

## Faculty of Life Sciences

### M.Sc. Biochemistry

### B.Sc. (Hons) BIOCHEMISTRY Paper I

## BIOMOLECULES

### UNIT I: WATER AND PROTEINS

Water: Physical properties and hydrogen bonding of water; structure of liquid water and its solvent properties; hydrophobic interactions; ionization of H<sub>2</sub>O and ion product of water; the pH scale; relationship between pH and pK<sub>a</sub> (Henderson-Hasselbalch equation); buffers

Proteins: Definition, biological functions of proteins; structure of twenty alpha-amino acids commonly found in proteins; abbreviations and classification of 20 amino acids; zwitterion nature of amino acid in aqueous solutions; essential amino acids; peptide bond formation; backbone structure of proteins/polypeptides; N-terminal and C-terminal amino acids; properties of amino acids/proteins arising from their dipolar nature; basic understanding of primary, secondary, tertiary, quaternary and domain structure of proteins/peptides; fibrous and globular proteins; elementary ideas on protein denaturation and renaturation.

### UNIT II: CARBOHYDRATES

Definition, biological functions; classification into monosaccharides (aldoses and ketoses), oligosaccharides and polysaccharides; optical isomerism, open chain and ring structures of carbohydrates; mutarotation; structure of biologically important carbohydrates (D-glucose, D-galactose, D-mannose, D-fructose, D-ribose, D-2-deoxyribose, D-maltose, D-lactose, D-sucrose); polysaccharides- starch, cellulose, glycogen and mucopolysaccharides; suitability of polysaccharides as storage material.

### UNIT III: LIPIDS

Definition; biological functions; general formulae, nomenclature and properties of fatty acids; essential and non-essential fatty acids; classification of lipids; general structure and function of major lipid subclasses: acylglycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steroids and prostaglandins; saponifiable and non-saponifiable lipids; suitability of triglycerides as storage lipids; saponification number and iodine number; biomembranes

## UNIT IV: NUCLEIC ACIDS

Nucleosides and nucleotides; generalized structural plan of nucleic acids; Watson-Crick model of DNA; size of DNA in prokaryotic and eukaryotic cells; central dogma of molecular biology; gene, genome and chromosome; basic ideas of DNA replication, transcription and protein biosynthesis; genetic code and codons; mutations- definition and types.

### RECOMMENDED BOOKS

1. Lehninger Principles of Biochemistry by Nelson and Cox (2008) Worth Publishers, Inc. New York.
2. Biochemistry by Berg, Tymoczko and Stryer (5<sup>th</sup> Edition, 2007) W.H. Freeman Press, San Francisco, USA.
3. Introducing Biochemistry by Wood and Pickering (1982) ELBS/John Muray.
4. Outlines of Biochemistry by Conn and Stumpf (5<sup>th</sup> Edition, 1987) Wiley, New Delhi.

# B.Sc. (Hons) BIOCHEMISTRY

## Paper II

### MICROBIOLOGY & VIROLOGY

#### UNIT I: CRITERIA FOR CLASSIFICATION, MORPHOLOGY, NUTRITION & PHYSIOLOGY OF BACTERIA

Brief introduction to microorganisms, criteria used in the classification of bacteria - morphology, cytology, genetics, host specialization, serology, physiology etc. General organization of bacterial cells - gram positive and gram negative organisms; structure and function of peptidoglycan in gram positive and gram negative organisms; function of polymeric components in outer membrane and acidic polymers in gram negative organisms. Bacterial growth; phases of growth, factors affecting bacterial growth; Physical (pH, temperature and oxygen requirements) and nutritional factors

#### UNIT II: BACTERIAL GENETICS

Adaptation and mutation: types of mutations and their effects; Significance of Gene transfer in bacteria; Methods of Lateral gene transfer: transformation, transduction and conjugation; their discovery and mechanism, Generalised and specialised transduction; Temperate and virulent phages, lysogenic and lytic cycles, Characteristics of plasmids, Transposable elements: Insertion sequence and transposons.

