

SYLLBUS FOR M.Sc. ( PREVIOUS) BIOCHEMISTRY  
FROM 2006-07 ACADEMIC YEAR  
SEMESTER -I

PAPER :I BIOMOLECULES

UNIT I

Carbohydrates: Classification of carbohydrates, reactions of monosaccharides, properties of carbohydrates, importance of Homo and hetero polysaccharides – structural elucidation of starch and glycogen. Structure and biological importance of aminosugars, Glycoproteins, proteoglycons, Bacterial cell wall polysaccharides, blood group substances and Lectins.

UNIT II

**Aminoacids and proteins:** Classification of amino acids, acid-base properties of amino acids, pKa of functional groups of amino acids, chemical reaction of aminoacids, Non-protein aminoacids. Peptide bond – structure and conformation, Merrifield solid phase peptide synthesis, Naturally occurring peptides.

Classification of proteins - Isolation and purification of proteins, criteria of purity of proteins, physico-chemical properties, structural organization of proteins, elucidation of primary structure, secondary structure helical, beta pleated sheet structure and triple helical structure.

UNIT III

Tertiary structural features of myoglobin, lysozyme, ribonuclease, chymotrypsin, Quaternary structure – Hemoglobin – protein folding (ribonuclease) Denaturation & renaturation of proteins. Chemical modification of proteins.

**Lipids:** classification, physico-chemical properties of fatty acids. Characterization of natural fats and oils, structure and biological role of triacyl glycerol, phospholipids, sphingolipids, gangliolipids. Prostaglandin's, thromboxanes, leucotrienes – steroids – cholesterol, and bile acids – bacterial and plant lipids.

UNIT IV

**Nucleic acids:** Isolation, fractionation and characterization of nucleic acids, properties of nucleic acids in solution- denaturation and renaturation, hypo and hyper chromic effects, T<sub>m</sub>, cot curves, chemical and enzymatic hydrolysis of nucleic acids, Structure of nucleic acids – purine and pyrimidine bases – nucleosides, nucleotides, polynucleotides – secondary and tertiary structure of DNA, different types of DNA, types of RNA – structures of RNAs.

UNIT V

**Porphyrins:** Structure, properties and Identification. Structure of metalloporphyrins – heme, cytochromes and chlorophylls.

**Vitamins:** Chemistry and properties of water soluble and fat-soluble vitamins.

Heterocyclic compounds: **Heterocyclic ring compounds in biological systems - pyrrole, thiophene, pyrone, indole, quinoline, isoquinoline, pyrimidine and purines with suitable examples.**

**Books Recommended:**

1. Lehninger's Principles of Biochemistry (2000) by Nelson, David L and Cox, M M, Macmillan/worth, NY.
2. Fundamentals of Biochemistry (1999) by Donald Voet, Judith G Voet and Charlotte W Pratt, John Wiley & Sons, NY.
3. Biochemistry III ed (1994) by Lubert Stryer, WH Freeman and Co., San Francisco.
4. Outlines of Biochemistry (1987) by Eric E Conn, P K Stumpf, G Bruening and Ray H Doi, John Wiley & Sons, NY.
5. Principles of Biochemistry General aspects 1983 Smith et al. (McGraw Hills)
6. Biochemistry (4<sup>th</sup> edition) – Thomas M.Devlin.

7. Text book of Biochemistry (1908) west and Todd. (Mac Milan)
8. Text book of Biochemistry – Zubay.
9. Biochemistry – Garret and Girsham

SEMESTER - I

## **PAPER –II BIO ORGANIC CHEMISTRY AND ANALYTICAL METHODS - I**

### **UNIT I**

Stereochemistry: Introduction, chirality & symmetry elements of methane, chloroform and dichloromethane. Relation between chirality and optical activity. Representation of chiral structure by Fisher's projection, perspective, Newman and sawhare formulas, molecular modules: classification of chiral compounds –DL & RS methods. Assignment of RS-nomenclature to chiral carbon compounds. Geometric isomerism- E& Z notation.

#### **ELECTRODE AND INDICATOR DYE TECHNIQUES:**

Henderson Hasselbalch equation; standard hydrogen electrode; reference electrodes calomel electrode and silver-silver chloride electrode pH measurement using organic indicators and potentiometry. Oxygen electrode. Buffers: buffer action and buffer capacity and their importance in biological systems.

