

Choice based Credit System

**Examination Scheme of M.Sc. Clinical Biochemistry (Semester System) w.e.f. The
academic Session 2011-12.**

(Semester I)

SL. No	Course no.	Title of Paper	Type	L-T-P	Credits	Evaluation Scheme		
						Theory	IA	Total Marks
1	CB 101	Bio Molecules	PC	4-0-0	4	80	20	100
2	CB 102	Cell Biology	PC	4-0-0	4	80	20	100
3	CB 103	Enzymology	PC	4-0-0	4	80	20	100
4	CB 104	Human Physiology	PC	4-0-0	4	80	20	100
5	CB 105	Biochemical Toxicology	PE	3-1-0	4	80	20	100
6	CB106	LAB COURSE 1		0-0-20	10			100

**Total Credits: 30
Total Marks: 600**

Semester –II

SL. No	Course no.	Title of Paper	Type	L-T-P	Credits	Evaluation Scheme		
						Theory	IA	Total Marks
1	CB 201	Metabolism	PC	4-0-0	4	80	20	100
2	CB 202	Clinical Molecular Biology	PC	4-0-0	4	80	20	100
3	CB 203	Clinical Pathology- I	PC	4-0-0	4	80	20	100
4	CB 204	Clinical Immunology	PC	4-0-0	4	80	20	100
5	CB 205	Developmental Biology & Genetics (Or)	PE	3-1-0	4	80	20	100
6	CB 206	Biosafety and Ethics in Science	PE	3-1-0	4	80	20	-
7	CB 207	LAB COURSE II		0-0-20	10	-	-	100
8	CB 208	Seminar		0-0-0	1	50	-	50

**Total Credits: 31
Total Marks: 650**

Semester -III

SL. No	Course no.	Title of Paper	Type	L-T-P	Credits	Evaluation Scheme		
						Theory	IA	Total Marks
1	CB 301	Clinical Pathology II	PC	4-0-0	4	80	20	100
2	CB 302	Clinical Biochemistry	PC	4-0-0	4	80	20	100
3	CB 303	Medical Laboratory Techniques	PC	4-0-0	4	80	20	100
4	CB 304	Medical Microbiology	PC	4-0-0	4	80	20	100
5	CB 305	Communication skills in Science	OE	2-1-0	3	40	10	50
6	CB 306	LAB COURSE III		0-0-20	10	-	-	100
7	CB307	Seminar		0-0-0	1	50	-	50

**Total Credits: 30
Total Marks: 600**

Semester -IV

SL. No	Course no.	Title of Paper	Type	L-T-P	Credits	Evaluation Scheme		
						Theory	IA	Total Marks
1	CB 401	Medical Transcription	PC	4-1-0	5	80	20	100
2	CB 402	Medico- Informatics	PC	4-1-0	5	80	20	100
3	CB 403	Methods in Molecular Biology	PE	4-1-0	5	80	20	100
4	CB 404	Hospital Training (21days) ^a	PC	0-2-0	2	-	-	100
5	CB 405	Self Study Paper ^b	PC	0-1-0	1	-	-	Qualifying
6	CB406	Dissertation ^c (Continued from 3 rd semester)	PC	0-0-48	24	-	-	300

Total Credits: 44

Total Marks: 700

a: Hospital training includes training in Biochemistry, Microbiology and pathology labs during vacations.

b: Grading: Excellent, Very Good, Good, Satisfactory and Unsatisfactory

c: i) The topic of the dissertation report and the faculty under which a student will have to complete the **dissertation shall be decided by completely random lottery draw system.**

This draw should be held within the first month of the third semester itself.

(ii) The candidate shall be required to submit two copies of his/her Dissertation report. The last date for receipt of dissertation report shall be 15th April.

(iii) The written part of Dissertation report shall account for 70% of marks and the viva-voce to be conducted by a duly constituted Board of Examiners for the remaining 30% of marks

(iv) Dissertation report will be evaluated on the basis of below given criteria:

Performance Evaluation Parameter	Score
Writing Quality	15%
Novelty/Scientific Significance of Aim	15%
Project Design	15%
Publication Potential	15%
Aim-Results Concurrence	10%

(v) The Viva-voce of the Dissertation report shall be conducted by the following board of examiners: **1.** HOD or internal faculty member as its nominee; **2:** One external examiner (to be appointed by the Vice-Chancellor out of the panel approved by the PGBOS). The Project Report /Training Report shall be evaluated jointly by the external and the internal examiners.

CB 101: Bio-molecules

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Introduction of solvents, water as biological solvent, weak acids and bases, pH, buffers, Handerson-Hasselbalch equation, physiological buffers, Acids, Bases buffers, electrolytes, isoelectric pH, reversible reaction, concentration units, osmolarity, osmolarity free energy change of a chemical reaction- diffusion, osmosis, colloids, partition coefficient, counter current distribution- surface tension, viscosity, Donnan membrane Equilibrium, Radioactivity.

Carbohydrates: Classification, structure, occurrence and biological functions. Physicochemical properties of monosaccharides, Structure, function and properties of carbohydrates structural elucidation of glucose, sucrose, lactose, cellulose, oligosaccharides – glycol proteins and proteoglycans.

UNIT 2

Classification, structure, occurrence and biological functions of lipids. Nomenclature and properties of fatty acids and triglycerides, saponification number, acid number, Reichert-Meissel number, rancidity of fats. Composition and types of lipoproteins. Steroids and carotenoids of biological origin, liposomes, Bile acids, isoprenoids, terpenes, isoprene rule, carotenoids natural rubber, gutta purcha.

UNIT 3

Amino acids: Physicochemical and structural properties of amino acids, Titration curve, isoelectric point.

Proteins: Classification, structure, peptide bond, Ramachandran Plot, properties and biological functions of proteins. Protein denaturation, renaturation. Amino acid sequencing techniques, Chemical synthesis of polypeptides, salting in and salting out of proteins.

UNIT 4

Nucleic acids: Nature of genetic material, properties of DNA in solution, evidence of DNA as genetic material and evidence for semi-conservative nature, Composition of RNA and DNA, generalized structure plan of nucleic acids, features of A, B, H and Z DNA, denaturation and annealing of DNA. Structure and roles of different types of DNAs and RNAs. Genetic code.

Suggested Readings:-

1. Lehninger Principles of Biochemistry 4th Ed **By** David L. Nelson and Michael M. Cox, WH Freeman and Company.

2. Chemistry of Biomolecules: an Introduction (Paperback) **By** Richard J. Simmonds. Publisher: Royal Society of Chemistry
3. Principles of Biochemistry (Hardcover) **By** Geoffrey Zubay. Publisher: McGraw Hill College.
4. Biochemistry **By** Lubert Stryer. WH Freeman and Co.
5. Biochemistry: The Molecular Basis of Life (Paperback) **By** Trudy McKee and James R McKee. Publisher: McGraw-Hill Higher education.
6. Biochemistry and Molecular biology **By** William H. Elliott and Daphne C. Elliott. Oxford University Press.
7. Biochemistry (Hardcover) 3rd Ed. **By** Donald J. Voet and Judith G. Voet. John Wiley and Sons.
8. Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 (Hardcover) **By** D Voet. John Wiley and Sons.
9. Fundamentals of Biochemistry: Life at the Molecular Level [Import] (Hardcover) **By** Donald Voet, Judith G. Voet and Charlotte W. Pratt. Publisher: Wiley.
10. Principles of Biochemistry (Paperback) **By** Robert Horton, Laurence A Moran, Gray Scrimgeour, Marc Perry and David Rawn. Pearson Education.
11. Biochemistry **By** U. S. Satyanarayana
12. Outlines of Biochemistry **By** Eric C Conn, PK Stumpf, G Bruening and Ray H. Doi. John Wiley & Sons.

CB 102: Cell Biology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

The ultra structure and functions of nucleus, mitochondria (organization of ETC), endoplasmic reticulum, Golgi apparatus, lysosomes and peroxisomes. Ultrastructure of cell membrane with reference to RBC. The epithelial apices- glycocalyx and microvilli. The basement membrane- structural features and characteristics. The extracellular matrix- collagen, elastin, fibrillin, fibronectin, laminin and proteoglycans. The cytoskeleton: microtubules and microfilaments, functions of motor proteins in microtubules. cell-cell interactions (cadherins, integrins, IgSF, selectins, tight/gap junctions).