#### UNIT III: MORPHOLOGY & REPLICATION OF VIRUSES

Definitions of virus, viroids, virusoids and prion; General properties of viruses; Virus structure; variations in size and shape/symmetry, Cultivation and detection of viruses; Plaque formation and Haemagglutination inhibition test, Replication of bacteriophages and retroviruses (to include all events in the infection cycle). Replication of DNA animal viruses.

#### UNIT IV: VIRAL INFECTIONS

Acute viral infections - Influenza, dengue and yellow fever viruses, persistent viral infections- Herpes/Hepatitis and AIDS; transformation and Cancer ; Role of vaccines in prevention of viral infections, types of Polio vaccines.

#### RECOMMENDED BOOKS

1. Jacquelyn G. Black, MICROBIOLOGY principles and explorations (2004) John Wiley & Sons, Inc.

2. E. Alcamo, FUNDAMENTALS MICROBIOLOGY (1994). The Benjamin/Cummings Publishing Co., Inc. California, USA.
3. M. Pelczar, E.C.S. Chan and M.R. Krieg, MICROBIOLOGY, McGraw Hill Inc., Singapore (1997).
4. Tortora, Funke and Case Microbiology and Introduction by Pearson Education, Inc.

# B.Sc. (Hons) BIOCHEMISTRY

## Paper III

### ENZYMOLGY

#### UNIT I: INTRODUCTION

Definition, historical perspective, IUB enzyme classification (rationale, overview and specific examples), Nature of non-enzymatic and enzymatic catalysis. Measurement and expression of enzyme activity, enzyme assays. Definition of IU, enzyme turn over number and specific activity. Role of non-protein organic molecules and inorganic ions co-factors, coenzymes, prosthetic groups. Role of vitamins as coenzyme precursors (general treatment), details of coenzyme function of NAD and pyridoxal phosphate.

#### UNIT II: MECHANISM OF ENZYME ACTION

Concept of enzyme-substrate complex, evidences for the formation of enzyme-substrate complex. Nature of substrate binding sites, active sites of enzymes. Collision and transition state theory. Michaelis-Menten equation, determination and significance of  $V_{max}$  and  $K_m$ . Lock and key and induced fit model of enzyme-substrate interactions. Stereo specificity of the enzyme for substrates. Enzyme catalytic efficiency, proximity, orientation, distortion or strain, acid-base and nucleophilic catalysis.

#### UNIT III: ENZYME KINETICS

Kinetics of zero and first order reactions, effect of enzyme concentration, substrate concentration temperature and pH on enzyme activity; enzyme inhibition (reversible and irreversible inhibition). Evaluation of  $K_m$ ,  $K_i$  and  $V_{max}$  in the presence of inhibitors. Significance and evaluation of energy of activation and free energy.

#### UNIT IV: BI-SUBSTRATE KINETICS, ALLOSTERIC AND ISOENZYMES

Bi-substrate enzymes (rapid equilibrium, random bi-bi, ordered bi-bi and ping-pong bi-bi reactions). Allosteric enzymes – definition, behavior and physiological significance. Isoenzymes – physiological and diagnostic significance.

#### RECOMMENDED BOOKS

1. R.K.Murray, D.K. Garner, P.A. Mayes and V.W. Rodwell, HARPER'S BIOCHEMISTRY, 22<sup>nd</sup> edn. (1990), Prentice-Hall, International, USA.
2. P.K. Stumpf, OUTLINES OF BIOCHEMISTRY, 4<sup>th</sup> edn. (1994), Wiley Eastern, New Delhi, (Chapters 7 & 8).
3. Nelson and Cox, LEHNINGER's PRINCIPLES OF BIOCHEMISTRY, (2000), Kalyani Publishers, Ludhiana/Worth Publishers, Inc., New York.

4. L. Stryer BIOCHEMISTRY 4<sup>th</sup> Ed. (1995) W.H. Freeman Co., San Francisco, USA
5. G.L. Zubay BIOCHEMISTRY 4<sup>th</sup> Ed. (1998) W.C. Brown Publishers, USA.

# B.Sc. (Hons) BIOCHEMISTRY

## Paper IV

### METABOLISM

#### UNIT I: ANAEROBIC CARBOHYDRATE METABOLISM

Definition, reactions of glycolysis, entry of galactose, fructose and mannose in glycolysis, utilization of sucrose and lactose, production of ATP and its utilization during muscle contraction; oxygen debt; alcoholic fermentation; glycogenolysis, gluconeogenesis, glycogenesis; hexose monophosphate shunt pathway and its significance; regulation of glycolysis; what happen in diabetes? galactosemia, glucose intolerance.