#### *UNIT - II*

##### **Chromatographic techniques:**

**Methods based on Polarity:** Principle, methodology and applications of Liquid-liquid chromatography (paper chromatography – circular, ascending, descending types, R<sub>f</sub> values), liquid-solid chromatography (TLC) and Gas-Liquid chromatography (Instrumentation, principle, supporting media, columns, methodology, analysis of results and applications. Detectors of Gas Chromatography.)

**Methods based on Charge:** Ion-exchange chromatography: Principle, types of exchangers, supporting media, Methodology, Automatic amino acid analyzer and its applications.

**Methods based on Size:** Gel permeation chromatography - Principle, Gel matrices – sephadex, acrylamide, agarose gels, Methodology, Applications – molecular weight determination, desalting.

**Methods based on Biological affinity:** Affinity chromatography: Principle, supporting media, ligands, linker arms, Methodology and applications.

**High performance Liquid Chromatography:** Principle, instrumentation, columns, materials, practical procedure and analysis of results. Applications of HPLC.

### **UNIT - III**

**Electrophoresis:** Ion movement in electric field, electrophoretic process, different tank systems, supporting media-starch, paper, acrylamide, agarose, agarose-acrylamide. Polyacrylamide gel electrophoresis DISC and slab, SDS PAGE; Isoelectric focussing, two dimensional gel electrophoresis, immunoelectrophoresis, high voltage electrophoresis, Denaturing gels for RNA separation, electroelution, detection of subunit composition and molecular weight. Pulse field electrophoresis and capillary electrophoresis.

**Blotting techniques:** Southern blot, western blot, and northern blot – general methodology and applications.

#### *UNIT IV*

**Spectroscopic techniques:** Principles of Spectroscopy; Laws governing light absorption (Beer-Lambert's Law). Instrumentation and biological applications, Colorimetry, Spectrophotometry, Fluorimetry, Flame photometry, Atomic absorption Spectrophotometry, Basic principles of IR spectroscopy, Electron Spin Resonance Spectroscopy, NMR spectroscopy and Mass Spectrometry, plasmon resonance spectroscopy.

#### *UNIT - V*

Centrifugation Techniques: Basic principles of centrifugation, preparative centrifugation-differential, rate-zonal, isopycnic and equilibrium isodensity centrifugation, analysis of sub-cellular fractions, assessment of homogeneity. Analytical ultracentrifuge and its applications.

##### **Books Recommended:**

1. The tools of Biochemistry – Terrace.E.Cooper (John Willey).

2. A Biologists guide to Principles and Techniques of practical Biochemistry – Ed. Bryan, L. Willians & Keith Wilson (Edward Arnold).
3. Biochemical research techniques – A practical introduction. - Ed. John M. Wriggelsworth.
4. Principles & Techniques of Practical Biochemistry – Wilson and Walker.
5. Analytical Biochemistry. David. J. Home & Hazelpeck. (Longman).
6. Practical Clinical Biochemistry, (5<sup>th</sup> edition) – H. Varley, A.H. Cowenlock & M. Bell
7. A manual of Radiology. J.C. Steward & D.M. Hawcroft. (Sidgwick &)
8. Instrumental methods of chemical analysis – B.K. Sharma publications)
9. Physical principles and Techniques of Protein chemistry – Leach. (Parts A, B, C)
10. Text book of biochemistry – west and Todd
11. Physical Biochemistry (II ed 1983) by D Friefelder, WH Freeman & Co., USA
12. Biophysical chemistry – Upodhya and Nath (Himalaya publications)
13. Physical Biochemistry (II ed 1985) by vanHolde KE, Prentice Hall Inc., New Jersey.
14. Chromotography: A laboratory handbook of chromatographic and electrophoretic methods. (IIIrd 1975) by Erich Heftman, van Nostrand Reinhold, NY.
15. Stereo chemistry of organic compounds (1994) by E L Eliel & SHW Awley, Inter Science Pub. 30, Wiley and Sons Inc.
16. Organic Chemistry (6<sup>th</sup> ed. 2000) by R T Morrison & R N Boyd, Prentice Hall of India, New Delhi.
17. Organic Chemistry Vol.1 Fundamental Principles (6<sup>th</sup> Ed. 1985) by IL Finar, ELBS.  
Vol.2 Stereo Chemistry and the Chemistry of Natural Products. (5<sup>th</sup> ed. 1985) by I L Finar, ELBS.