UNIT 2

Transport proteins in cell membrane (channel proteins, passive carrier proteins, coupled transporters and ATP-driven pumps). Cell cycle- phases and regulation. Tissues, Classification and role of various type of tissues, organization of various tissues in organs. Cellular adaptation, overview of cell injury, mechanisms of cellular injury, cellular adaptation to cellular injury, Pathologic calcification, Programmed cell death, cell apoptosis, cellular regeneration, control on cell growth, cellular differentiation, repair of connective tissue, fibrosis. Growth factors in cell regeneration and fibrosis, wound healing.

UNIT 3

Chemical structure of gene and chromosome. Replication, transcription and translation (with regulation) in *eukaryotes*, Activators, repressors and insulators of transcription. Post-transcriptional modifications of mRNA and processing of pre-tRNA & pre-rRNA. Transport of processed mRNA. Inhibitors of replication, transcription and translation. Turnover of RNA, protein targeting and degradation, Gene regulation in eukaryotes and prokaryotes, Operon concept, *Lac* operon, *Arab* operon and *Trp* operon, Mutations in DNA, mutagenicity testing and DNA repair mechanisms.

UNIT 4

Receptors, Types of receptors, role of receptors in signal transduction, Mechanisms of signal transduction, Role of GTP in signal transductions, Metabolic disorders due to non functional signal transduction in cells.

Role of signal transduction in immunological mechanisms. Neoplasia, Types of cancer, Differentiation and anaplasia, cancer epidemiology, Molecular basis of cancer, basis of multi-step carcinogenesis, Etiology of cancer, Carcinogens, classification of carcinogens, mode of action of carcinogens, laboratory diagnosis of cancer, molecular profiling of cancer.

Suggested readings:-

1. Albert B. Bray D and Lewis J Molecular biology of the cells, 2nd edition New York Garland Publications 1989.
2. Kirby L.T DNA fingerprinting; An introduction, New York, W.H. Freeman and Co.1992.
3. De Robertis, E.D.P., and De Robertis, E.M.F. Cell and Molecular Biology (6 Ed), W. B. Saunders College, Philadelphia. 1990.
- P.Parimoo, A Textbook of medical chemistry, New Delhi: CBS publishers.1995.
4. G.Patrick, medical chemistry, New Delhi: Viva Books,2002.
5. S.Ramakrishnan, K.G.Prasannan and R.Rajan, Textbook of medical biochemistry, Hyderabad: Orient Longman.3rd Edition,2001.
6. G.M.Brenner, Pharmacology, W.B.Sounders. Co 2000.
7. F.S.K.Barar, Essential of pharmacotherapeutics, New Delhi: S. Chand and Company 2000.
8. N.J.Ellenhorn, Medical Toxicology, Williams and Wilkins1997.
9. Albert B. Bray D and Lewis J Molecular biology of the cells, 2nd edition New York Garland Publications 1989.
10. Kirby L.T DNA fingerprinting; An introduction, New York, W.H. Freeman and Co.1992.

CB 103: Enzymology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

Unit 1

Introduction: History, general characteristics, nomenclature, IUB classification, Holoenzyme, apoenzyme, prosthetic groups, cofactors, activators, inhibitors, metalloenzymes, isozymes and multienzyme complexes. Classification of co-enzymes as group transfer, hydrogen transfer, structure of conenzymes, coenzyme function of nucleotide coenzymes, Units of enzyme activity (definition of IU, Katal), specific activity of enzyme, measurement of enzyme activity..

Enzyme Catalysis: Role of enzymes in energy of activation, factors of affecting action of enzymes- proximity and orientation, strain and distortion, acid base catalysis and covalent catalysis. Methods for the determination of enzymes activity, expression of the activity coupled reactions, Determination of active site. Mechanism of action of chymotrypsin, ribonuclease, carboxypeptidase and lysozyme.

Unit 2

Enzyme kinetics: Factors affecting enzyme activity- pH, temperature, time of incubation, enzyme concentration and substrate concentration. Derivation of Michaelis-Menten equation for unisubstrate reaction, K_{cat}/K_m and its significance, Lineweaver-Burk plot and its limitations; Eadie-Hofstee Plot, Eadie Plot, Hanes plot. Significance and calculation of energy of activation from Arrhenius plot. Type of Inhibition with determination of K_m and V_{max} in presence of reversible inhibitor. Kinetics of multisubstrate reactions, introduction to sequential and ping-pong mechanisms and their classifications & double reciprocal plots with examples, Anomalous kinetics of competitive and non-competitive inhibition. End product inhibition with examples..

Unit 3

Protein-ligand binding, cooperativity phenomenon, Hill and Scatchard plots. Allosteric enzymes: Sigmoidal kinetics and their physiological importance, symmetric and sequential modes for action of allosteric enzymes and their significance. Clinical enzymology – Serum enzymes in health and diseases. Immobilised enzyme technology – designer enzymes Abzymes Biosensors – Ribozymes

Unit 4

Enzyme Regulation: Reversible and irreversible covalent modification, feedback inhibition, control of enzyme by products, substrates and adenylate energy charge, monocyclic and multicyclic cascade systems. Enzyme activation, induction and repression.

Suggested Readings:-

1. Fundamentals of Enzymology: Cell and Molecular Biology of Catalytic Proteins (Paperback) *By* Nicholas C. Price and Lewis Stevens. Oxford University Press.

2. Advances in Enzymology: v. 47 (Hardcover) **By** Alton Meister. John Wiley and Sons Inc.
3. Lehninger Principles of Biochemistry 4th Ed **By** David L. Nelson and Michael M. Cox, WH Freeman and Company.
4. Principles of Biochemistry (Hardcover) **By** Geoffrey Zubay. Publisher: McGraw Hill College.
5. Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 (Hardcover) **By** D Voet. John Wiley and Sons.
6. Basic Biochemical Laboratory Procedures and Computing **By** R. Cecil Jack, Oxford University Press.
6. Enzyme Kinetics: Principles and Methods (Hardcover) **By** Hans Bisswanger. Publisher: Wiley VCH.
7. Enzymatic Reaction Mechanisms (Hardcover) **By** Perry A. Frey and Adrian D. Hegeman. Oxford University Press.
8. Comprehensive Enzyme Kinetics (Hardcover) **By** Vladimir Leskovac. Publisher: Kluwer Academic / Plenum Publishers.
9. Enzyme Kinetics: A Modern Approach (Hardcover) **By** Alejandro G. Marangoni. Publisher: WileyBlackwell.
10. Enzyme Kinetics and Mechanisms (Hardcover) **By** Kenneth B. Taylor. Kluwer Academic Publishers.
11. Nature of Enzymology **By** RL Foster
12. A textbook of enzyme biotechnology **By** Alan Wiseman.
13. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry **By** Trevor Palmer.
14. Enzymes **By** M Dixon and EC Webb. EC Longmans, London.
15. The chemical kinetics of enzyme action **By** KJ Laidler and PS Bunting. Oxford University Press, London.

CB 104: Human Physiology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Blood- Composition and functions of plasma, hemopoiesis, erythrocytes including Hb, leukocytes and thrombocytes, plasma proteins and their role. Blood coagulation - mechanism and regulation, Fibrinolysis, Blood groups and Rh factor. Transfers of blood gases - oxygen and carbon dioxide. Role of 2, 3-BPG, Bohr effect and chloride shift. Regulation of respiration, Pulmonary circulation.

Digestive system- Composition, functions and regulation of salivary, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins, nucleic acids, minerals and vitamins. Role of peristalsis and large intestine in digestion.

UNIT 2

Resting potentials and action potentials of excitable cells, contraction of skeletal, cardiac and smooth muscles.

Neurophysiology: Types of neurons and synapses and transmission of nerve impulse across them, Neurochemistry of vision, gustation, olfaction and hearing. Sensory receptors in skin and muscles.