#### UNIT II: AEROBIC CARBOHYDRATE METABOLISM

History and background of the tricarboxylic acid (TCA) cycle; oxidation of pyruvate to acetyl CoA; individual reactions of the TCA cycle; energetic of the cycle, anabolic nature of TCA cycle; regulation of TCA cycle, electron transport oxidative phosphorylation; Energy coupling hypothesis.

#### UNIT III: LIPID METABOLISM

Historical development and individual reactions of beta oxidation pathway; oxidation of unsaturated fatty acids and odd chain fatty acids; metabolism of triacylglycerols; formation of ketone bodies; biosynthesis of fatty acid and cholesterol; role of serum lipoproteins (LDL, HDL) in the development of coronary heart disease (CHD).

#### UNIT IV: NITROGEN METABOLISM

Introduction, metabolism of ammonia, urea cycle (preliminary account), nitrogen balance studies in man (normal, negative and positive nitrogen balance); transamination and deamination reactions, comparative biochemistry of nitrogen excretion; metabolism of purines and pyrimidines including regulation (preliminary account); amino acids as biosynthetic precursors & nucleotide and nucleoside coenzymes; biologically active amines (e.g. epinephrine, non-epinephrine, dopamine, serotonin,  $\alpha$ -amino-butyric acid & histamine), glutathione as cofactor.

#### RECOMMENDED BOOKS

1. Nelson and Cox, Lehninger's, PRINCIPLES OF BIOCHEMISTRY, (2000), Kalyani Publish, Ludhiana/Worth Publish., Inc. New York (Chapters 13,14,15,16,17,18,19,20 & 21).

2. E.E. Conn and P.K. Stumpf, OUTLINES OF BIOCHEMISTRY, 4<sup>th</sup> edn., (1994), Wiley Eastern, New Delhi (Chapters 10 to 14,16, & 17).
3. L. Stryer, BIOCHEMISTRY , 4th edn., (1995), W.H. Freeman Press, San Francisco, USA (Chapter 26 for UNIT V).

# B.Sc. (Hons) BIOCHEMISTRY

## Paper V

### ELEMENTARY CELL BIOLOGY AND PHYSIOLOGY

#### UNIT I: SUBCELLULAR ORGANELLES

- (a) Ultrastructure, organization and functions of mitochondria, nucleus, endoplasmic reticulum, golgi apparatus, lysosomes and microbodies, peroxisome.
- (b) Structure of a typical plant cell. Cell wall – composition, structure and functions. Ultrastructure of chloroplast. Light and dark reactions of photosynthesis. Photophosphorylations. Vacuoles – special functions in plants.

#### UNIT II: MEMBRANE STRUCTURE AND FUNCTION

Functions of biological membranes. Composition - nature of lipids, proteins, carbohydrates and other molecules. Model membranes - monolayer, bilayer, liposomes. Singer and Nicholson model (fluid-mosaic model). Cytoskeleton, Transport function of membranes., active and passive transport of various substrates; synapse: chemical and electrical synapse. Membrane potential and nerve impulses.

#### UNIT III: BLOOD AND LYMPH

Components of blood and their functions, erythrocytes and leucocytes, granular and agranular leucocytes, resistance of the body to infection: the macrophage system and inflammation, phagocytosis by neutrophils and macrophages, immunity and allergy: Humoral and cellular immunity (or innate and acquired immunity), antigens and haptens T and B lymphocytes, blood groups, the ABO system, the Rhesus system, intrinsic and extrinsic pathways for blood clotting, composition and functions of lymph and lymphatic system

#### UNIT V: ENDOCRINE EXCRETORY SYSTEM

- (a) Endocrine system: A brief outline of various endocrine glands and their physiological roles, hormones: storage and secretion, feedback regulation, receptors and their activation, mechanisms of extracellular and intracellular hormones, plant hormones.
- (b) Excretion: The structure and functions of the kidney. Nephron, glomerular membrane, glomerular filtration rate (GFR); function of tubules, selective reabsorption by active and passive transport of sugars, amino acids, urea and creatinine, urine formation, role in acid base balance.