## SEMESTER – I

### PAPER III : CELL BIOLOGY AND MOLECULAR PHYSIOLOGY

#### UNIT I

Structural organization of prokaryotic and Eukaryotic cells, cell isolation, cell disruption, Biochemical methods identification of organelles (marker enzymes). ultrastructure, composition and function of nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, peroxisomes, lysosomes, vacuoles, microbodies, ribosomes, cytoskeleton, plant cell wall.

#### UNIT II

**BIOMEMBRANES:** Chemical composition of membranes – organization of lipids, carbohydrates and proteins, Assembly of membrane components.

**Molecular structure of membranes:** Micelle, and liposome, biological membrane, asymmetry of the membrane; membrane fluidity; fluid-mosaic model of biological membranes; structure of RBC membrane; Isolation of membrane and techniques used to study membrane structure, membrane biogenesis.

#### UNIT III

**MEMBRANE TRANSPORT:** Ficks law and simple diffusion across cellular membranes porins facilitated simple diffusion; energetics of transport systems; passive transport – anion exchange proteins; active transport; active transport of  $\text{Na}^+$ ,  $\text{K}^+$  ( $\text{Na}^+$  - $\text{K}^+$  ATPase);  $\text{Ca}^{2+}$  ( $\text{Ca}^{2+}$  - ATPase)  $\text{Na}^+$  dependant symport system (sugars and amino acid in animal cells). Active transport of sugars coupled to phosphorylation; group translocation (gamma-glutamyl cycle), proton motive force in bacterial transport processes. Ionophores, Gap-junctions, Endocytosis, Exocytosis.

#### UNIT IV

**Nervous system:** Outlines of organization of nervous system; blood brain barrier; nerve growth factor. Origin of membrane potential, mechanism of propagation nerve impulse of synaptic transmission. Myelin sheath – composition and function. Neurotransmitters - Biogenic amines, aminoacids and peptides. Transmission at cholinergic, adrenergic nerve endings, Use of agoists and antagonists.

**Digestive system:** Secretion, composition and functions of saliva, gastric, pancreatic, intestinal and bile juices in the digestion of ingested foods. Digestion and absorption of carbohydrates, proteins and lipids in gastrointestinal tract.

#### UNIT V

**Muscle:** Types of muscules, structure of striated muscle fiber, molecular organization of contractile systems, mechanism of muscle contraction. Regulation and energetics of contraction. Role of calcium.

**Body fluids:** Blood, composition of blood, Cellular constituents and their functions Transport of gases. Plasma proteins and their functions. Blood coagulation factors and mechanism. Fbrinolysis, transfer of blood gases – Oxygen and carbon dioxide. Role of 2,3 DPG, Bohr effect and Chloride shift.

**Excretory system:** Kidney structure and its functions, renin-angiotensin system, mechanism of urine formation and urine composition, role of kidney maintaining water, electrolyte and acid-base balance.

#### Books recommended:

1. Cell biology – De Roberties and DeRoberties.
2. Cell and Molecular biology – Shieler and Bianchi.
3. Cell biology (1991) – David E.Sadva (Johnes & Barrette, -C.H Best & B.T.Taylor.
4. Biochemistry –West et al.

5. Principles of Biochemistry. – A.L. Lehninger.
6. Text book of Biochemistry with clinical correlations (ed.)- Thomas M. Devlin, (John Wiley).
7. Harper's review of Biochemistry – Martin et al (Longman)
8. Biochemistry- L. Stryer. (Freeman)
9. Dynamics of Biological Membranes – M.D. Houseley and K.K. Staines (John Wiley).
10. Introduction to Biological membranes (2<sup>nd</sup> edn 1988) M K Jain, John Wiley & Sons, NY.
11. Comprehensive introduction to membrane biochemistry (1987) by D B Datta.
12. Biological membranes: Their structure and function ( 2<sup>nd</sup> edn 1980) Harrison R.
13. Text Book of Medical Physiology (10<sup>th</sup> edn 2001) by A G Guyton and Hall J E. Harcourt, Asia.
14. Review of Medical Physiology (12<sup>th</sup> ed, 1985) Ganong W F Lange Medical Pub
15. Cell biology Karp et al

**SEMESTER -I**  
**PAPER IV : ENZYMOLOGY**

**UNIT I**

Remarkable properties of enzymes – catalytic power, specificity, transformation of different forms of energy. Formation of Enzyme Substrate complex – Fischer and Koshland models. Holoenzyme, apoenzyme, coenzyme and cofactors. Classification of enzymes (IUB), enzyme units and enzyme assay.

