, chromatin remodeling, Levels of eukaryote gene control - Control at the level of transcription, processing of RNA, mRNA stabilization in the cytoplasm and translation of mRNA. Eukaryote promoter and enhancer sequence organization. Interaction of eukaryote transcriptional factors with DNA - helix-turn-helix motif, zinc-finger motif, leucine zipper, helix-loop-helix motif. Regulation of galactose metabolism in yeast. Steroid hormone induced gene expression. Regulation of gene expression by anti-sense RNA.

Unit-3:

Unit-4:
BC 3.4: INDUSTRIAL BIOTECHNOLOGY

Unit-1:

Fermentation technology – Principles of fermentation, surface, submerged and solid state fermentations. Batch, fed batch, semi-continuous and continuous culture techniques. Design and operation of fermentors, Agitation and aeration, Types of fermentors- continuous stirred tank fermentor (CSTF), air-lift fermentor, Types of reactions in fermentations, Selection and characteristics of industrial microorganisms, Primary and secondary metabolites, Strategies for strain improvement and maintenance of the industrial strains, Raw materials, different types of fermentation media, Recovery of products, steps in downstream processing, Bioreactors.

Unit-2:

Production of ethyl alcohol and beer by yeast, Fermentative production of Antibiotics - pencillín, streptomycin, tetracycline, Organic acids - citric acid, lactic acid, acetic acid, Enzymes - amylase, proteases, streptokinase, Amino acids - glutamic acid, lysine and Vitamins - B₁₂, B₂, and vitamin C. Production of biogas from agricultural wastes.

Unit-3:

Immobilization of enzymes and cells – methods of immobilization, effect of partition on kinetic properties of enzymes, immobilization of multi-enzyme systems, enzyme reactors, packed bed reactors, fluidized bed reactors, problems in using immobilized biocatalysts, Industrial and medical applications of immobilized enzymes and cells. Principle and applications of Protein engineering. Principle, types and applications of Biosensors.

Unit-4:

Single cell protein- Production and applications, Microbial transformations (bioconversions)-: Types and applications, steroidal transformations. Bioleaching, biosorption, biodegradation, bioremediation. Biofertilizers – Blue-green algal fertilizers (Azolla, Anabena), seaweed fertilizers, Mycorrhiza, Biocontrol agents- Siderophores, biopesticides – Insecticidal toxin of Bacillus thuringiensis, mode of action and control, Bacculoviruses.
Determination of A, B, O and Rh blood groups in human beings
Dissection and Identification of thymus, spleen and lymph nodes
Techniques of Immunization and Bleeding
Ouchterlony immunodiffusion for detection of Antigens
Radial Immunodiffusion
Immunoprecipitation and precipitin curve
Immunoelectrophoresis
Rocket immunoelectrophoresis
Purification of bovine serum IgG by ammonium sulphate precipitation
Enzyme Linked Immuno Sorbent Assay (ELISA)
Western blotting
Diagnostic test for typhoid fever
VDRL Test
Pregnancy Test
Isolation of Glycogen from Sheep Liver
Preparation of Carotenes from Carrots
Preparation of Haemoglobin from Blood
Preparation of Chloroplasts from green leaves
Isolation of Glutamic acid from Gluten of Wheat
Extraction and estimation of total lipids from oil seeds (solvent extraction)
Quantitative analysis of foods for -
  a) Moisture
  b) Ash
  c) Iron
  d) Calcium
  e) Copper
BC 3.6: BIOTECHNOLOGY AND GENETIC ENGINEERING

Fermentative production and quantification of:
Antibiotics - penicillin/ streptomycin/ tetracycline
Organic acid: citric acid/ lactic acid/ acetic acid
Enzymes: amylase/ protease/urease
Amino acid: glutamic acid/ lysine
Vitamins: B<sub>12</sub>/ B<sub>2</sub>/vitamin C
Ethyl alcohol/ fruit wine and calculation of fermentation efficiency
Methods of immobilization of protein/enzyme and microbial cells
Isolation of plasmids and estimation of plasmid DNA by UV method
Restriction digestion of λ DNA, Ligation of RE fragments
Agarose and Polyacrylamide gel electrophoresis of nucleic acids
Recovery of DNA/RNA fragments from agarose gels
Preparation of competitive *E. coli* cells and transformation
Expression of cloned gene (GFP)
DNA finger printing (RFLP or RAPD)
PCR
Southern blotting
### M.Sc., BIOCHEMISTRY SEMESTER SYSTEM

#### CREDIT SYSTEM

**SCHEME OF INSTRUCTION AND EXAMINATION**

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the Paper</th>
<th>Periods/Week</th>
<th>No of Credits</th>
<th>Duration of Exam (hrs)</th>
<th>Max Marks</th>
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**Total marks for III Semester**: 535 + 90* = 625

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*Internal assessment component carries 15 marks for each theory and practical papers.*