#### RECOMMENDED BOOKS

1. G.Karp, CELL BIOLOGY, (1999), McGraw Hill, New York, USA.
2. B. Alberts, D. Bray, J. Lewis, M. Reff, K. Roberts & J.D. Watson MOLECULAR BIOLOGY OF THE CELL, 3<sup>rd</sup> edn: (1989) Garland publishing Inc. New York, USA.
3. J. Darnell, H. Lodish and D. Baltimore. MOLECULAR CELL BIOLOGY, (1986), Scientific American Books (a subsidiary of W.H. Freeman Press, USA).
4. C.J. Avers, A MOLECULAR CELL BIOLOGY, (1986), Addison Wesley Pub. Co. Inc. USA.
5. S.C. Rastogi, CELL BIOLOGY, (1988), Tata McGraw Hill Publishing Co., Ltd. New Delhi.
6. Guyton: Textbook of Medical Physiology 10<sup>th</sup> edition (2000).

# B.Sc. (Hons) BIOCHEMISTRY

## Paper VI

### ENVIRONMENTAL BIOCHEMISTRY AND IMMUNOLOGY

#### UNIT I: Ecology and Environmental Toxicology

- (a) Food chain and Food web; Biogeochemical cycles; Types of ecosystems; Concept of habitat and ecological niches;
- (b) Toxic chemicals in the environment, Impact of toxic chemicals on enzymes; Biochemical effects of –As, Cd, Pb, Hg, Co, NO<sub>x</sub>, SO<sub>x</sub>, O<sub>3</sub>, pesticides, carcinogens; Toxicity testing systems.
- (c) Water treatment strategies; Bioremediation.

#### UNIT II: ENVIRONMENTAL POLLUTION

- (a) Concept of environment and its pollution; primary and secondary pollutants; pollution of water, air, soil.
- (b) Oil slick, eutrophication, biomagnifications; Green house effect and global warming, Ozone hole and its causal agents, Acid Rain.

#### UNIT III: BASIC ASPECTS OF IMMUNITY

- (a) Resistance to disease: cellular and humeral immunity, clonal selection hypotheses and cell mediated immunity.
- (b) Definition of antigen, antibody, hapten, antigenic and haptenic determent, structure of antibody molecules, classes of antibodies, polyclonal and monoclonal antibodies.
- (c) Primary and secondary immune response, idea of vaccination, adjuvant.

#### UNIT IV: INFECTION AND DISEASE

- (a) Host-parasite relationship: normal flora, pathogenecity, disease progress, transmission and types of diseases, disease establishment and diagnosis with special reference to AIDS.
- (b) Hypersensitivity reactions, Gel and Coombs classification, Type I, II, III IV types of hypersensitivity. Interleukins and interferon.
- (c) Brief introduction to autoimmunity, major autoimmune disorders and antigens involved.

#### RECOMMENDED BOOKS

1. A.K. De “Environmental Chemistry” Wiley Eastern Limited, New Delhi, 3<sup>rd</sup> Edition (1994).

2. H.R. Singh "Environmental Biology" S. Chand, 2009
3. E.P. Odum "Fundamentals of Ecology" S. Chand, 2008.
4. Alcamo "Fundamental of Microbiology, Jones & Bartectt-2011.

# B.Sc. (Hons) BIOCHEMISTRY

## Paper VII

### BIOCHEMICAL TECHNIQUES

#### UNIT I: SPECTROSCOPIC AND CHROMATOGRAPHIC TECHNIQUES

a) Spectroscopic techniques: Basic principles of radiation energy and atomic structure. Absorption spectra and its biochemical usefulness, Beer Lamberts law, essential components and use of colorimeters and spectrophotometers (UV, Vis) and fluorescence spectroscopy.

b) Column chromatographic techniques: Gel filtration, Ion exchange and affinity chromatography - basic principles, materials and applications.

#### UNIT II: CENTRIFUGATION TECHNIQUES

Principle of centrifugation, Ultracentrifugation: Preparative and analytical ultracentrifugation, Sub cellular fractionation: Differential centrifugation, sedimentation velocity and sedimentation equilibrium methods, applications of centrifugation techniques.