**UNIT II**

**Elements of kinetics** - Reaction rates, transition state theories, methods use in the investigation of kinetics of enzyme catalyzed reactions – initial velocity studies, ion-selective electrode studies and rapid reaction technology.

Factors affecting enzyme catalysis – pH, Temperature and substrate on enzyme kinetics. Enzyme kinetics of single substrate reaction. Derivation Michaelis-Menton equation Significance of  $K_m$  and  $V_{max}$  values. linear transformations of Michaelis-Menton equation, King-Altman procedure for deriving the rate equation.

**Enzyme inhibition:** Irreversible inhibition and reversible inhibition - competitive, non-competitive, uncompetitive and mixed inhibition – partial inhibition – substrate inhibition and allosteric inhibition. Irreversible inhibition.

**UNIT III**

**Kinetics of Bi-substrate reactions:** Sequential mechanism – compulsory order and random order mechanism, non-sequential mechanism- Ping-Pong mechanism.

**Chemical nature of enzyme catalysis:** general acid-base catalysis, electrostatic catalysis, covalent catalysis, intramolecular catalysis, and enzyme catalysis.

**Active site determination:** Identification of binding sites and catalytic sites – detection of presence of Ser, His, Cys, Asp, Lys, Arg, Try, Tyr in the active site.

**UNIT IV**

Mechanisms of reaction catalyzed by chymotrypsin, trypsin, lysozyme, ribonuclease, carboxypeptidase and carbonic anhydrase.

**Co-enzymes-** Mechanistic role of following co-enzymes in enzyme catalyzed reactions – nicotinamide nucleotides, flavin nucleotides, coenzyme A, lipoic acid, thiamin pyrophosphate, biotin, tetrahydrofolate and cobalamine.

**UNIT V**

Regulation of enzyme activity - zymogen activation, covalent phosphorylation, Isoenzymes, multienzyme complexes (pyruvate dehydrogenase complex).

**Allosteric enzyme action:** cooperativity – the hill equation. Sigmoidal kinetics - The MWC and KNF models – significance of sigmoidal behaviors – study of ATCase as a typical allosteric enzyme.

**BOOKS RECOMMENDED:**

- 1.Principles of Biochemistry, 1993-A..L.Lehninger, Nelson and Cox (C.B.S., India).
- 2.Principles of Biochemistry General Aspects 1983 –Smith et al., general.(Mc Graw Hills)
- 3.Biochemistry, (2<sup>nd</sup> edition) –Voet &Voet.
- 4.Biochemistry (4<sup>th</sup> edition) –A.Stryer (Freeman)
- 5.Text book of biochemistry with clinical correlations. (4<sup>th</sup> edition) –Thomas M.Devlin
- 6.Text book of Biochemistry, (1908) –West and Todd. (Mac Milan)
- 7.Biochemistry –Zubay.
- 8.Nucleic acid Biochemistry and Molecular biology –Main Waring, et al. (Blockwell).
- 9.Understanding enzymes. (1985) –Trevor Palmer (John Wiley)

10. Fundamentals of Enzymology (II ed ) by Nicholas C Price and Lewis Stevens, Oxford Univ Press.
11. Principles of Enzymology for Food Science ( 1972) by J R Whitkar, M Dekker Publishers.
12. Enzymes (3<sup>rd</sup> ed 1979) Dixon M and Webb, E C, Longmans, London.
13. The chemical kinetics of enzyme action by K J Laidler and P S Bunting, Oxford University Press, London.
14. Enzyme structure and function by S Blackburn, Marcel Dekker, Inc., NY.

