Approved by BUGS in Biochemistry on Sept. 05, 2012

B. Sc. (Hons) BIOCHEMISTRY

(Under-Graduate)

(Six Semesters)
DEGREE PROGRAM

NORTH-EASTERN HILL UNIVERSITY
SHILLONG

Year	Semester	Paper No.	Paper Name	Paper-wise Marks	Total Marks
First Year	1st Semester	I (T)	Biomolecules & Biophysical Techniques	75	100
		I (P)	Biochemistry Practical - I	25	
	2nd Semester	II (T)	Thermodynamics, Membrane Biophysics & Biostatistics	75	
		II (P)	Biochemistry Practical - II	25	100
Second Year	3rd Semester	III (T)	Proteins & Enzymes	75	
		III (P)	Biochemistry Practical - III	25	100
	4th Semester	IV (T)	Cell Biology & Physiology	75	
		IV (P)	Biochemistry Practical - IV	25	100
Third Year	5th Semester	V(T)	Intermediary Metabolism	75	
		V(P)	Biochemistry Practical - V	25	100
		VI (T)	Nutritional & Clinical Biochemistry	75	
		VI (P)	Biochemistry Practical - VI	25	100
	6th Semester	VII(T)	Microbiology & Immunology	75	
		VII (P)	Biochemistry Practical - VII	25	100
		VIII (T)	Molecular Biology	75	
		VIII (P)	Biochemistry Practical - VIII	25	100
GRAND TOTAL MARKS					800

PAPER I (Theory)
BIOMOLECULES & BIOPHYSICAL TECHNIQUES

MM 75

Biomolecules

Water: molecular structure of water, hydrogen bonds & physical properties of water; pH, pK; Buffers in laboratory & biological system.

Properties, structure and classification of monosaccharides (glucose & fructose), disaccharides (sucrose,maltose and lactose) and polysaccharides (dextrins, starch, glycogen and cellulose). Stereochemistry ofsugars: chiral carbon, epimers, anomers, mutarotation, chair and boat forms, glycosides, glycopyranose
andfructopyranose.

Alpha amino acids: structure and properties of amino acids; Proteins: Primary structure (Structure of peptide bond-restricted rotation, cis/trans); Secondary structure (α, β and super secondary structures); Tertiary structure- Protein folding; and Quaternary structure of Proteins.

Fatty acids: nomenclature and chemical properties; Lipid classification: simple and complex. General structure and function of the major lipid subclasses; acylglycerols, phosphoglycerides, sphingolipids, waxes and terpenes, steroids and prostaglandins.

Nucleotides: chemistry and properties. Nucleic acids:DNA and RNA forms and functions.

Biophysical Techniques

Principles and applications of the following techniques: Centrifugation, chromatography (Gel, Ion exchange& Affinity), electrophoresis (PAGE & SDS-PAGE), UV/Visible spectrophotometry, X-ray crystallography, spectroflourimetry, microscopy (light & electron), NMR.

Isotopes, radioactive decay, α, βand γradiation, detection of radioactivity (scintillation counting, labeling, quenching and autoradiography).

Suggested Readings:

Nelson D L and Cox M M (2008) Lehninger's Principles of Biochemistry, Macmillan Pub.
Berg J M, John L, Stryer L (2012) Biochemistry 6th Edn., W H Freeman & Co. Ltd.
Zubay G (1999) Biochemistry 4th Edn., W C Brown Commun, Inc.
Harper's Illustrated Biochemistry 29th Edn. (2012) , Murray et al. McGraw Hill Pubn.
Voet D &Voet J G (2004) Biochemistry 3rd Edn., John Wiley & Sons.
Gareth & Grisham (2008) Biochemistry 4th Edn., Brooks Cole Pbn.
Devlin T. M. (2010) Textbook of Biochemistry with Clinical correlations 7th Edn., Wiley Pubn.
Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Freifelder D (1982) Physical Biochemistry, W H Freeman.
Wilson K and Walker J (2002) Principles and Techniques of Practical Biochemistry 5th Edn. Cambridge Pbn.