#### UNIT III: MICROSCOPIC TECHNIQUES

Microscopy: Light microscopy; compound light microscopy, phase contrast microscopy, transmission and scanning electron microscopy. Freeze fracture and freeze etching techniques. Confocal microscopy.

#### *UNIT IV: IMMUNOLOGICAL AND RADIOISOTOPE TECHNIQUES*

Immunological Techniques: Single radial immunodiffusion and immunodouble diffusion, immunoelectrophoresis; rocket and counter current immunoelectrophoresis, electrophoresis PAGE and SDS protein immunoblotting / western blotting- basic principle, practical procedures and applications.

Radioisotope Techniques: The nature of radioactivity, types of radioactive decay, rate of radioactive decay; decay constant and half life, detection and measurement of radioactivity; methods based upon gas ionization (Geiger-Muller counting) , excitation (liquid scintillation counting) and exposure to photographic emulsion (autoradiography)

#### RECOMMENDED BOOKS

1. K. Wilson and K.H. Goulding, A. BIOLOGIST' GUIDE TO PRINCIPLES AND TECHNIQUES OF PRACTICAL BIOCHEMISTRY, (1986), ELBS/Edward Arnold.
2. D. Friefolder, PHYSICAL BIOCHEMISTRY, (1992), W.H. Freeman and Co., New York.
3. T.G. Cooper, TOOLS OF BIOCHEMISTRY, (1977), John Wiley and Sons, New York.
4. D.T. Plummer, AN INTRODUCTION TO PRACTICAL BIOCHEMISTRY, (1979), Tata McCraw Hill Publishing Co., Ltd., New Delhi.
5. C.K. Mathews and K.E. Van Holde, BIOCHEMISTRY, (1990), The Benjamin/Cummings Publishing Company, Redwood City, California, USA (See under Tools of Biochemistry, Chapters 6, 10, 11, 12 & 16).
6. R.F. Boyer, MODERN EXPERIMENTAL BIOCHEMISTRY, (1986), The Benjamin/Cummings Publishing Co., Redwood City, California, USA.

# B.Sc. (Hons) BIOCHEMISTRY

## Paper VIII

### NUTRITIONAL AND CLINICAL BIOCHEMISTRY

#### UNIT I: HUMAN NUTRITION

Introduction and definition of food and nutrition, functions of food, factors altering nutritional requirements, Genetic and environmental determinants of food intake. Macronutrients (carbohydrates, fats, proteins and water) and their functions; Micronutrients (vitamins A, D, E, K, vit. B-complex group and vit. C; minerals: Calcium, phosphorus, iron, zinc, copper and iodine); arsenic, lead and fluoride toxicity.

#### UNIT II: NUTRITIVE AND CALORIFIC VALUE OF FOODS

Basic concepts of energy expenditure, units of energy, measurement of energy expenditure by direct or indirect calorimetry, calculation of non-protein RQ and its conversion to weight of carbohydrates and fats (in gm) metabolized, determination of amount of protein metabolized and calculation of total heat production of the diet; basal metabolism and methods of measuring basal metabolic rate (BMR), energy requirements under conditions of pregnancy, lactation and various physical activities, calculation of energy expenditure of average reference men and women. Specific dynamic action (SDA) of food; prevention of malnutrition specially protein - calorie malnutrition (kwashiorkor and marasmus) by improvement of diets; under nutrition (anorexia and bulimia) and starvation; over nutrition and obesity; nutritional support in special clinical situations.

#### UNIT III: BASIC CONCEPTS OF CLINICAL BIOCHEMISTRY

(a) Definition and scope of clinical biochemistry in diagnosis; setting up and solving problems related to operation of clinical biochemistry laboratory including its quality control; internal and external quality assurance producers; manual vs automation in clinical laboratory.

(b) Collection and preservation of biological fluids (blood, serum, plasma, urine and CSF); chemical parameters of blood, clearance tests, physical and chemical analysis of urine and CSF; controllable biological variables, physiological factors affecting the composition of body fluids; influence of food, drugs and stimulants; effect of underlying medical conditions on laboratory values.