## SEMESTER - II

### PAPER I: BIOENERGETICS AND INTERMEDIARY METABOLISM – I (Carbohydrates and lipids)

#### UNIT - I

**BIOENERGETICS:** Thermodynamic principles- chemical equilibria, free energy, enthalpy(H), entropy(S), measurement of free energy, high energy compounds. Oxidation- reduction reactions, Reduction potential measurement.

**Mechanism of oxidative phosphorylation:** Electron transport system, Organization of electron carriers and enzymes in mitochondria, Inhibitors of electron transport system, Mechanism of oxidative phosphorylation – various theories, uncouplers of oxidative phosphorylation, Microsomal electron transport.

#### UNIT - II

**Photosynthesis:** Pigments involved in photosynthesis, Hill reaction, Cyclic and non-cyclic photo-phosphorylation. Photochemical events associated with pigment system –I and II, quantum efficiency. Calvin cycle, Regulation of photosynthesis, C3 & C4 plants, Hatch Slack pathway, Utilization of oxygen by oxygenases, superoxide dismutase and catalase. Photorespiration, Bacterial photosynthesis and anoxygenic photosynthesis.

#### UNIT III

**CARBOHYDRATE METABOLISM:** Glycolysis and Fermentation. Different forms of fermentation. Pasteur effect. Control of glycolysis in muscle. Metabolism of fructose, galactose and mannose. Reactions of TCA cycle. Anaplerotic reactions. - Amphibolic nature Energy yields and central importance of the pathway.

#### UNIT IV

The Cori cycle. Gluconeogenesis. Glucose-alanine cycle. Glyoxylate cycle. Lactose synthesis. Glycoprotein synthesis. Hexose monophosphate shunt. Uronic acid pathway. Amino sugar pathway. Glycogen metabolism. Breakdown and synthesis of glycogen. Control of glycogen metabolism.

#### UNIT V

**LIPID METABOLISM:** Fatty acid oxidation, role of carnitine, metabolism of triacyl glycerols-phospholipids and glycolipids. Biosynthesis of fatty acids, Regulation of fatty acid metabolism. Biosynthesis of cholesterol and its regulation. Ketone bodies metabolism, Arachidonic acid metabolism - synthesis of prostaglandins, prostacyclins, thromboxanes and leukotrienes.

#### BOOKS RECOMMENDED:

1. Principles of Biochemistry. –A.L. Lehninger (CBS Publishers).
2. Biochemistry –Lubert Stryer (5<sup>th</sup> edition).
3. Principles of Biochemistry –General aspects –Smith et al., (7<sup>th</sup> edition)
4. Harper's Review of Biochemistry –Martin et al., (Lange).
5. Text book of Biochemistry with Clinical correlation –Thomas M. Devlin ; John Wiley)(2<sup>nd</sup> edition).
6. Text book of Biochemistry -West et al.,(1966)(Mac Milan:)
7. Biochemistry –Voet and Voet
8. Handbook of photosynthesis (ed) Mohammad Pe sarakle, Marcel Dekkar, Inc. NY. Basel. Hong Kong 1997.
9. Introduction to plant biochemistry (1983) T W Goodwin and E I Mercer. Pergamon Press, Oxford, NY, Toronto, Sydney, Paris, Frankfurt.

10. Seed: Physiology of development and germination (2<sup>nd</sup> ed. 1994) J D Bewley and M Black plenum Press NY.
11. Biochemistry of energy utilization in plants D T dennis Blackie, Glasgow and London 1987.
12. Plant Biochemistry by P M Dey and J B Harborne. Harcourt Asia PTE Ltd., Singapore Plant Biochemistry by P M Dey and J B Harborne. Harcourt Asia PTE Ltd., Singapore

## *SEMESTER – II*

### **Paper-II: INTERMEDIARY METABOLISM – II (Nitrogen compounds)**

#### **UNIT I**

**AMINO ACID METABOLISM:** Biological nitrogen fixation- Nitrogenase catalysis – Mechanism nitrogen fixation, ammonia assimilation, Nitrate and sulfate reduction and their incorporation into amino acids. General modes of amino acid Catabolism, decarboxylation, transamination, oxidative deamination and other mechanisms, Role of pyridoxal phosphate in amino acid metabolism. Ammonia transport Urea cycle and its regulation.