Endocrinology- Secretion, mechanisms of action and effects of hormones of hypothalamus, pituitary, thyroid, adrenal gland and pancreas. Synthesis and functions of testosterone and ovarian hormones.

UNIT 3

Rhythmical excitation of heart, basic theory of circulatory function, blood flow and resistance, function of arterial and venous systems

Microcirculation and lymphatic system, control of blood flow, regulation of arterial pressure, cardiac output.

Spinal cord and motor functions, role of brain stems in controlling motor functions, functions of cerebellum, functions of cortical areas, the limbic system and cerebrospinal fluid system.

UNIT 4

Excretory system- Structure of nephron, formation of urine (glomerular filtration, tubular reabsorption of glucose, water and electrolytes), tubular secretion, role of kidneys regulation of blood pressure.

Control of body temperature, effect of low oxygen pressure on body, effects of acceleratory forces on body, effects of high partial pressures of gases on body

Suggested Readings:-

1. Textbook of Medical Physiology 10th Ed **By** Arthur C. Guyton and John E. Hall, Harcourt Asia Pte Ltd.
2. Essential Medical Physiology 3rd Ed **By** Leonard R. Johnson, Elsevier Academic Press.
3. Endocrinology: An Integrated Approach **By** SS Nussey and SA Whitehead. BIOS Scientific Publishers
4. Physiology 3rd Ed, **By** Linda Costanzo, Saunders Publishers.
5. Principles of Anatomy and Physiology 10th Edition **By** Gerard J. Tortora and Sandra Grabowski. Publisher: John Wiley and Sons.
6. Principles of Human Physiology (Paperback) **By** Cindy L. Stanfield and William J. Germann. Publisher: Pearson Education.
7. Samson Wright's Applied Physiology 13th Ed. CA Keele, E Neil & N Joels. Oxford University Press.
8. Principles of Biochemistry: Mammalian Biochemistry **By** Emil Smith. McGraw Hill Publications.
9. Human Physiology: The Mechanisms of Body Function (Paperback) **By** Arthur J. Vander, James Sherman, Dorothy S. Luciano, Eric P. Widmaier, Hershel Raff and Hershhal Strang. McGraw Hill Education.
10. Medical Physiology: Principles for Clinical Medicine 3rd Ed. **By** Rodney R. Rhoades and David R. Bell. Lippincott Williams & Wilkins.

CB 105: Biochemical Toxicology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: **80**

Max. Time: **3 hrs**

Unit 1

Definition and Scope of Toxicology: Dose-response relationship, synergism and antagonism, determination of ED50 & LD50, acute and chronic exposure; clinical signs of systemic toxicity.

Xenobiotic metabolism: absorption & distribution, phase I reactions; oxidation, reduction, hydrolysis and hydration; phase II reactions/conjugation; methylation, glutathione and amino acid conjugations, detoxification.

Unit 2

Biochemical basis of toxicity: mechanism of toxicity: distribution of excitable membrane functions; altered calcium homeostasis; genotoxicity;

Toxicity testing: genetic toxicity testing & mutagenesis assays-*in vitro* test systems-bacterial mutation tests, reversion test, ames test and fluctuation tests; *in vivo* mammalian mutation tests-host mediated assay & dominant lethal test.

Unit 3

Pesticide toxicity: Insecticides-organochlorines, anti-cholinesterases-organophosphates and carbomates; biopesticides

Metal toxicity: toxicity of arsenic, mercury, lead and cadmium, environmental factors affecting metal toxicity-light, temperature & pH

Unit 4

Food toxicology: Role of diet in cardio-vascular diseases and cancer; Toxicology of food additives

Diagnosis of toxic changes in liver and kidney: metabolism of haloalkanes, haloalkenes and paracetamol with their toxic effects on tissues.

Suggested reading:-

1. General and applied toxicology, 1995 by Marrs and Turner Macmillan Press Ltd
2. Basic environmental toxicology 1994 by Lorriss G. Corkerhem and Barbara SS Shane CRP Press Inc.
3. Introduction to food technology Takayurki Shibamoto & Leonard F. Bzeldaan.
4. Molecular biotechnology 2nd Ed 1994 by Barnard R Glick & JJ Pasternak.

CB 106: Lab Course I

Max Marks :100

Total Time Duration: 6 hours

Unit -1

Preparation of Buffers and various biochemical reagents, Calculations of Normality and molarity of the reagents, pH estimations, Weighing of reagents, Preparation of distilled water, Autoclaving, cleaning and sterilization of reagents.

Unit-2

Preparation of glucose standard curve, Estimation of glucose in biological fluids using various biochemical methods, Estimation of other carbohydrates,

Unit -3

Isolation of lipids from various samples, Biochemical assays for identification of lipids, separation of lipids using Thin layer chromatography (TLC) and paper chromatography (PC).

Unit -4

Rf Value calculation of various amino acids using TLC & PC, Biochemical assay for protein estimations (Branford and Lowry method),

Unit-5

Estimation of Sodium, Potassium, Calcium, chloride, bicarbonate, phosphorus and magnesium in biological fluids.

CB 201: Metabolism

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Introduction: Concept of metabolism, experimental approaches to study metabolism- use of intact organisms, bacterial mutants, tissue slices and radioisotopes.

ETC and Oxidative phosphorylation: Sequence of electron carriers, sites of ATP production, inhibitors of ETC, mechanism and regulation of mitochondrial oxidative phosphorylation, ATP synthase, uncouplers of oxidative phosphorylation, transport of reducing potential and ions across mitochondrial membrane, phosphorylation potential, reversed and microsomal electron transfers, generation of Super-oxides in mitochondria.

UNIT 2

Carbohydrate Metabolism: Reactions and energetics of glycolysis. Alcoholic and lactic fermentations, entry of fructose, mannose and galactose. Reactions and energetics of TCA cycle, gluconeogenesis, glycogenesis and glycogenolysis. Reactions and physiological significance of HMP pathway, regulation of glycolysis and gluconeogenesis, cataplerosis and anaplerosis, biosynthesis of starch and oligosaccharides, regulation of blood glucose. Uronic acid pathway and glyoxylate cycle.

Lipid metabolism: Transport and mobilization of lipids, oxidation of saturated fatty acids (β -, α -, ω -), oxidation of unsaturated and odd-chain fatty acids, role of carnitine in transport of fatty acid, energetics of β -oxidation scheme, metabolism of ketone bodies and its biological significance.

UNIT 3

Lipid metabolism (contd.): Biosynthesis of saturated and unsaturated fatty acids. Biosynthesis of triglycerides, phospholipids, Sphingolipids and cholesterol. Regulation of cholesterol metabolism. Metabolism of lipoproteins. Biosynthesis of prostaglandins.

Amino acid metabolism: General reactions of amino acid metabolism- transamination, deamination and oxidative decarboxylation. Biosynthesis and degradation of amino acids and their regulation. Feedback regulation of amino acid biosynthesis. Urea cycle and its regulation.

UNIT 4

Nucleic acid Metabolism: Sources of atoms in purine and pyrimidine molecules, biosynthesis and degradation of purines and pyrimidines, regulation of purine and pyrimidine biosynthesis, structure and regulation of ribonucleotide reductase. Biosynthesis of ribonucleotides, deoxyribonucleotides and polynucleotides. Inhibitors of nucleic acid biosynthesis. Porphyrin Metabolism: Biosynthesis and degradation of porphyrins, production of bile pigments.

