M.Sc. Semester III (Admission 2012-14)

Paper 1. Enzymology

Unit I

Isolation and purification, Classification and nomenclature of enzymes.
Enzyme catalysis: enzyme specificity and the concept of active site, determination of active site. Stereospecificity of enzymes.

Unit II

Enzyme kinetics: Factors affecting rates of enzyme catalyzed reactions, unisubstrate reactions, concept of Michaelis - Menten, Briggs - Haldane relationship, Determination and significance of kinetic constants, catalytic rate constant and specificity constant, Limitations of Michaelis-Menten Kinetics.

Unit III

Classification and kinetics of multisubstrate reactions.
Reversible and irreversible inhibition, competitive, non competitive and uncompetitive inhibitions.

Unit IV

Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid - base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis. Theories on mechanism of catalysis.
Mechanism of enzymes action: mechanism of action of lysozyme, chymotrypsin, carboxypeptidase. Multienzyme system, Mechanism of action, regulation and coenzymes of pyruvate dehydrogenase and fatty acid synthetase complexes.

Unit V

Enzyme regulation: General mechanisms of enzyme regulation, Allosteric enzymes, sigmoidal kinetics and their physiological significance, Symmetric and sequential modes for action of allosteric enzymes. Reversible and irreversible covalent modifications of enzymes.
Immobilised enzymes and their industrial applications.

Paper 2. Metabolism I

Unit I

The concept of Gibbs free energy, exergonic and endergonic reactions, redox potential. High energy bond and key position of ATP, substrate level and oxidative phosphorylation. ETC, Inhibitors and uncouplers of ETC.

Unit II

Carbohydrates :, glycogenesis and glycogenolysis, glycogen storage diseases glycolysis and gluconeogenesis, Cori's cycle,

Unit III

Pyruvate dehydrogenase complex, Kreb-cycle, glyoxalate pathway, pentose phosphate pathway and uronic acid pathway.
Regulation of carbohydrate metabolism.

Unit IV

Lipids. Oxidation of fatty acids- mitochondrial β-oxidation, α-and ω-oxidation, oxidation of unsaturated and odd-chain fatty acids, ketone bodies.
Biosynthesis of fatty acids, desaturases.

Unit V

Phospholipids and glycosphingolipids- synthesis and degradation, lipid storage diseases.
Salient features of the metabolism, cholesterol and bile acids.
Regulation of lipid metabolism.

Paper 3. Plant Biochemistry

Unit I

Structure of chloroplast, Photosynthesis,dissipipation of excitation energy by chlorophyll,Photosynthetic electron transport chain. Thylakoid membrane protein complexes - PS I, PS II, LHC II, Cyt b_6f, ATP synthase complexes, cyclic photophosphorylation.

Unit II

Calvin cycle : Biochemistry of RuBP carboxylase/oxygenase, activation of RUBISCO, oxygenation reaction, stereochemistry of RUBISCO, photorespiration and compensation point, photosynthetic effeciency .

Unit III

Regulation of enzymes of carbon dioxide fixation by light; Hatch and slack pathway, CAM plants; productivity of C4 plants.

Unit IV

Nitrogen Metabolism : Nitrogen fixation, nitrogenase complex, mechanism of action of nitrogenase. Structure of ‘NIF’ genes and its regulation. Hydrogen uptake and bacterial hydrogenases.
Nitrate Metabolism : Enzymes of nitrate metabolism, regulation of their synthesis and activity.

Unit V

Special features of secondary plant metabolism,
Water and mineral balance in plants, structure, function and mechanism of action of phytohormones, Defence system in plants.

Paper 4. Biotechnology

Unit I

Basic principles of genetic engineering: Methods of creating recombinant DNA molecule, splicing, properties of restriction endonucleases and their mode of action,
Construction of DNA library, chemical synthesis of gene,

Unit II

Cloning vectors (lambda phage, plasmid, M-13 phage, cosmid, shuttle vectors, expression vectors). Selection/screening.

Unit III

Analysis of genomic DNA by Southern hybridization, Northern and Western blotting techniques.
Restriction mapping : Restriction fragment length polymorphism (RFLP).

Unit IV

DNA sequencing techniques: plus and minus, dideoxynucleotide, Maxam and Gilbert method, Amplification of DNA by polymerase chain reaction (PCR)
Site directed mutagenesis.

Unit V

Gene transfer methods for animals and plants; Agrobacterium mediated gene transfer, electroporation and particle gun
Application of genetic engineering in medicine and agriculture, vaccine production.

Semester III

List of Practicals

1 Extraction and estimation of proteins from plant material.
2.Extraction and estimation of RNA from biological material
3 Extraction and estimation of DNA from biological matyerial
4 Estimation of phosphate in serum.
5 Estimation of creatinine in serum.
6 Estimation of calcium in serum.

M.Sc. Semester IV (Admission 2012-14)

Paper 1. Molecular Biology

Unit I

Concept and defination of the gene, complexity of the eukaryotic gene. Structural organization of the DNA in the nuclear material- General properties of histones, nucleosomes and solenoid structure.