#### **UNIT II**

Biosynthesis and degradation of Non-Essential amino acids:  
Alanine, Cysteine, Glycine, Serine, Tyrosine, Asparagine, Aspartate, Glutamate, Glutamine and Proline.

#### **UNIT III**

Biosynthesis and degradation of Essential amino acids:  
Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine.

#### *UNIT IV*

Biosynthesis and degradation of heme and its regulation. Biosynthesis of Biogenic amines, biosynthesis of NO, Biosynthesis of glutathione and its role. Biosynthesis of nucleotide co-enzymes – NAD, FAD, Coenzyme - A

#### **UNIT V**

**NUCLEIC ACID METABOLISM:** Biosynthesis of purines and its regulation. Biosynthesis of pyrimidines and its regulation. Salvage pathways of nucleic acid biosynthesis. Biosynthesis of deoxyribonucleotides and its control. Catabolism of purine and pyrimidines.

#### **BOOKS RECOMMENDED:**

- 1.Principles of Biochemistry. –A.L.Lehninger (CBS Publishers).
- 2.Biochemistry –Lubert Stryer (5<sup>th</sup> edition).
- 3.Principles of Biochemistry –General aspects –Smith et al., (7<sup>th</sup> edition)
- 4.Harper's Review of Biochemistry –Martin et al., (Lange).
- 5.Text book of Biochemistry with Clinical correlation –Thomas M.Devlin&John Weiley)(2<sup>nd</sup> edition).
- 6.Text book of Biochemistry -West et al.,(1966)(Mac Milan)
- 7.Biochemistry –Voet and Voet

SEMESTER – II  
PAPER III: MICROBIAL BIOCHEMISTRY

**UNIT I**

**Microbial biochemistry:** Outlines of Bergey's manual of classification Gram positive and gram negative bacteria. General characteristics of actinomycetes, rickettsia, mycoplasmas, spirochetes, fungi. Ultrastructure of bacterium, variant and invariant components of Bacterial cell wall, cell membrane, capsule, cyst, external appendages, cytoplasmic inclusions, nuclear material, ribosomes, Plasmids and endospore. Staining techniques.

**UNIT II**

General methods of isolation and cultivation of bacteria.

Sterilization methods. Bacterial growth. Phases of growth and kinetics. Diauxic growth.

Synchronous growth, chemostatic cultures. Continuous cultivation of microbes.

**Microscopy:** Bright-field microscopy, Dark-field microscopy, fluorescence microscopy, phase contrast microscopy, transmission electron microscopy, scanning electron microscopy, Applications of Microscopy.

*UNIT III*

Nutritional requirements in microorganisms: Modes of nutrition – phototrophy, chemotrophy, methylotrophy, organotrophy, mixotrophy, and saprophytic, symbiotic and parasitic mode of nutrition.

Control of microorganisms: Fundamentals of control by physical agents control by chemical agents, antibiotics and other chemotherapeutic agents. Role of microorganisms in food spoilage, food-borne infections, sewage (domestic and industrial) disposal.

UNIT - IV

**Virology:** Classification of viruses, Composition and structure of viruses, virusoids, prions, Virus-host interactions. General methods of virus isolation with examples of TMV and T phages; Assay of TMV; Plaque assay for Bacteriophage. Bacteriophage life cycles O x 174; Q $\beta$ , M 13, lytic and lysogenic cycle in lambda phage.

UNIT –V

**Eukaryotic viruses:** Animal viruses, General features and outlines of adenovirus, poliovirus, herpes virus, SV 40, retrovirus and HIV/AIDS, Hepatitis. Oncogenic viruses and carcinogenesis, Plant viruses – TMV, CaMV, Peanut clump virus and Tomato yellow leaf curl virus.

**Books recommended:**

1. Text book of Microbiology – William Burrows
2. The Microbial world –R.Y.Stainer et al,
3. Microbiology – Peleczar, reid and Chan.
4. Biology of microorganisms – Sandes T.Lyles
5. Fundamentals of Microbiology – M.Frobisher,
6. Microbiology – Pyalkin,
7. Principles of Microorganisms – Brocks.
10. Microbiology (5<sup>th</sup> ed 2000) M J Pelczar (jr) & R D Reid, Tata-McGraw Hill.
11. Microbiology – Davis Bernard.
12. Fundamental Virology (1995) B. N. Fields, D. M. Knipe, P. M. Howley, R. M. Chanock, J. L. Meenick, T. P. Monath, S. E. Strans, Lippin Cott Raven.