PAPER I (Practical)
BIOCHEMISTRY PRACTICAL - I

MM 25

1. Preparation of Buffer solution using Henderson Hasselbalch equation.
2. Verification of Beer-Lambert's Law
3. Estimation of protein by Lowry's method
4. Estimation of protein by Bradford's method.
5. Estimation of DNA using diphenylamine
6. Estimation of RNA using orcinol

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Sambrook J and Russel D W (2012) Molecular Cloning 4th edn., CSH Lab Press
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.

PAPER II (Theory)
THERMODYNAMICS, MEMBRANE BIOPHYSICS & BIOSTATISTICS

MM 75

Thermodynamics, Membrane Biophysics

Law of Thermodynamics and its application to biological systems: First law of Thermodynamics, Heat of Formation & Heat of reaction. Second law of Thermodynamics, molecular basis of entropy, Helmholtz and Gibbs free energy.

Types of cells, electrodes, oxidation –reduction reaction, standard electrodepotential and its determination, measurement of ΔG. Electron transfer measures and phosphate group transfer potentials. Coupled reactions and simultaneous equilibria.

Membrane and membrane transport (Fluid Mosaic model, uniport, symport, antiport, active and passive transport).

Biostatistics

Collection of data, Primary and Secondary data, classification and tabulation of data
Measures of central tendency; Measures of dispersion, Methods of sampling- sampling theory & test of significance (definition of random sampling, simple random sampling, systematic & stratified sampling and confidence level for those sample statistics)

Correlation coefficient, Regression analysis; Probability (theorem on total probability of two events, definition of conditional probability with some elementary problems), Distribution- definition properties and uses of Bernoulli trials, Binomial, Poisson & Normal distribution.

Definition and applications of x_2, t, F & Z statistic: definition of confidence level & limits.

Suggested Readings:

Nelson D L and Cox M M (2008) Lehninger's Principles of Biochemistry, Macmillan Pub.
Berg J M, John L, Stryer L (2012) Biochemistry 6th Edn., W H Freeman & Co. Ltd.
Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Freifelder D (1982) Physical Biochemistry, W H Freeman.
Wilson K and Walker J (2002) Principles and Techniques of Practical Biochemistry 5th Edn. Cambridge Pbn.
Zar J H Biostatistical Analysis 5th edn.
Freedman D (1998) Statistics 3rd Edn. W W Norton & Co. Pbn
Yates D S (2010) The Practice of Statistics 3rd Edn. W H Freeman

PAPER II (Practical)
BIOCHEMISTRY PRACTICAL - II

MM 25

1. Estimation of amino acids by Ninhydrin method
2. Estimation of carbohydrates by Anthrone method
3. Separation of carbohydrates by paper chromatography
4. Separation of amino acids by paper chromatography
5. Separation of lipids / pigments using thin layer chromatography (TLC).

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Sambrook J and Russel D W (2012) Molecular Cloning 4th edn., CSH Lab Press
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.

PAPER III (Theory)
PROTEINS & ENZYMES

MM 75

Proteins

Protein isolation and purification techniques (salt precipitation, dialysis and chromatography). Criteria for homogeneity; Protein sequencing.

Enzymes

Enzymes: properties (enzyme activity & specific enzyme activity) andclassification (IUB enzyme classification and nomenclature system).

Enzyme-substrate(ES) complex: concept of substrate binding sites and active sites, significance of activation energy and free energy. Factors affecting enzyme activity; Coenzymes (Pyridoxal phosphate, NAD^+ & FAD^+) & cofactors.Mechanism of enzyme catalysis (chymotrypsin & lysozyme).

Michaelis-Menten equation: derivation, significance of V_{max}, $k_{cat}$and K_m. Lineweaver- Burk Plot. Enzyme inhibition: competitive, non-competitive and uncompetitive. Regulation of enzyme activityallostericregulation, covalent modification, zymogenicity and protein turnover.