Suggested Readings:-

1. Lehninger Principles of Biochemistry 4th Ed **By** David L. Nelson and Michael M. Cox, WH Freeman and Company.
2. Principles of Biochemistry (Hardcover) **By** Geoffrey Zubay. Publisher: McGraw Hill College.
3. Harper's Biochemistry (Lange Medical Books) (Paperback) **By** Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.
4. Bioenergetics **By** David G. Nicholls and Stuart J. Ferguson. Academic Press.
5. Bioenergetics at a Glance: An Illustrated Introduction (At a Glance) (Paperback) **By** D. A. Harris. Publisher: Wiley Blackwell
6. Bioenergetics: 0 (Paperback) **By** Lars Garby and Poul S. Larsen. Cambridge University Press.
7. Fundamentals of Biochemistry: Life at the Molecular Level [Import] (Hardcover) **By** Donald Voet, Judith G. Voet and Charlotte W. Pratt. Publisher: Wiley.
8. Biochemistry (Hardcover) 3rd Ed. **By** Donald J. Voet and Judith G. Voet. John Wiley and Sons.
9. Biochemistry of Lipids, Lipoproteins and Membranes (4th Ed.) D.E. Vance and J.E. Vance. Pub: Elsevier Science B.V
10. Medical Biochemistry 4th Ed. by NV Bhagavan. Pub: Elsevier India Pvt. Ltd.
11. Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 (Hardcover) **By** D Voet. John Wiley and Sons.
12. Biochemistry **By** Lubert Stryer. WH Freeman and Co.
13. Principles of Biochemistry (Paperback) **By** Robert Horton, Laurence A Moran, Gray Scrimgeour, Marc Perry and David Rawn. Pearson Education.
14. Harper's Biochemistry **By** RK Murray, DK Granner, PA Mayes and VW Rodwell. Appelton and Lange, Stanford.
15. Biochemistry **By** U. S. Satyanarayana
16. Outlines of Biochemistry **By** Eric C Conn, PK Stumpf, G Bruening and Ray H. Doi. John Wiley & Sons

CB 202: Clinical Molecular Biology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Secondary and tertiary Structure of DNA and RNA, Locked nucleic acids, role of locked nucleic acid in therapeutics, siRNA, Micro RNA, Role of micro RNA in gene regulation, Isolation of nucleic acids, Qualitative and quantitative estimation of nucleic acids.

Recombinant DNA Technology, Applications of recombinant DNA, Polymerase chain reaction, application of PCR in Diagnostics of pathogens identification, Site directed mutagenesis, RAPD, RFLP & DNA finger printing, DNA Foot Printing, Mobility shift assay, Promoter & Reporter assay, Yeast Two hybrid systems, antisense-RNA technology, chromosomal walking, gene therapy and recombinant vaccines.

UNIT 2

Extraction, purification and analysis of mRNA from eukaryotic cells, methods for synthesis of double strand cDNA, Expression profiling, Transcriptome analysis, RT PCR, Real Time PCR, Rapid DNA sequencing techniques like Sanger's dideoxynucleotide, partial ribonucleotide substitution, Maxam and Gilbert's method, pyrosequencing and single molecule sequencing, Genome, Genome sequencing, DNA Sequence Characterization (Open reading frames, promoters, coding frames)

UNIT 3

Molecular diagnostics, Viral load monitoring, window period, Role of molecular diagnostics in present diagnostic area, Benefits of molecular diagnostics over serological diagnostics tests, Ethical issues related to molecular diagnostics, role of Molecular diagnostics in Blood banking, Basic techniques used in molecular diagnostics, future of molecular diagnostics,

UNIT 4

Molecular diagnostic of various viral diseases: HIV type -1, HIV type -II, HPV, Various hepatitis strains, Influenza (H1N1) , sample preparation, various steps required for viral infection analysis and Viral load monitoring,

Molecular diagnostics of bacterial infections; Mycobacterium tuberculosis, Shwenella typhus, Pathogenic E Coli, sample preparation and pathogen detection.

Suggested Readings:-

1. Basic Biotechnology (Paperback) **By** Colin Ratledge and Bjorn Kristiansen. Cambridge University Press.
2. Introduction to Biotechnology (Paperback) **By** William J. Thieman and Michael A. Palladino. Benjamin Cummings; US Ed edition.
3. DNA Repair and Mutagenesis, **By** Errol C. Friedberg, Graham C. Walker, Wolfram Siede. ASM Press.
4. Recombinant DNA Principles and Methodologies **By** James Joseph Greene, CRC Press.

5. Molecular Biotechnology: Principles and Applications of Recombinant DNA (Paper-back) **By** Bernard J Glick and Jack J Pasternak. Publisher: American Society for Microbiology.
6. Molecular Cloning: a laboratory manual (Vol 1, 2 & 3) **3rd Ed. By** J. Sambrook and DW Russel. Cold Spring Harbor Laboratory Publications, NY
7. Laboratory Techniques in Biochemistry and Molecular Biology; DNA sequencing (Vol 10). **By** J Hindley. Elsevier Biomedical.
8. Methods of DNA and RNA sequencing. **By** Sherman M. Weissman. Pub: Praeger
9. RNA isolation and analysis **By** P. Jones, J Qiu and D. Rickwood. Bios Scientific Publishers.
10. Advanced Organic Chemistry of Nucleic Acids (Paperback) **By** Zoe A. Shabarova and Alexey A. Bogdanov. Pub: VCH Publishers, Inc., New York, NY (USA).
11. Analytical Techniques in DNA sequencing **By** Brian Nunnally. Pub: Taylor and Francis.
12. Gene Cloning and DNA Analysis: An Introduction (Paperback) **By** Terence. A. Brown. WileyBlackwell.
13. Gene Cloning: An Introduction (Paperback) **By** Terence A. Brown. Nelson Thornes Ltd.
14. Principles of Gene Manipulation and Genomics, **By** S.B. Primrose & Richard M. Twyman, Blackwell Publishing.
15. Principles of Fermentation Technology (Paperback) **By** P F Stanbury, A. Whitaker and S. Hall. Publisher: Butterworth-Heinemann.
16. Biochemical Engineering and Biotechnology **By** Ghasem D. Najafpour. Publisher: Elsevier Science
17. Plant Propagation by Tissue Culture 'Vol 1' **By** Edwin George, Michael Hall and GJ de Klerk, Pub: Springer.
18. Biotechnology: A textbook of Industrial Microbiology, **By** Wulf Crueger and Thomas D. Brock. Sinauer Assoc.
19. Molecular Biology of the gene **By** J Watson, NH Hopkin, JW Roberts, JP Stertz and AM Weiner. WH Freeman and Co., San Fransisco.
20. Gene IX **By** Benjamin Lewin. Oxford University Press.
21. Biotechnology: Expanding Horizons **By** B. D. Singh, Kalyani Publishers.
22. Textbook of Biotechnology **By** PK Gupta, Rastogi Publications.
23. Biotechnology **By** U. Satyanarayana.
24. Advances in Biotechnology **By** Prof. SN Jogdand, Himalaya Publishing House.

CB 203: Clinical Pathology part -I

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

Unit 1

Genetic disorders, Mutations, types of mutation, Molecular repair mechanisms, Diseases due to defected repair mechanisms, Mendelian Disorders, Transmission pattern of single gene disorders, Autosomal disorders, sex chromosome related disorders, Diseases caused by change in structural proteins: Marfan Syndrome, Ehlers Syndrome, Dalos syndrome, Diseases caused by mutation in receptor proteins: familial hypercholesterolemia. Diabetes, Protein energy malnutrition's.