Unit II

DNA synthesis: The enzymes of DNA replication in prokaryotes and eukaryotes, mechanism of replication in bacteria and viruses, reverse transcriptase, salient features of eukaryotic nuclear and mitochondrial DNA replication.

Unit III

RNA synthesis: The enzymes of transcription in prokaryotes and eukaryotes, mechanism of transcription in bacteria, heteronuclear RNA, post transcriptional processing of RNA, role of ribozymes.

Unit IV

Protein synthesis: Concept of the genetic code, structure of r-RNA and t-RNA, enzymes of translation in prokaryotes and eukaryotes, mechanism of protein synthesis, post translational processing of proteins.

Unit V

Regulation of gene expression in prokaryotes and eukaryotes, structure and mechanism of various operons, such as Lac, Trp and Ara.

Paper 2. Metabolism II

Unit I

Proteins: Digestion and absorption of proteins, general reactions of protein metabolism, nitrogen balance, ammonia transport, urea cycle.

Unit II

Amino acid metabolism: Glucogenic and ketogenic amino acids, One carbon metabolism, Biosynthesis of non essential amino acids, Pyruvate forming and glutamate forming amino acids,
Inborn errors associated with them.

Unit III

Catabolism of methionine, aspartate, lysine, branched chain and aromatic amino acids. Inborne errors associated with them

Unit IV

Biosynthesis and degradation of purines and pyrimidines and their regulation. Structure and regulation of ribonucleotide reductase. Inhibitors of nucleic acid biosynthesis. Inherited disorders of purine and pyrimidine metabolism.

Unit V

Mineral metabolism : Biological role of minerals and trace elements, toxic effects of heavy metals, such as, Hg, Cd, Pb, As.

Paper 3. Immunology

Unit I

Types of immunity, innate, acquired, passive and active, self vs nonself discrimination.
Physiology of immune response : HI and CMI specificity and memory, antigen-antibody reactions. Antigen types.
Immunoglobulins - structure, distribution and functions, Isotypic, Allotypic and Idiotypic variants. Immunoglobulin superfamily.

Unit II

Lymphoid tissue, origin and development of T- and B- lymphocytes, differentiation of lymphocytes, lymphocyte-sub-populations of mouse and man. Structure and function of lymphoid tissue. T and B cells and their surface antigens. Activation of T- and B-lymphocytes and signaling pathways in T- and B- cells.
Antigen Processing and Presentation, Lymphokines, Phagocytic cells, macrophage, dendritic cells, K and NK cells

Unit III

MHC genes and products, polymorphism in MHC genes, Role of MHC antigens in immune responses., MHC antigens in transplantation and HLA tissue typing. Structure and function of class I and class II molecules.
Effector mechanisms in immunity, macrophage activation, cell mediated cytotoxicity, cytotoxicity assay,

Unit IV

Hypersensitivity reactions and types.
The complement system, mode of activation, classical, alternate and lectin pathway, biological functions of C proteins.
Immunological tolerance and supression.

Unit V

Immunotechniques- Agglutination and precipitation, Single and double immuno diffussion, Immunoelectrophoresis, Immuno fluorescence, RIA and ELISA, Monoclonal antibodies.

Paper 4. Clinical Biochemistry

Unit 1

Collection and preservation of biological fluids.and their significance, chemical analysis of CSF and its significance.
Water and electrolyte balance. Acid base balance.

Unit II

Disorders of carbohydrate metabolism, Postprandial and Glucose tolerance test. Biochemical changes in diabetes mellitus, Hypoglycemia, Ketone bodies. Biochemical changes in diabetes mellitus, glycohaemoglobin, serum lipids and other complication of diabetes mellitus.
Lipids, lipoproteins and apolipoproteins-role in diseases.

Unit III

Evaluation of organ function tests of gastric, pancreas, kidney and liver.
Bilirubin, direct and indirect Vanderwal tests and their clinical significance, jaundice. Fatty liver, Bile pigments - chemical nature and physiological significance.

Unit IV

Porphyrins chemistry and disorders, structure of Hb, derivatives and abnormal Hb. Detection by spectrophotometry and by fluorescence.
Enzymes in differential diagnosis of diseases and their clinical significance.

Unit V

Detoxification, phase I and phase II reactions, Enzymes of detoxification. Carcinogenesis, characteristics of cancerous cells, agents promoting carcinogenesis.
Free radicals in biological systems, Antioxidants.

Semester IV List of Practicals

1. Assay of serum enzymes- acid and alkaline phosphatase, SGOT and SGPT and amylase.
2. Estimation of cholesterol in serum
3 Assay of enzymes of N-metabolism: NR, GDH.
4. Assay and kinetic analysis of salivary amylase and serum alkaline phosphatase. Effect of enzymes and substrate concentration, pH, and temperature on enzyme activity.
5. Estimation of chloride, urea, bilirubin, uric acid in serum
6 Electrophoretic separation of proteins

SCHEME OF PRACTICAL EXAMINATION FOR M.Sc. I to IV SEMESTER

Duration 7 hr

1. Two experiments from the Semester wise list (**60** marks)
2. Viva (**30** marks) Record (**10** marks)-