Suggested Readings:

Whitford D (2005) Proteins 1st edn. Wiley
Bell J. E. et al (1988) Proteins & Enzymes, Prentice hall
Williamson Mike (2011) How Proteins Work 1st edn. Garland Science
Palmer T (2007) Enzymes 2nd Edn. Ellis Horwood Ltd.
Price N C (2009) Exploring Proteins, Oxford University Press
KesselAmit (2011) Introduction to Proteins 1st edn.CRC Press
Bohager Tom (2006) Enzymes: What Experts know? One World Press
Effront J (2008) Enzyme & their Application, KessingerPubn.
Nelson D L and Cox M M (2008) Lehninger's Principles of Biochemistry, Macmillan Pub.
Berg J M, John L, Stryer L (2012) Biochemistry 6th Edn., W H Freeman & Co. Ltd

PAPER III (Practical)
BIOCHEMISTRY PRACTICAL - III

MM 25

1. Separation of proteins by SDS-PAGE
2. Gel filtration chromatography using protein mixture or dye
3. Assay of urease/ amylase activity
4. Determination of K_m and V_{max} of urease/ amylase
5. Effect of temperature and substrate concentration on enzyme activity.

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Sambrook J and Russel D W (2012) Molecular Cloning 4th edn., CSH Lab Press
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.

PAPER IV (Theory)
CELL BIOLOGY & PHYSIOLOGY

MM 75

Cell Biology

Prokaryotes: Cell structure and components, structure of viruses (bacteriophages & TMV)
Eukaryotes : Cell structure and subcellular organelles; plants and animal cells- differences in structure and functions.

Methods for studying cells and organelles: Phase contrast; staining; freeze fracture technique. Subcellular fractionation- centrifugation, differential and density gradient centrifugation.

Cytoskeleton: microtubules and microfilaments; Cell motility- ciliary and flagellar movement, bacterial taxis. Cell division (mitosis & meiosis): Cell cycle and its regulation; Introduction to Apoptosis and stem cells.

Physiology

Homeostasis, Digestion, absorption and transport of carbohydrates, lipid, proteins and nucleic acids. Absorption and transport of minerals (Fe^{++} and Ca^{++}) and vitamins (C & D). Blood cells; hemoglobin, oxygen and carbon dioxide transport; regulation of respiration; blood clotting.

Formation of urine, regulation of water, electrolyte balance, role of hormones in its maintenance. Action potential, impulse transmission, synaptic transmission, muscle protein, mechanism of muscle contraction (skeletal and smooth), biochemistry of vision.

General classification of hormones; receptors: intracellular & cell surface, second messengers. Hormones of the pituitary, thyroid and pancreas. Basic mode of steroid and protein/ peptide hormone action mechanisms.

Suggested readings:

Darnell J, Lodish H and Baltimore D (2008) Molecular Cell Biology 6th edn., W H Freeman and co.
Darnell J, Lodish H and Baltimore D (2012) Molecular Cell Biology 7th edn., W H Freeman and co.
Roberts K et al.(2002) Molecular Biology of Cell 4th edn., garland Science
Alberts et al. (2010) Essentials Cell Biology 3rd edn., Garland Science
Karp Gerald (2009) Molecular cell Biology 6th edn., Wiley Pubn.
Weaver R (2011) Molecular Biology 5th edn., McGraw Hill Sc.
Wilson K and Walker J (2002) Principles and Techniques of Practical Biochemistry 5th Edn. Cambridge Pbn.
Guyton A C & Hall (2010)Textbook of Medical Physiology 12th Edn., W B Saunders.
Barrett K E et. Al. (2009) Ganong's Review of Medical Physiology 23rd edn. LANGE Basic Science McGraw Hill Medical
Ganong W F (2003) Review of Medical Physiology 21st edn. Appleton & Lange USA
Bhagavan N V et. al. (2011)Essentials of Medical Biochemistry with Clinical cases 1st Edn., Acad. Press.
Physiology & Biochemistry in Modern Medicine (2012) by Books Group, General Books Pbn.

PAPER IV (Practical)
BIOCHEMISTRY PRACTICAL - IV

MM 25

1. RBC and WBC count
2. Study of the stages of mitosis
3. Study of meiotic cell division
4. Sub-cellular fractionation of organelles

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Sambrook J and Russel D W (2012) Molecular Cloning 4th edn., CSH Lab Press
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.