Unit 2

Cytogenic disorders, Trisomy of 21st chromosome, Down syndrome, Klinefelter syndrome, Turner syndrome, Fragile X Syndrome, Pediatric diseases, congenital anomalies, prenatal infections, Premature and intrauterine growth retardation, Respiratory distress syndrome of new born, Necrotizing enterocolitis, sudden death syndrome, cystic fibrosis, Fluorescent in-situ hybridization for identification of chromosomal abnormalities,

Unit 3

Hemodynamic Disorders, Hyperemia and congestion, Hemorrhage, Hemostasis, and thrombosis, Endothelium platelets, Coagulation cascades, DIC embolism, Pulmonary Thromboembolism, systemic thromboembolism, Fat Embolism, Air Embolism, Amniotic Fluid Embolism, Infarction,

Unit 4

Environmental pollution, air pollution, water pollution and soil pollution, injury by chemical agents, injury by therapeutic agents, Exogenous estrogen and oral contraceptive pills side effects, injury by non therapeutic agents, : lead, Carbon monoxide, alcohol and drug abuse, Injury by physical agents,

Suggested readings:-

1. Guyton A.C and J E Hall, A text book of medical physiology, W.B Saunders, 1996.
2. Vijaykumar, Ramzi.S. Cotran, Stanley L. Robbins, Basic pathology, 7th edition, Saunders publications, 2003.
3. Braunwald, Fauci, Kasper, Hauser, Jorgo, Principles of internal medicine, Volume-1, 15th edition, McGrawHill, 2001.
4. Kanai L. Mukherjee, Medical Laboratory Technology Vol. I. Tata McGraw Hill 1996, New Delhi.
5. Gradwohl, Clinical Laboratory-methods and diagnosis, Vol-I

6. Sabitri Sanyal, Clinical pathology, B.I.Churchill Livingstone(P)Ltd, New Delhi.2000.
7. Judith Ann Lewis, Illustrated guide to diagnostic tests-students version, Springhouse Corporation, Pennsylvania, 1994.
8. Henry., Bernard, J., Sanford, T and Davidson, 2002. Clinical diagnosis & Management by laboratory methods. W.B. Saunders, New York.
9. Gradwohls, 2000. Clinical Laboratory Methods and Diagnosis. (ed) Ales C.Sonnenwirth and Leonard jarret, M.D. B.I. Publications, New Delhi.
10. Richard, R, 1989. Clinical Laboratory Medicine, Medical Publi, Chicago.

CB 204: Clinical Immunology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Introduction to Immune System: Memory, specificity, diversity, innate and acquired immunity, self vs non-self discrimination. Structure and functions of primary and secondary lymphoid organs. Cells Involved in Immune Responses: Phagocytic cells and their killing mechanisms; T and B lymphocytes; Differentiation of stem cells and idiotypic variations. Nature of Antigen and Antibody: Antigen vs Immunogen, Haptens; Structure and functions of immunoglobulins; Isotypic, allotypic and idiotypic variations.

UNIT 2

Generation of Diversity in Immune System: Clonal selection theory - concept of antigen specific receptor. Organization and expression of immunoglobulin genes: generation of antibody diversity. T cell receptor diversity. Humoral and Cell Mediated Immune Responses: Kinetics of primary and secondary immune response. Complement activation and its biological consequences. Antigen processing and presentation. Cytokines and costimulatory molecules: Role in immune responses. T and B cell interactions. Major Histocompatibility Complex (MHC) Genes and Products: Role of MHC antigens in immune responses. MHC antigens in transplantation.

UNIT 3

Development, Regulation and Evolution of the Immune System: Measurement of Antigen-Antibody Interaction. Production of polyclonal and monoclonal antibodies: Principles, techniques and applications. Agglutination and precipitation techniques. Radio immunoassay, ELISA, immunofluorescence assays: Fluorescence activated cell sorter (FACS) technique. Tolerance vs Activation of Immune System: Immunotolerance, Immunosuppression, Hypersensitivity (Types I, II, III and IV).

UNIT 4

Immune Responses in Diseases: Immune responses to infectious diseases: viral, bacterial and protozoal. Cancer and immune system. Immunodeficiency disorders. Autoimmunity. Immunization: Active immunization (immunoprophylaxis), Passive immunization (Immunotherapy) and role of vaccines in the prevention of diseases.

Suggested Readings:-

1. Fundamental Immunology (Hardcover) **By** William E. Paul. Publisher: Lippincott Williams and Wilkins.
2. Immunology: International Edition (Paperback) **By** Janis Kuby, Thomas J. Kindt, Barbara A. Osborne and Richard A. Goldsby. WH Freeman and Co. Ltd.
3. Immunology (Paperback) **By** Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne and Janis Kuby. WH Freeman and Co. Ltd.

4. Immunology (Paperback) **By** Ivan M. Roitt, Jonathan Brostoff and David Male. Publisher: Mosby.
5. Introduction to Medical Immunology **By** Gabriel Virella, Marcel Dekker Inc.
6. Roitt's Essential Immunology **By** Ivan M. Roitt and Peter J. Delves, Blackwell Publishing
7. Understanding Immunology (Cell and Molecular Biology in Action) (Paperback) **By** Peter Wood. Publisher: Prentice hall.
8. Basic Immunology: The Functions of the Immune System (Paperback) **By** Abul K. Abbas and Andrew H. Lichtman. Publisher: Saunders.
9. A Handbook of Practical Immunology, **By** G. P. Talwar, Pub: Vikas Publishing House.
10. Fundamental Immunology (Hardcover) **By** Robert M. Coleman and M.F. Lombard. Publisher: Brown (William C.) Co , U.S.
11. Atlas of Immunology (Hardcover) **By** J.M. Cruse (Author), Robert E. Lewis. CRC Press Inc.
12. Immunology **By** Edwards S Golub. Sinauer Associate, Sunderland.

CB 205: Development Biology and Genetics

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Mendel and his laws, Applications of laws and probability tests. Chi-square test and its application in the analysis of genetic data. Pattern of inheritance, Dominant and recessive inheritance. Multiple alleles, lethal alleles, penetrance and expressivity. Pleiotropy, Sex linked inheritance, Sex chromosomes, Sex determination, Multiple sex chromosomes, Sex linked and sex-limited traits. Physical and genetic mapping, Gene mapping by in-situ hybridization, Isolation of individual chromosomes, Linkage analysis and genetic maps, Linkage equilibrium and disequilibrium.

UNIT 2

Speciation concept, modes of speciation, Molecular clock and evolution, Allele and genetic variations, Sources of variations: Hardy-Weinberg principles and its applications. Pattern of changes in nucleotide and amino acid sequences, Basic attributes and polymorphic structures in human protein coding genes. Mitochondrial DNA polymorphism. Y-chromosome polymorphism and Single nucleotide polymorphism (SNP)

UNIT 3

Structure, chemistry, dynamics and regulation of sperm locomotion, capacitation and egg-surface targeting. Molecular biology, cytology and biochemistry of oogenesis. Synthesis and storage of maternal transcripts, proteins and cell organelles. rDNA amplification in amphibia; transcription on lampbrush chromosomes, Ovulation and hormonal control in mammals. Molecular and cellular biology of fertilization: acrosome reaction and signal transduction, monospermy and species-specificity.

UNIT 4

Egg activation, early cleavages and blastocyst formation in mammals and biochemical and cellular changes during the passage down the oviduct to the uterus. Implantation and formation of the placenta in mammals. Gastrulation in mammals-formation of primitive streak, morphogenetic movements and neural induction. Organogenesis and fetal development. Pattern forming genes and expression in mammalian embryos. Development of the mammalian brain-cerebral cortex-cell lineages; Lens development-fibre differentiation, programmed morphogenetic histogenetic cell death (apoptosis).

Suggested Readings:_____.

1. Tom Strachan & Andrew P.Read 1999. Human Molecular Genetics (2nd Edition), John Wiley & Sons.
2. Ricki Lewis, 1998. Human Genetics-Concepts & Applications (3rd Edition), McGraw-Hill.
3. T. A. Brown, 1999. Genomes, John Wiley & Sons (Asia) PTE Ltd.
- 4 . Scott Freeman & Jon C. Herron, 2001. Evolutionary Analysis (2nd Edition), Prentice Hall.
5. Derek A. Roff, 1997. Evolutionary Quantitative Genetics, Chapman & Hall.
6. R.S.Singh & C. Krimbas, 2000. Evolutionary Genetics- From Molecules to Morphology, Cambridge University Press.
- 7.Garner E.J, Simmons, M.J. & Snustad, D.P.1991. Principles of Genetics, John Wiley & Sons Inc, N.Y
- 8.Watson, J.D., Hopkins, N. H., Roberts, J. W. Steitz & Weiner, A. M., 1987. Molecular Biology of the Genes, The Benjamin/Cummings Publishing Company Inc., Tokyo.
9. William S. Klug & Michael R. Cummings 1996. Essentials of Genetics, 2nd Ed, Prentice Hall Internationals
10. Daniel L. Hartl & Elizabeth W. Jones, 1999. Essential Genetics, 2nd Ed., Jones & Bartlett Publishers

CB 206: Biosafety and Ethics in Science

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3hrs

UNIT 1

Properties of Radiation, Mechanism of Radioactive Decay, Beta & Gamma emission, Interactions of beta and gamma radiation with matter, electron capture, Decay schemes and energy level diagrams. The laws of Radioactive Decay. Physical, biological and effective half lives, Radionuclide hazards.