#### UNIT IV: CLINICAL ENZYMOLOGY, HORMONAL AND OTHER DISORDERS

Principles of diagnostic enzymology; definition of functional and non-functional plasma enzymes, problems of enzyme assay in clinical biochemistry laboratory; factors affecting enzyme levels in plasma or serum; selection of enzyme tests; enzyme and enzymes pattern in health and diseases with special mention of plasma lipase, amylase, cholinesterase, alkaline and acid phosphates, SGOT, SGPT, LDH & CPK.

Hypo- and hyperthyroidism and goiter, hypo- and hyper-adrenocorticism, hypo- & hyper-pituitarism, haemoglobinopathies; anemia, thalassemia, sickle cell anaemia, jaundice, rheumatoid arthritis; kidney and liver function tests.

### RECOMMENDED BOOKS

1. M.L. Bishop, J.L.D.V. Laufen and E.P. Fody, CLINICAL CHEMISTRY (1985), J.B. Lippincot Co., Philadelphia, USA.
2. D.L. Williams and V. Mark (editors), PRINCIPLES OF CLINICAL BIOCHEMISTRY , 2<sup>nd</sup> edn. (1988), Heipman Professional Publications Ltd., Oxford, UK.
3. T.M. Delvin (editor), TEXT BOOK OF BIOCHEMISTRY WITH CLINICAL CORRELATION, (1982), Jhon Wiley & Sons Inc. USA.
4. R.K. Murray, D. Granner, P. Mayes and V. Rodwell HARPER'S BIOCHEMISTRY (25<sup>th</sup> ed., International Edition) (2000) Appleton and Lange, USA.
5. G.P. Talwar, L.M. Srivastava and K.D. Moudgil (Editors), TEXT BOOK OF BIOCHEMISTRY AND HUMAN BIOLOGY, Chapters 36-42 (SectionA), Chapters 100 & 101 (Section B).
6. I.M. Weisbrot STATISTICS FOR CLINICAL LABORATORY.
7. A.L. Lehninger, PRINCIPLES OF BIOCHEMISTRY, (1982), Worth Publishers, Inc. New York, USA/Kalyani Publishers, Ludhiana, NewDelhi.
8. R. Montgomery, R.L. Dryer, T.W.onway and A.A.pector, BIOCHEMISTRY, A CASE ORIENTED APPROACH, 2<sup>ND</sup> EDN. (1977), The C.V. Mosby Co. St. Louis, USA.
9. C.H. Gray, P.J.N. Howorth and M.G. Rinsler, CLINICAL CHEMICAL PATHOLOGY (1985), ELBS.

# B.Sc. (Hons) BIOCHEMISTRY

## Paper IX

### MOLECULAR GENETICS

#### UNIT I: BASIC ASPECTS OF GENETICS

- (i) Mendelian Genetics – Principles of Mendelian inheritance and epistasis, gene interaction; linkage-autosomal and sex-linked traits, principle of cross-over mapping.
- (ii) Extranuclear Inheritance – Mitochondrial and chloroplast mediated inheritances.

#### UNIT II: GENETIC INFORMATION: BIOCHEMIST'S OUTLOOK

- (i) Genetic Material: historical perspective – DNA, RNA and protein as potential candidates, earlier theories and circumstantial evidence in favour of DNA, concrete proofs in favour of DNA and RNA as genetic material; Salient features of viral, bacterial and eukaryotic genomes and extrachromosomal DNAs.
- (ii) Central dogma of molecular genetics – Old and current version; Teminism
- (iii) Nucleic Acid Hybridization – Denaturation and renaturation of DNA,  $T_m$  and buoyant density of DNA;  $cot$  value and satellite DNA; Unique, moderate and highly repetitive DNA sequences, DNA palindromes.

#### UNIT III: STRUCTURAL DETAILS OF NUCLEIC ACIDS

- (i) Primary, Secondary and Tertiary Structures of DNA – Generalized structures of nucleotides and nucleic acids; Watson – Crick model, A,B, and Z types of DNA, deep and narrow grooves; handedness and chirality in DNA; tertiary structure and linking number.
- (ii) Structure and properties of RNA-Classes of RNA and brief idea of their primary, secondary and tertiary structure.