PAPER V (Theory)
INTERMEDIARY METABOLISM

MM 75

Introduction to metabolism: Carbohydrate metabolism; glycolysis, Warburg effect and Alcoholic fermentations, TCA cycle, regulation of glycolysis and TCA cycle, gluconeogenesis, glycogenesis, glycogenolysis and pentose phosphate pathway..

Lipid Metabolism: Hydrolysis of triacylglycerols, transport of fatty acids into mitochondria, β-oxidation of saturated fatty acids, oxidation of unsaturated and odd chain fatty acids, ATP yield from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids. Biosynthesis and regulation of triglycerides and cholesterol.

Amino acid Metabolism: General reactions of amino acid metabolism: transamination, oxidative deamination and decarboxylation. Urea cycle. Biosynthesis of amino acids (Glutamine, trptophan and Histidine).Degradation of amino acids.

Nucleotide Metabolism: Sources of the atoms in the purine and pyrimidine molecules. Biosynthesis and degradation of purines and pyrimidines. Regulation of purine and pyrimidine biosynthesis.

Introduction to bioenergetics: Photosynthetic and respiratory electron transfer chain, photophosphorylation. Mechanism of ATP production, inhibitors of electron transport chain and uncouplers of oxidative phosphorylation.

Suggested readings:

Nelson D L and Cox M M (2008) Lehninger's Principles of Biochemistry, Macmillan Pub.
Berg J M, John L, Stryer L (2012) Biochemistry 6th Edn., W H Freeman & Co. Ltd.
Zubay G (1999) Biochemistry 4th Edn., W C Brown Commun, Inc.
Harper's Illustrated Biochemistry 29th Edn. (2012) , Murray et al. McGraw Hill Pubn.
Voet D &Voet J G (2004) Biochemistry 3rd Edn., John Wiley & Sons.
Gareth & Grisham (2008) Biochemistry 4th Edn., Brooks Cole Pbn.
Devlin T. M. (2010) Textbook of Biochemistry with Clinical correlations 7th Edn., Wiley Pubn.
Harris D A (2009) Bioenergetics at a Glance-An Illustrated Introduction, Blackwell Sci. Pub.
Nicholls D G et al (2002) Bioenergetics 3rd edn., Academic Press.
Rai A N (1990) handbook of Symbiotic Cyanobacteria, CRC Press
Rawn J D (2005) Biochemistry 4th edn., Prentice Hall
Davies David D (2011) Intermediary Metabolism in Plants, Cambridge University Press.

PAPER V (Practical)
BIOCHEMISTRY PRACTICAL - V

MM 25

1. Isolation of casein from milk.
2. Isolation and estimation of starch from potato
3. Isolation and estimation of glycogen from animal tissues
4. Isolation and estimation of photosynthetic pigments.

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Sambrook J and Russel D W (2012) Molecular Cloning 4th edn., CSH Lab Press
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.

PAPER VI (Theory)
NUTRITIONAL & CLINICAL BIOCHEMISTRY

MM 75

Nutritional Biochemistry

Nutrition and dietary habits: Nutritive values of carbohydrates, fats, protein, vitamins (A, D, E, K vitBcomplexand vit C) and minerals (Ca, Fe and iodine). Basal metabolic rate (BMR); Calorimetry; Specificdynamic action (SDA) and Recommended Daily Allowance (RDA) of foods; Protein-Calorie malnutrition(Kwashiokor and Marasmus); Overnutrition& Obesity.

Clinical Biochemistry

Basic concepts of clinical biochemistry: Definition and scope in health and diseases; Collection and preservation of biological fluids [blood, plasma, serum, urine, cerebral spinal fluid(CSF) and amniotic fluid]: Analysis of blood, urine and CSF. Normal values of important constituents in blood (Plasma/ serum), CSF and urine, clearance test for urea.

Enzymes used in clinical diagnosis; Enzyme pattern in health and diseases (lipases, amylases, cholinesterases, alakaline and acid phosphatases, SGOT, SGPT, LDH and CPK); Isoenzymes and diagnostic tests; Functional tests of liver and kidney. Inborn errors of metabolism (alkaptonuria, phenylketonuria,albinism). Metabolic disorders (Hypo- and Hyper- glycemia, gout and porphyrias).