UNIT 2

Radiation measurement – monitoring, Personal monitoring: TLD's film. Contamination monitoring: Survey instruments, wipe tests, Accidents and emergencies, Spills & Personnel contamination.

UNIT 3

Medical emergencies: including death of patient, Loss of radioactive sources. Internal exposure – contamination control; External exposure – shielding, distance, time; Safe handling of radioactive sources. Activity in body fluids – urine, blood, breast, milk, etc.

UNIT 4

Ethical: somatic and germ line gene therapy, clinical trials, the right to information, ethics committee function. Biosafety containment facilities, biohazards, genetically modified organisms (GMOs), living modified organisms (LMOs)

Suggested Readings:-.....

1. Radioisotope Gauges for Industrial Process Measurements (Measurement Science and Technology) by Geir Anton Johansen and Peter Jackson (Jul 26, 2004).
2. Radioisotope Laboratory Techniques by R. A. Faires, etc. and G. G. J. Boswell (Dec 1980).
3. Radiotherapy in Practice: Radioisotope Therapy by Peter J. Hoskin (Mar 22, 2007).
4. Radioisotopes in Biology (Practical Approach Series) by Robert J. Slater (Feb 1, 2002).
5. Clinical Use of Radioisotopes by William Beierwaltes (1957) .

6. Biological Safety: Principles And Practices (Biological Safety: Principles & Practices) by Diane O., Ph.D. Fleming and Debra Long Hunt (Aug 30, 2006).
7. Biosafety in the Laboratory: Prudent Practices for Handling and Disposal of Infectious Materials by National Research Council (U. S.) (Dec 1989) .
8. Genetically Modified Organisms: A Guide to Biosafety (Cabi) by George T Tzotzos (May 1995).
9. Biotechnology, Biosafety, and Biodiversity: Scientific and Ethical Issues for Sustainable Development by Sivramiah Shantharam, Jane F. Montgomery and Satellite Symposium on Biotechnology and Biodiversity (Apr 1999).

CB 207 Lab Course II

Max Marks :100

Total Time Duration: 6 hours

Unit-1

Lab management, Handling of spectrophotometer, water baths, pipettes, Preparation and handling of reagents for enzyme assay, Enzyme assay and calculation of optimum pH, Temperature, time of incubation for alkaline phosphatase, AST and ALT, Polyacrylamide gel electrophoresis (PAGE) and SDS- PAGE),

Unit 2

Qualitative and quantitative determination of RNA and DNA, Standard curve preparation of DNA & RNA, Isolation of DNA, Agarose gel electrophoresis, Polymerase chain reaction.

Unit 3

Collection of urine and blood, Types of preservative, physical examination; Volume, colour, odour, appearance, specific gravity and pH.

Unit 4

Reducing sugar-Benedict test, protein: -Heat and acetic acid test, and sulfosalicylic acid method, Ketone bodies-Roth's test, Bile pigment (Fouchet method), bile salt (Hay's test), Urobilinogen-Ehrlich aldehyde test and Bence Jones protein test, Renal clearance test-urea, creatine, Test for mucin.

Unit 5

Antigen Antibody assay, ELISA tests, Immuno- electrophoresis.

CB 301: Clinical Pathology part-II

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

Unit 1

Growth and functional development of the fetus, adjustment of the infant to extrauterine life, special functional problems in the neonate, problems of prematurity, congenital anomalies, perinatal infections, syndrome of the newborn, immune hydrops, tumors and tumor like lesions of infancy and childhood. The role of fetal factors in programming adult-onset diseases.

Unit 2

Gynaecological malignancies- ovarian cancer, uterine cancer, cervical cancer, gestational trophoblastic neoplasia. Sexually transmitted diseases- syphilis, gonorrhoea, trichomoniasis, human papilloma virus infection. Diseases during pregnancy-placental inflammations and infections, ectopic pregnancy, gestational trophoblastic diseases, eclampsia.

Unit 3

Haemostasis – disorders and regulation – Types of Anaemia (deficiency of iron, B12 and folic acid, hemolytic, aplastic and genetic disorders), Bleeding disorders of man. General inflammatory marks and specific therapeutic bioindicators. CRP (C reactive protein), RA (Rheumatoid Arthritis), ASO(Anti Streptolysin O),

Acute inflammation, Vascular changes. Cellular vents, Chemical mediators, inflammation induced cell injury, Chronic inflammation, Chronic inflammatory cells and mediators, Lymphatics and lymph nodes in inflammation, systemic effect of inflammation,

Unit 4

General toxicology: Mechanism of toxic effect, toxicokinetics - chemical carcinogens and teratogens, treatment of intoxication. Response of respiratory system, reproductive system, liver, kidney to toxic agents. Toxic effects of metals, solvents, environmental pollutants. Inherited metabolic disorders (Phenylketonuria, MSUD, homo-cystinuria, galactosemia), gout, diabetes insipidus and diabetes mellitus).

Suggested readings:-

1. Guyton A.C and J E Hall, A text book of medical physiology, W.B Saunders, 1996.
2. Vijaykumar, Ramzi.S. Cotran, Stanley L. Robbins, Basic pathology, 7th edition, Saunders publications, 2003.
3. Braunwald, Fauci, Kasper, Hauser, Jorgo, Principles of internal medicine, Volume-1, 15th edition, McGrawHill, 2001.
4. Kanai L. Mukherjee, Medical Laboratory Technology Vol. I. Tata McGraw Hill 1996, New Delhi.
5. Gradwohl, Clinical Laboratory-methods and diagnosis, Vol-I
6. Sabitri Sanyal, Clinical pathology, B.I. Churchill Livingstone(P)Ltd, New Delhi. 2000.

CB 302: Clinical Biochemistry

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Disorders of carbohydrate metabolism: Diabetes mellitus, glycohemoglobins, hypo-glycemia, galactosemia and ketone bodies. Various types of glucose tolerance tests. Glycogen storage diseases.

Physiology of lipids/lipoproteins. Lipidosis. Clinical inter-relationships of lipids (sphingolipidosis and multiple sclerosis), lipoproteins and apolipoproteins. Diagnostic tests for HDL-cholesterol, LDL-cholesterol and triglyceride disorders.

Inborn errors of metabolism:

- a) **Disorders of amino acid metabolism**- Phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and aminoacidurias.
- b) **Disorders of nucleic acid metabolism**- Disorders in purine/ pyrimidine metabolism.

UNIT 2

Electrolytes, blood gases, respiration and acid-base balance. Disorders of acid-base balance and their respiratory and renal mechanisms.

Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Clinical importance of bilirubin.

Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase. Enzyme tests in determination of myocardial infarction. Enzymes of pancreatic origin and biliary tract.

UNIT 3

Hormonal disturbances: Protein hormones (anterior pituitary hormones, posterior pituitary hormones), steroid hormones, adrenocorticosteroids, and reproductive endocrinology. Disturbances in thyroid function.

Disorders of mineral metabolism: Hypercalcaemia, hypocalcaemia, normocalcaemia, hypophosphataemia and hyperphosphataemia.

UNIT 4

Biochemical aspects of hematology: Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias thrombosis and anemias. Laboratory tests to measure coagulation and thrombolysis.

Detoxification in the body: enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion, Disorders of vitamins and trace elements.

Suggested Readings: -

1. Textbook of Medical Biochemistry **By** MN Chatterjea and Rana Shinde, Jaypee Brothers.

2. Lehninger Principles of Biochemistry 5th Ed **By** David L. Nelson and Michael M. Cox, WH Freeman and Company.
3. Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed **By** LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.
4. Medical Biochemistry (Paperback) **By** John W. Baynes and Marek Dominiczak. Publisher: Mosby.
5. Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Ed **By** Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James Shepherd. Publisher: Churchill Livingstone.
6. Review of Medical Physiology (Lange Basic Science) (Paperback) **By** William F. Ganong. Publisher: McGraw-Hill Medical
7. Harper's Biochemistry (Lange Medical Books) (Paperback) **By** Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.
8. Clinical Biochemistry **By** Richard Luxton. Scion Publishing Ltd.
9. Principles of Medical Biochemistry: With STUDENT CONSULT Online Access (Paperback) **By** Gerhard Meisenberg and William H. Simmons. Publisher: Mosby.

