COURSE DISTRIBUTION OF B.Sc. (BIOCHEMESTRY) PROGRAMME

First Year :

BBC 101	Biomolecules	Marks 45
BBC 102	Biophysical & Biochemical Techniques	Marks 45
BBC 103	Cell Biology & Membrance Biochemistry	Mark 45
BBC 104	Laboratory Course I	Marks 60

Second Year :

BBC 205	Enzymology	Marks 45
BBC 206	Intermediary Metabolism	Marks 45
BBC 207	Human Phystology	Marks 45
BBC 208	Laboratory Course II	Marks 65

Third Year :

BBC 309	Molecular Biology	Marks 50
BBC 310	Nutritional & Clinical Bioshemistry	Marks 50
BBC 311	Microbiology & virology	Marks 50
BBC 312	Environmental Biochemistry & Immunology	Marks 50
BBC 313	Laboratory Course II	Marks 100

SELECTION OF SUBJECTS COMBINATIONS

Subject 1 : Biochemistry

Subject 2 : Chemistry

Subject 3 : Botany/Environmental Science/Zoology (any one)

B.Sc.

First Year

BBC-101

BIOMOLECULES

Introduction

Introduction to Biochemistry, water as a biological solvent, weak acids and bases, pH, buffers, Henderson-Hasselbalch equation, physiological buffers, fitness of the aqueous environment for living organisms.

(i) Carbohydrates

Structure of monosaccharldes. Stereoisomerism and optical isomerism of sugars Reactions of aldehyde and ketone groups. Ring structure and anomeric forms, metarotation. Reactions of sugar due to hydroxyl groups. Important derivatives of monosaccharides, disaccharides and trisaccharides (structure, occurrence and functions of important ones). Structure, occurrence and biological importance of monosaccharides, oligosacchaddes and polysaccharides e.g. Coliulose, chitin, agar, algenic acids, pectins, preteolglyague, blood group polysaccharides, glycogen and starch. Bacterial cellwall polysaccharides etc. Glycoproteins.

(ii) Lipids

Definition and classification fatty acids: Introduction classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, prostaglandins. Triacylglycerols: nomenclature,physical properties, chemical properties and characterization of fats - hydrolysis, saponification value, rancidity of fats. Relchert-M elssel number and reactionof giycerol. Biological significances of fats. Glycophosopholipids (tecithins, lysolecithins, cephalins, phosphatidlyl serine, phosphatidyl inositol, plasmalogens), phospholipids, isoprenoids and sterols.

(iii) Proteins

Introduction, classification based on solubiity, shape, composition and functions. Amino acids: common structural features, stereo-isomerism and RS system of designating optical isomers, classification and structures of standard amino acids as zwitterion in aqueous solutions,physical and chemical properties, titration of amino acids, separation of amino acids. Essential amino acids.

Peptides: structure of peptido bond, chemical synthesis of polypeptides - protection and deprotection of N-terminal, and C-terminal ends and functional groups in the side-chains, formation of peptide bonds, condensing agents, strategy of chemical synthesis, Merrifield solid-phase peptide synthesis. Determination of the amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of a polypeptide chains and separation of peptides. Protein structure: levels of structure in protein architecture, primary structure of proteins, secondary structure of proteins - helix and pleated sheets, tertiary structure of proteins, forces stabilizing the tertiary structure and quaternary structure of proteins. Denaturation and renaturation of proteins. Behaviour of proteins in solutions, salting in and salting out of proteins. Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (hemoglobin, myoglobin), lipoproteins, metalloproteins,

glycoproteins and nucleoproteins.

(v) Porphyrins

Porphyrins: Porphyrin nucleus and classification of porphyrins. Important Metalloporphyrins occurring in nature. Detection of porphyrins spectrophotometrically and by fluorescence. Bile pigments - chemical nature and their physiological significance.

BBC-102

BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

(i) Concepts of Bicenergetics

Principles of thermodynamics and their applications in biochemistry - Introduction, thermodynamic system, thermodynamic state functions, first and second faws of thermodynamics, concept of free energy, standard free energy, determination of ΔG for a reaction relation between equilibrium constant and standard free energy change, biological standard state and standard free energy change in coupled reactions. Biological oxidation-reduction reactions - introduction, redox potentials, relation between standard reduction potentials and free energy change (derivations and numericals included). High-energy phosphate compounds - introduction, phosphate group transfers-free energy of hydrolysis of ATP and sugar phosphates along with reasons for his ΔG.

(ii) Hydrodynamic Methods

Sedimentation - sedimentation velocity, preparative and analytical untracentrifugation techniques, determination of molecular weight by hydrodynamic methods (derivations excluded and numericals included).