Suggested readings:

Guyton A C & Hall (2010)Textbook of Medical Physiology 12th Edn., W B Saunders.
Barrett K E et. Al. (2009) Ganong's Review of Medical Physiology 23rd edn. LANGE Basic Science McGraw Hill Medical
Ganong W F (2003) Review of Medical Physiology 21st edn. Appleton & Lange USA
Bhagavan N V et. al. (2011)Essentials of Medical Biochemistry with Clinical cases 1st Edn., Acad. Press.
Burtis et al (2010) Tietz Fundamentals of Clinical Chemistry 6th Edn. Elsevier
Wu et al (2006) Tietz Clinical Guide to Laboratory Test 4th edn. Saunders Pbn.
Trueman P (2007) Nutritional Biochemistry MJP Pubn.
Elsawy H (2010) Nutritional Biochemistry, Lap Lambert AcadPbn.
Haugen S (2010) Handbook of Nutritional Biochemistry, Nova Science Pbn.
Grooper S S (2000) Biochemistry of Human Nutrition – A Desk Reference 2nd Edn.Wadsworth Pbn.
Luxton R (2010) Clinical Biochemistry, Viva Books
Berg J M (2011) Biochemistry 7th Edn. W H Freeman
Devlin T. M. (2010) Textbook of Biochemistry with Clinical correlations 7th Edn., Wiley Pubn

PAPER VI (Practical)
BIOCHEMISTRY PRACTICAL - VI

MM 25

1. Estimation of blood haemoglobin.
2. Estimation of serum GOT & serum GPT.
3. Estimation of urea in blood.
4. Estimation of serum alkaline phosphatase.
5. Estimation of bilirubin.
6. Estimation of blood glucose.
7. Estimation of creatinine.

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Farrell et al (2005) Experiments in Biochemistry: A Hands-on Approach 2nd Edn. Brooks Cole Pbn.
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G K (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.
Bhargava/ Gupta (2010) Practical Biochemistry, CBS Publishers
Sawhney S K. (2005) Introductory Practical Biochemistry, Alpha Science International Ltd.
DivyaSanthi (2010) An Easy Guide for Practical Biochemistry, Jaypee brothers & Medical Publn.

PAPER VII (Theory)
MICROBIOLOGY & IMMUNOLOGY

MM 75

Microbiology

Classification of microorganisms: Types, general characteristics, criteria used in the classification of bacteria. Growth curve and use of selection media in bacterial cultivation. Role of microorganisms: in food spoilage, food-borne infections.

Microbial Genetics: transformation, conjugation, transduction and transfection; Plasmids.

Immunology

Concept of immunity: innate and adaptive immunity; Cells and Organs of the immune system; Immunoglobulins- structure and functions; classes of antibodies: Antigens- Nature of antigens; Antigen-antibodyinteractions; Immunogens; Haptens; Adjuvants.

Haemotopoietic stem cells; clonal selection theory: Structure and functions of MHC molecules. Genetic basis of antibody diversity: Complement fixation: Hypersensitivity and allergy: Autoimmune diseases; monoclonal antibody and its application in biology. Vaccines.

Suggested readings:

Presscott L M et al (2004) Microbiology 6th edn, McGraw Hill
Nester E W (2003) Microbiology 4th edn. McGraw Hill
Burton, Leboffe et al (2012) Photographic Atlas for Microbiology 4th edn.Morton Pbn.
Willey J et al (2010) Presscott's Microbiology 8th edn. McGraw Hill
Talaro K P (2011) Foundations in Microbiology 8th edn. McGraw Hill
Brown A E (2011) Benson's Microbiological Application 12 edn. McGraw Hill
Male D K (2006) Immunology 7th edn. Mosby Pubn.
Thomas J et al (2006) Kuby Immunology 6th edn. W H Freeman
Khanna Raj (2011) Immunology, Oxford University Press
Alberts et al. (2010) Essentials Cell Biology 3rd edn., Garland Science
Murphy (2012) Immunobiology 8th edn. Garland Science
Kuby Immunology (2010) Goldsby R A et al, 6th edn. W H Freeman pbn.
Roitt I M, Burton D R et al (2011) Essential Immunology 12th edn. Wiley Blackwell Pbn.