CB 303: Medical Laboratory Techniques

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

Unit 1

Analysis of amino acids, Screening tests, quantitative tests, test for specific amino acids, determination of proteins in serum, plasma and CSF. Determination of glucose in body fluids, glucose tolerance test and hypoglycemia determination, analysis of ketone bodies, method of estimation of lactate pyruvate, pyruvate and glycated hemoglobin in blood. Analytical methods for estimation of triglycerides, high density lipoproteins, low density lipoproteins, apolipoproteins,

Unit 2

Laboratory application of nucleic acid technologies to elucidate, diagnose, monitor disease state and to evaluate non-disease status techniques for the detection of DNA, and RNA structures at the molecular level, Basic principles and techniques-nucleic acid biochemistry-Relation to laboratory evaluation of disease and establishing a molecular diagnostic laboratory facilities, equipment, personnel. Clinical testing process, quality assurance, clinical validation and accreditation.

Unit 3

Molecular genetics of hematopoietic neoplasm-lineage probes in the evaluation of hematopoietic neoplasms- Molecular analysis of chromosomal aberrations in leukemias and lymphomas, Molecular diagnosis of genetic diseases. Choice of techniques, choice of applications, special concept unique to molecular genetic disorders, specific disease examples. Application of molecular methods in clinical microbiology.

Unit 4

DNA analysis; historical aspects advantage of DNA over traditional serology; impact of DNA specimen collection, DNA degradation and environmental damage, quality assurance, standard, databank, legal challenge.

Suggested readings:

1. Henry, John Bernard, Todd Sanford and Davidson, 2002. Clinical diagnosis and management by laboratory methods. W.B. Saunders & Co.
2. Fischbach Francis A, 2003. Manual of laboratory and diagnostic tests. Philadelphia, J.B. Lippincott & Co, N.Y.
3. Gradwohls, 2000. Clinical laboratory methods and diagnosis ed. Alex.C. Sonnenwirth & Leonard Jarret. M.D.B.I. Publications, New Delhi,
4. Sood, R, 2005, Medical Laboratory methods and interpretation, Jaypee brothers medical publications, New Delhi.

CB 304: Medical Microbiology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

UNIT 1

Methods of classification of microorganisms, general characteristics of main groups of microorganisms. Mycoplasmas. Gram +ve and Gram -ve bacteria with structure and functions of peptidoglycan in them. Different phases of microbial growth and physical conditions required. Culture media and isolation of pure bacterial cultures. Staining methods for bacteria. Quantitative measurement of bacterial growth, microbial taxonomy, Bacterial morphology, growth and nutrition of bacteria,

UNIT 2

Bacterial genetics, pathogenesis, antibacterial agents, drug resistance and drug sensitivity tests, laboratory diagnosis of bacterial infections. Chemical control of microorganisms: Heat, filtration and radiation. Identification of bacteria on the basis of cultural characteristics (morphological and serological features): Staphylococcus and streptococcus including pneumococci, Family Enterobacterial, Haemophilus & Bordetella, Corynebacterium and Neisseria & Treponema.

UNIT 3

Virus structure including viral proteins, virus classification and lytic/lysogenic life cycles in viruses. Virus-induced changes in cells, methods of assay of viruses. Replication of RNA viruses- negative strand (VSV), positive strand (polio) and retroviruses. Replication of DNA viruses (Adenovirus or SV40).

UNIT 4

Air borne infections (Tuberculosis, Whooping cough, Influenza, Pneumonia, streptococcal infections, Diphtheria, Measles, Chicken pox, Mumps), Food and water borne infections (Cholera, Typhoid, Shigellosis, Brucellosis, Gastroenteritis, Amoebiasis, Taeniasis, Poliomyelitis, Jaundice) Sexually transmitted diseases (AIDS, Syphilis, Gonorrhoea, Lymphogranuloma venereum, Genital Herpes, Trichomoniasis) Vector borne diseases (Plague, Rickettsia, Malaria, Filariasis, Rabies, Leptospirosis),

Suggested Readings:-

1. Microbiology: An Introduction, Eighth Edition **By** Gerard J. Tortora, Berdell R. Funke, Christine L. Case. Pearson Education.
2. Fundamentals of Microbiology **By** I. Edward Alcamo. Benjamin-Cummings Pub Co.
3. Microbial Life (Hardcover) **By** Jerome Perry, James Staley and Stephen Lory. Pub: Sinauer Associates Inc.
4. Microbiology: Concepts and Applications (Hardcover) **By** MJ Pelczar, ECS Chan and NR Krieg, McGraw-Hill.

5. Microbiology (Hardcover) **By** Lansing M. Prescott, John P Harley and Donald A. Klein. Publisher: McGraw Higher Education.
6. Principles of Microbiology **By** Ronald M. Atlas
7. Microbiology **By** BD Davis, R Delbecco, HM Eisent and HS Ginsberg. Medical Division, NY.
8. Microbial Biochemistry (Hardcover) **By** ML Srivastava, Alpha Science Intl Ltd.
9. Microbial Biochemistry (Hardcover) **By** GN Cohen, Publisher: Springer.
10. Microbial Physiology **By** Albert G. Moat, John Watkins Foster, Michael P. Spector. Publisher: John Wiley & Sons.
11. Cofactor Biosynthesis: A Mechanistic Perspective, Volume 61 (Vitamins and Hormones) (Hardcover) **By** Gerald Litwack, Tadgh Begley. Publisher: Academic Press.
12. Principles of Virology: Molecular Biology, Pathogenesis and Control. **By** SJ Flint, LW Enquist, RM Krug, VR Racaniello and AM Skalka. ASM Press.
13. Fundamentals of Molecular Virology **By** Nicholas H. Acheson. John Wiley & Sons.
14. Basic Virology (Paperback) **By** Edward K. Wagner (Author), Martinez J. Hewlett, David C. Bloom and David Camerini. Publisher: WileyBlackwell

CB 305: Communication skills in Science

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 40

Max. Time: 1.5 hrs

Unit 1

Scientific and technical writing: Preparation of scientific report, Thinking and planning, Information, ideas, order of writing, Paragraph writing proper use of verb, Nouns, pronouns, tense, use of MS office, excel, powerpoints for preparing a scientific report.

Unit 2

Scientific presentation: Preparation of presentation, Order of material, Use of web information in presentation, Ethical/Copyright issues in presentations, Title, objective, methodology and results presentation, Different ways to make impressive presentations.

Unit 3

Oral presentations: General gesture for presentations, Speed, loudness, clarity during presentations, use of appropriate vocabulary during presentation, General discussions, scientific presentation, Sharing view and ideas.

Unit 4

Use of web to collect specific information, Scientific paper and review writing, Correspondence with editors and reviewers, appropriate citations, copyright and Ethical issues in paper drafting, Acknowledgment, Keywords, Use of appropriate citations, usage of different softwares for manuscript preparation, usage of line-,bar-graphs, charts to describe the results.

Suggested readings:.....

1. Rastogi, B.C., Bioinformatics, Concept, Skills & Applications, CBS Publications.
2. Richard Ellis, Communication Skills: Stepladders to success for professional, Gutenberg Press, Malta.
3. John W. Davis, Communication skills: a guide for engineering and applied science students, Prantics Hall, 2001.
4. Gupta S., Communication skills and Functional Grammar, University Science Press, New Delhi 110002.
5. Lloyd M., Bor R., Communication skills for medicine, Elsevier press, Churchill Liverstone Elsevier.