## SEMESTER -II

### PAPER –IV: NUTRITIONAL BIOCHEMISTRY AND ANALYTICAL METHODS-II

#### UNIT – I

##### NUTRITIONAL BIOCHEMISTRY

Calorific values of carbohydrates, fats and proteins, specific dynamic action. Measurement of energy expenditure - direct and indirect calorimetry, respiratory quotient and BMR. Factors effecting BMR.

Essential and non-essential amino acids. Nitrogen balance, Determination of biological value of proteins, Kwashiorkor and Marasmus.

#### UNIT - II

Essential fatty acids and phospholipids in nutrition.

Fat soluble and water soluble vitamins-requirement, sources, deficiency symptoms.

Macro and trace elements in nutrition - recommended allowances, sources, deficiency symptoms.

Special aspects of nutrition for the infants, children, pregnant, lactating women, Obesity, Starvation and old age. Importance of nutrition under stress conditions.

#### UNIT - III

**Experimental approaches to study of metabolism** – Metabolic inhibition, growth studies and Biochemical genetics, Isotopic biochemistry, isolated organs, cells and sub cellular organelles Organ perfusion. Use of experimental animals, tissue slices, homogenates and mutant organisms in the study of intermediary metabolism.

##### **Manometric Techniques:**

Types of manometry – Warburg constant volume manometer, Gilson differential respirometer-practical aspects and application of manometry for the measurement of gas-exchange and enzyme activity (SDH and GAD)

**Colloidal state:** Emulsification, micelles with reference to proteins and lipoproteins.

Precipitation, flocculation and protective colloidal formation. Donnan membrane equilibrium, Osmotic pressure, viscosity, surface tension in biological systems.

#### UNIT - IV

**Radioactivity:** Stable and radio isotopes, Half-life, decay constant, average life, units of radioactivity, radioactivity measuring techniques, G.M. counters, proportional counters and scintillation counters; methods of measurement of radio activity and correction factors. Statistics of counting operations, radiation dose units, Roentgen, REP, REM, maximum permissible dose, lethal dose and tolerance doses, evaluation of exposed doses, dosimetry and dosimeters; radiation monitoring hazards, biological effects of radiation, isotope dilution technique and its application in biochemical investigation. Radioisotopes in biochemistry and medicine, Auto radiography. In vivo and in vitro labeling techniques.

#### UNIT V

**Polarimetry:** Optical activity, plane-polarised light, X-ray Diffraction. Experimental techniques; X-ray diffraction in fibers; Basic principles of protein crystallography, Birefringence, light scattering.

**ORD & CD: Optical** rotation –Drude equation – Motfit equations- Cotton effect- application to a few biomolecules: Flow- birefringence.

##### **Books Recommended:**

- 1.Nutrition: An integrated approach (3<sup>rd</sup> edn. 1984) R L Pike and M L Brown, Wiley & Sons Inc. NY.
- 2.Text Book of Biochemistry and Human Biology G P Talwar, Prentice Hall.
- 3.Mechanism and Theory in Food Chemistry (1996) DWS Wong, CBS, New Delhi.
- 4.Text Book of Human Nutrition (1996) M S Bamji N Pralhad Rao and V Reddy, Oxford & IBH Publishers.
- 5.Nutritional Biochemistry and Metabolism Linten.

6. Principles of Food Science –I (Food Chemistry) Fennemona D R.
7. Human Nutrition and Dietetics (8<sup>th</sup> Ed. 1982) by Davidson and Passmore ELBS.
8. Modern Nutrition in Health and Diseases (7<sup>th</sup> ed 1988) by Maurice E Skills and V R Young K M Varghese Co. Bombay.
9. The tools of Biochemistry – Terrace.E.Cooper (John Willey).
10. A Biologists guide to Principles and Techniques of practical Biochemistry – Ed.Bryan, L.Williams& Keith Wilson. (Edward Arnold).
11. Biochemical research techniques – A practical introduction. - Ed.John M. Wriggelsorth.
12. Principles & Techniques of Practical Biochemistry –Wilson & Walker
13. Analytical Biochemistry. David. J.Home & Hazelpack. (Longman).
14. Practical Clinical Biochemistry, (5<sup>th</sup> edition) – H.Varley, A.H.cowenlock & M.Bell
15. A manual of Radiology.J.C.Steward & D.M. Hawcroft. (Sidgwick &)
16. Biophysical chemistry – D.Freifelder
17. Biophysical chemistry – Upodhya and Nath (Himalaya publications)