PAPER VII (Practical)
BIOCHEMISTRY PRACTICAL - VII

MM 25

1. Isolation of microbes from water and soil using selective media.
2. Study of bacterial growth kinetics.
3. Effect of antibiotic on bacterial growth.
4. Determination of ABO blood groups and Rh factor
5. Determination of antigen- antibody specificity by immunodiffusion (ODD).

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Farrell et al (2005) Experiments in Biochemistry: A Hands-on Approach 2nd Edn. Brooks Cole Pbn.
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G K (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.
Bhargava/ Gupta (2010) Practical Biochemistry, CBS Publishers
Sawhney S K. (2005) Introductory Practical Biochemistry, Alpha Science International Ltd.
DivyaSanthi (2010) An Easy Guide for Practical Biochemistry, Jaypee brothers & Medical Publn.

PAPER VIII (Theory)
MOLECULAR BIOLOGY

MM 75

Nucleic acids as genetic material, experimental evidence (bacterial genetic transformations and Hershey-Chase Experiment): Salient features of viral, prokaryotic and eukaryotic genomes; Repetitive DNA sequences.

DNA replication in prokaryotes (semi conservative, semi-discontinuous & mechanism); inhibitors of DNA replication. Salient differences in eukaryotes.

Transcription in prokaryotes- Mechanism of transcription in prokaryotes; inhibitors of transcription; Regulatory RNA (miRNA&snRNA); Catalytic RNA: Salient differences in eukaryotes.

Basic features of the genetic code; Wobble hypothesis; Mechanism of prokaryotic translation; Salient differences in eukaryotes; signal sequences.

Regulation of gene expression in prokayotes; operon concept (*lac* operon and *trp*operon).

Molecular cloning : general approach; Application of recombinant DNA technology: PCR, RT-PCR and qPCR:

Introduction to bioinformatics: gene & protein databases.

Suggested Readings:-

Pal J K et al (2011) Fundamentals of Molecular Biology. Oxford University Press
Krebs J E et al (2011) Lewins Gene X. Jones & Bartlett Pbn.
Weaver et al (2011) Molecular Biology 5th edn. McGraw Hill
Alberts B et al (2008) Molecular Biology of the Cell 5th edn. Garland Science
Watson J D et al (2007) Molecular Biology of the Gene 6th edn. Benjamin Cummins
Karp et al (2009) Cell & Molecular Biology 6th edn. Wiley Pbn.
Cox M M& O'Donnell (2011) Molecular Biology- Principle & Practice, W H Freeman

PAPER VIII (Practical)
BIOCHEMISTRY PRACTICAL - VIII

MM 25

1. Isolation of DNA from animal/plant systems.
2. Agarose gel electrophoresis of DNA.
3. Measurement of Tm of DNA sample
4. Amplification of DNA using PCR technique.

Suggested readings:

Boyer R F (2009) Modern Experimental Biochemistry 3rd edn. , 5th Impression Pearson edn.
Sadasivam S and Manickam A (2005) Biochemical Methods,(Rev Edn.) New Age Int. Pub, New Delhi.
Jayaraman (2011) Laboratory Manual in Biochemistry, New Age Int. Pub.
Plummer D T (2008 reprint) An Introduction to Practicals in Biochemistry3rd Edn., Tata McGraw- Hill
Farrell et al (2005) Experiments in Biochemistry: A Hands-on Approach 2nd Edn. Brooks Cole Pbn.
Rao B S &Deshpande (2005) Experimental Biochemistry Students Companion I K International Pub
Damodaran G K (2011) Practical Biochemistry, Pub Jaypee bros.
Nigam A &Ayyagiri A (2008) Lab Manual in Biochemistry, Immunology & Biotechnology, Tata McGraw Hill
Yadav V. K. et al (2012) Biochemistry & Biotechnology- A Lab Manual, Pointer Publns.
Bhargava/ Gupta (2010) Practical Biochemistry, CBS Publishers
Sawhney S K. (2005) Introductory Practical Biochemistry, Alpha Science International Ltd.
DivyaSanthi (2010) An Easy Guide for Practical Biochemistry, Jaypee brothers & Medical Publn.