#### UNIT - IV: MUTATION AND REPAIR

- (i) Mutation: Molecular basis of mutation, types of mutation, e.g., transition, transversion, frame shift, suppresser sensitive, germinal and somatic, backward and forward mutations. True reversion and suppression, dominant and recessive mutations, spontaneous and induced mutations - Lederberg's replica plating experiment.
- (ii) Mutagenecity Testing: Correlation of mutagenecity and carcinogenecity; Ames testing.

- (iii) Mechanism that safeguard DNA: A brief description of UV repair systems in *E. coli*: repairs--including mismatch, excision, nucleotide and SOS. Role of uracil-DNA glycosylase; significance of thymine in DNA.

### RECOMMENDED BOOKS

1. Nelson and Cox, Lehninger's Principles of Biochemistry (2000), Worth Publish., Inc. New York.
2. J.D. Watson et al., MOLECULAR BIOLOGY OF THE GENE, (2007) 5<sup>th</sup> Edition Pearson Education.
3. E.J. Gardner and D.P. Snustad. PRINCIPLE OF GENETICS (2000) 10<sup>th</sup> Edition, John Wiley & Sons, Singapore.
4. D.P. Snustad et al., PRINCIPLES OF GENETICS (2002) 6<sup>th</sup> Edition.
5. B.D. Davis et al., MICROBIOLOGY, Harper International edition, 5<sup>th</sup> Edition.

# B.Sc. (Hons) BIOCHEMISTRY

## Paper X

### MOLECULAR BIOLOGY

#### UNIT I: DNA REPLICATION AND TRANSCRIPTION

- (i) Replication: Possible modes of replication, Meselson Stahl experiment, origin of replication in *E. coli*, major proteins and enzymes involved in replication process: DNA replication in nut shell, rolling circle model of replication.
- (ii) Transcription: Mechanism of transcription, DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/Pribnow box, chain termination and the role of the protein, split genes and post-transcriptional processing of RNA in eukaryotes including splicing of primary transcript, inhibitors of transcription.

#### UNIT II: GENETIC CODE AND

- (i) Genetic Code: Basic features of genetic code, biological significance of degeneracy, Wobble hypothesis, gene within genes and overlapping genes, universality of genetic code and its exception, single coding system between the nucleic acids and amino acids, pseudo genes.
- (ii) Mechanism of Translation: Ribosome structures, A and P sites, Charged tRNA, f-met tRNA, initiator codon, Shine-Dalgarno consensus sequence, formation of 70S initiation complex, role of EF-Tu, EF-Ts, EF-G and GTP, Non-sense codons and release factors, RFI and RF2. Post-translational modifications and inhibitors of protein synthesis.

#### UNIT III: GENE REGULATION, PCR, SITE DIRECTED MUTAGENESIS AND DNA SEQUENCING

- (i) Regulation of Gene Expression: Enzyme induction and repression, positive regulation and negative regulation, operon concept, Lac operon, attenuation and trp operon.
- (ii) DNA sequencing, PCR and site directed mutagenesis: Amplification of DNA by Polymerase Chain Reaction, primer designing, site directed mutagenesis. Sanger's and Maxam-Gilbert methods of DNA sequencing.

#### UNIT IV: RECOMBINANT DNA

- (i) Tools of recombinant DNA technology: Enzymes used in genetic engineering e.g. Restriction endonucleases, SI nucleases, DNA ligases, Alkaline phosphatase, Reverse transcriptase, DNA polymerase, poly nucleotide kinase, terminal transferase. Use of Linkers and Adapters.
- (ii) Cloning vectors: General properties of Plasmid, Cosmid, Phage, YAC, Shuttle vector and Expression vectors.

### RECOMMENDED BOOKS

1. Nelson and Cox, Lehninger's Principles of Biochemistry (2000), Worth Publish., Inc. New York, USA.
2. L. Stryer. BIOCHEMISTRY, 4<sup>th</sup> Edn., (1995), W.H. Freeman Press, San Fransisco, USA.
3. E. J. Gardner and D.P. Snustad. PRINCIPAL OF GENETICS (1984), John Wiley & Sons, New York, USA.