(iii) Measurement of pH

Principles of glass and reference electrodes, types of electrodes, complications of pH measurement (dependence of pH on ionic strength, electrode contamination and sodium error) and use of pH paper.

(iv) Radiolsotopic Techniques

Types of radiolsotopes used in Biochemistry, units of radioactivity measurements, techniques used to measure radioactivity (gas ionization and liquid scintillation counting), nuclear emulsions used in biological studies (pre-mounted, liquid and stripping), isotopes commonly used in biochemical studies - ^{32}P, ^{35}S, ^{14}C and ^{3}H), Autoradiography, Biological hazards of radiation and safety measures in handling radioisotopes, Biological applications.

(v) Chromatogrphy

Generaal principles and applications of:

1. Adsorption chromatography
2. Ion-exchange chromatography
3. Thin-layer chromatography
4. Molecular-sieve chromatography
5. Hydrophobic chromatography
6. Gas-liquid chromatography
7. HPLC
8. Affinity chromatography
9. Paper chromatography

(vi) Electrophoresis

Basic principles of agarose electrophoresis, PAGE and SDS-PAGE, Two-dimensional electrophoresis, its importance. isoelectrofocussing.

(vii) Spectroscopic Techniques

Beer-Lambert Law, light absorption and its transmittance, determination and application of extinction coefficient, application of visible and UV spectroscopic techniques (structure elucidation and numericals excluded). Principle and application of NMR, ESR, Mass spectroscopy. Fluorescent and emission spectroscopy.

(viii) Immunological Techniques

Immunodiffusion, immunoelectrophoresis, radioimmunoassay, ELISA, immunoffuorescence.

BBC-103

CELL BIOLOGY AND MEMBRANE BIOCHEMISTRY

A. Cell Biology

(i) Morphology of Cell

Cell size, shape, comparison of prokaryotic and eukaryotic cell structure, cell types including cellular specialization and differentiation, differences in plant and animal cells, Photosynthesis and Nitrogen metabolism.

(ii) Structure and Function of Cell Organelles

Detailed description of eukaryotic cell structure, endoplasmic reticulum, nucleus, mitochondria, lysosomes, peroxisomes, Golgl apparaturs, ribosomes and polysomes, cytoskeletal elements.

(iii) Cell biology Techniques

Use of light microscopy, phase contrast microsocopy, transmission and scanning electron microscopy, electron tunneling microscopy and freeze fracture technique in the study of cells and cell organelles.

(iv) Cell Division

Cell cycle and Cell growth, Cell and tiasue culture techniques, properties of cell in culture.

B. Membrane Biochemistry

(i) Biological Membranes

Types and sub cellular location. Chemical composition of biomembranes, Gap and tight junctions. Model lipid membranes - preparation and properties. similarities and differences btetween biomembranes and artificial phospholipid membranes. Physical and biochemical methods to study membrane structure and properties. different models of cell membrane - a historical perspective. Functions of biomembranes with examples-energy transduction, signal recognition. Specialized forms of membranes-brush border, flogella and pancreatic activity.

(ii) Membrane Transport

Nutrient transport across biomembranes. Simple diffusion and Fick's law. Porins facilitated diffucion. Porter molecules, Kinetics of facilitated transport. Sympor, antiportand uniport. Red cell membrane-proteins. Anion porter and glucose porter. Active transport, Proton and Na^+-K^+ pumps - examples and metabolic significance.

(iii) Membrane Receptors

Structure and functions. Methods to study membrane receptors. Purification and characterization of adrenergic and cholinergic receptors.

(iv) Bacterial and Plant cell walls

Structure, composition and biosynethesis. Inhibitors of cell wall synthesis.

BBC-104

PRACTICAL FOR 1st YEAR

LABORATORY-I

1. Preparation of standard buffers and determination of pH of a solution.
2. Qualitative tests for :

a. Carbohydrates
b. Proteins and amino acids
c. Lipids

3. Determination of saponification value and iodine number of fats.
4. Estimation of ascorbic acid.
5. Titration curve for amino acids and determination of pH value.
6. Verification of Beer-Lambert's law.
7. Estimation of
   (i) Carbohydrate by anthrone method.
   (ii) Blood glucose by the methods (a) Folin-Wu. (b) Nelson-Somogyi
8. Estlmation of amino acids by ninhydrin method.
9. Isolation and assay of glycogen from rat liver.
10. (i) Extraction of total lipids by Folch method
    (ii) Estimation of food adulterant.
11. Estimationof DNA and RNA.
12. Separation of sugars usingpaper chromatography.