## **M.Sc. (previous)**

### **PRACTICAL-1**

#### **BIOCHEMICAL ANALYSIS AND MICROBIOLOGY**

1. General reactions of carbohydrates. Specific reactions of different sugars: Arabinose, xylose, Fructose, Galactose, Sucrose, Maltose and Lactose.
2. General reactions of proteins and Aminoacids. precipitation reactions of Albumins a Globulins.
3. General reactions of lipids and Cholesterol.
4. Isolation and estimation of cholesterol from brain.
5. Isolation and estimation of glycogen/starch.
6. preparation of Casein from milk.
7. Crystallization of egg albumin.
8. Estimation of proteins in biological samples:  
a.) Biuret method. b.) Folin-lowry method c.) UV method, d.) Bradford dye binding method.
9. Titration curve of aminoacids and calculation of  $pK$  and  $pI$  values.
10. Estimation of aminoacids by formal titration.
11. Estimation of aminoacid by ninhydrin method.
12. Estimation of tyrosine by Millions method.
13. Identification of N-Terminal group of proteins by Sanger's method.
14. Estimation of Fructose in Fruit- juice.

#### **MICROBIOLOGY:**

15. Sterilization techniques- autoclave, hot air oven sterilization, seitz filtration, membrane filtration.
16. Preparation of protein laboratory media- nutrient broth, Luria broth, agar media.
17. Isolation of bacteria from soil/water.
18. Development of single colony from bacterial cultures
19. techniques of maintenance of stock cultures.
20. Staining techniques- simple, differential, acid fast and spores staining.
21. Counting of microbial cells.
22. Motility (hanging drop) of microbial cells.
23. Microscopic observation of microbial culture.
24. Study of growth of bacteria.
25. Effect of pH, temperature and osmotic concentration on bacteria growth.
26. Microbial assay of antibiotics.

### **PRACTICAL-2**

#### **ANALYTICAL METHODS AND ENZYMOLOGY ANALYTICAL BIOCHEMISTRY:**

1. Effect of solvent system on the  $R_f$  value of two solutes using TLC.
2. Separation of purines and pyrimidines by paper chromatography.
3. Separation of aminoacids by paper chromatography.
4. Separation of sugars by TLC.
5. Isolation and characterization of brain lipids by solid phase extraction and TLC.
6. Separation of aminoacids by paper electrophoresis (demonstration).
7. Separation of aminoacids by Ion exchange chromatography (demonstration)
8. Separation of Serum proteins by paper electrophoresis,
9. Measurement of pH of a biological fluid using pH meter.
10. Absorption spectra of phenol red, aminoacids and nucleic acids.
11. Verification of Beer's law and determination of molar extinction co-efficient using P-nitrophenol.
12. Isolation and spectrophotometric characterization of plant pigments.
13. Isolation of mitochondria from rat liver by density gradient centrifugation (demonstration).
14. Demonstration of use of GM counter.
15. Viscosity measurement of bovine serum albumin.
16. Measurement of inversion of sucrose by polarimetry.
17. Measurement of refractive index of biological sample.

**18.**Dialysis.

**19** Determination of molecular weight of protein by gel filtration chromatography.

**20.**Determination of subunit composition of protein by SDS-PAGE.

***ENZYMولوجY:***

**21.** Amylase from Saliva.

**22.**Urease from Horse-gram

**23.**Acid phosphatase from potato.

**24.**Alkaline phosphatase from serum.

**25.**Cholinesterase from blood.

**26.**SDH from liver.

**27.**Trypsin.

**28.**invertase.

**29.**LDH from Serum (Isoenzymes).

**30.**Purification and study of enzyme kinetics with respect to substrate and enzyme concentrations pH, temperature, activators and inhibitors and immobilization.

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