CB 306- Lab Course III

Max Marks :100

Total Time Duration: 6 hours

Unit 1

Sterilization of glassware & culture media; preparing & dispensing culture media-establishing pure cultures. Preparation of wet mount, mobility test –Simple stain-Gram's stain-Acid Fast stain-Capsule stain.

Unit 2

Physiological reaction of bacteria –Catalase test –Coagulates test –Oxidase Test- Nitrate test –Carbohydrate Fermentation test – IMVIC test –TSI test, Antibiotic sensitivity test- Qualitative: Kirby Bauer's methods, Quantitative, MIC

Unit 3

Blood Pressure, Pulse rate, Clotting time, Bleeding time, Haemoglobin estimation, Erythrocyte Sedimentation Rate, Packed cell volume. Prothrombin time, Differential count, Total Red Blood cell count, Total White blood cell count, Platelet count, Eosinophilic count, Reticulocyte count.

Unit 4

Blood sugar, Urea, Uric acid, Creatinine, Cholesterol, triglyceride, High Density Lipoproteins, Low Density Lipoproteins, Very Low Density Lipoproteins.

CB 401: Medical Transcription

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

Unit-1

Developing a hypothesis, aims and objectives; Experimental design; Laboratory research methodology; Qualitative research methods; Design of human subject research; Background and Information Sources; Sources of Funding; Monitoring, Quality assurance and safety, role of ethics in human studies.

Unit -2

Consumers in research; Introduction to preclinical studies; Animal models, *In vitro* models, *In silico* models, Medical terminology: IT enabled services, Need of medical transcription, Medical terminology-Word root, combining form, Suffixes prefixes, Formation and defining medical words.

Unit-3

Lab procedures, Drug used Vocabulary, Abbreviation Editing and phonetic problem solving-Types of errors, Editing, Proofreading. ; Transcription Guidelines, Formatting of reports, English Grammar- Parts of Speech, Subject verb agreement, Tense, Punctuation.

Unit-4

Statistical design in clinical trials: Descriptive statistics – Diagrammatic representation, Measures of location, Measures of dispersion, skewness and Kurtosis, Correlation and regression- Bivariate frequency table – Rank correlation – Multiple linear Regression. Statistical inference – Point and interval estimation, Hypothesis testing, Test for assigned proportion, Equality of proportions, Assigned mean, Equality of means. Chi – Square test for goodness of fit, Contingency table, test for independence of two attributes. Analysis of variance – One way classification, Two way classification.

Suggested readings:-

1. The language of medicine, Fifth edition, WB Saunders Company, Devi-Ellen Chabner, BA, MAT.
2. Medical Terminology a text workbook, Alice V. Prendergast, Frances C. Fulton, 4th Edition, Addison Wesley, 1997.
3. Guyton and Hall, A text book of medical physiology, W.B. Saunders, 1996.
4. Textbook of Human Physiology, Sarada Subramanyam, K. Madhavan Kutty, H.D. Singh.
5. Medical Transcription made easy, Alok jha, Prinyanka arora, Macmillan India Ltd.
6. Manual of Medical Transcription, Sheila B. Sloane, Marlyn Takahashi Fordney, W.B Saunders Company, 1994.

- 7 Bradford Hill, S.A., A Short Textbook of Medical Stastics. The English Language book and hodder and Stoughton, London. 1981
8. Daniel, W.W. , Biostastics – A A Foundation for analysis in health science, New York, 1995
9. Gupta, P. K. , Cytology, Genetics, Bio technology and Biostastics, RastogiPublishers, Meerut, 1996
10. Rosner , B., Fundamentals of Bio - Stastics, Duxbury Press, California, 2000.

CB 402: Medico –informatics

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

Unit-1

Introduction to Medical Network Design & Development Emergence of Medical Informatics as a Discipline; Library facilities & Logistics ; Online Resources ; Grading and Class Policies, Medical data acquisition and database systems: PC based multichannel data acquisition system; storage, analysis and retrieval techniques.

Unit-2

Visual programming concepts; visual Basic environment, tools and controls; Dynamic data exchange; VB based Medical information System. Basic concepts of Multimedia; Design of Multimedia information systems; Components of virtual reality; Virtual reality applications in medicine. Medical Informatics and its levels; Design and development of educational packages on medical sciences; Integrated design concepts; Interactive multimedia, Virtual and digital libraries, Internet and its applications.

Unit-3

Hospital Information System its design and functional characteristics; Pattern Recognition, Neural Network and Fuzzy Logic in Medicine. Autonomous, Decision-Support & "Expert" System: History of Artificial Intelligence in Medicine; Expert Systems in Medicine; Clinical Software Overview Risks of Decision-Support Systems, Computational Statistics in medical biology.

Unit -4

Basics of sequence analysis- Dot matrix method, Needleman–Wunsch Algorithm and Smith-Waterman algorithm, Alignments using BLAST and FASTA, Multiple Sequence Alignment (CLUSTAL-X and CLUSTAL-W), Application of multiple sequence alignment . Analysis tools: Analysis by TreeView, Genedoc and Lasergene. Protein Structure Prediction in Bioinformatics- Ab initio based methods, Homology based methods, prediction with neural networks, secondary structure prediction (helical membrane proteins, beta-barrel membrane proteins). Protein structure comparison- intermolecular and intramolecular methods Phylogenetics- construction by distance based methods, character based methods

Suggested readings:-

1. R. D. Lele, "Computer in Medicine", Tata McGraw-Hill, New Delhi, 1997.
2. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, New Delhi, 1997.
3. Davis Chapman, "Teach Yourself Visual Basic 6 in 21 days", New Delhi, 1997.
4. Harold Sackman, "Biomedical Information Technology", Academic Press, New York, 1997.
5. Mary Brth Fecko, "Electronics Resources: Access and Issues", Bowker and Saur, London, 1997.

CB 403 : Methods in Molecular Biology

Note: Que. 1 will be compulsory and will cover the entire syllabus in the form of short questions. Que. 2 to 9 will include two questions from each unit and candidate will have to attempt one question from each unit. Overall, five questions to be attempted. All questions to carry equal marks.

Max. Marks: 80

Max. Time: 3 hrs

Unit 1

Classes of DNA sequences: Methods of distinguishing double and single stranded DNA-SSB protein binding, S₁ nuclease digestion, ethidium bromide staining, silver staining and fluorescence.

Re-association kinetics: Cot values, experimental procedure, qualitative significance, use of Ag* cesium sulphate. Satellite DNA: Mechanical strength, gene library, suppressor mutation, centromeric DNA, split genes.

Unit 2

Chromatin: Histone and non-histone proteins, general properties of histones, packing density. Nucleosomes, size variable linker, role of H1. Transcriptionally active chromatin.

Movable genes: transposons and associated inverted repeats. The cassette model. Transforming DNA and plant genes. Retrovirus life cycle.

Unit 3

Strategies for cloning in plasmid vectors, features of commonly used vectors, their purification and characterization. Identification of bacterial colonies that contain recombinant plasmids. Bacteriophage vectors, Cloning in Bacteriophage vectors.

Cloning in cosmid vectors. Construction of Genomic DNA libraries in cosmid vectors. Enzymes used in molecular cloning, restriction enzymes, DNA-Polymerases, ligases, kinases, phosphatases, and nucleases. DNA binding proteins.

Unit 4

Agarose gel electrophoresis, detection and extraction of DNA from gels. Construction and analysis of cDNA- protocols and strategies for cDNA cloning. Analysis of Genomic DNA by Southern Hybridization. Amplification of DNA by the polymerase chain reaction.

Preparation of radiolabeled DNA and RNA probes. Synthetic oligonucleotides probes. Expression of cloned Genes in cultured cells. Screening expression with antibodies and oligonucleotides.

Suggested Readings: _____.

1. Molecular Cloning: a laboratory manual (Vol 1, 2 & 3) **2nd Ed. By** T. Maniatis, EF Fritsch and J. Sambrook. Cold Spring Harbor Laboratory Publications, NY.
2. Molecular Cloning: a laboratory manual (Vol 1, 2 & 3) **3rd Ed. By** J. Sambrook and DW Russel. Cold Spring Harbor Laboratory Publications, NY
3. Laboratory Techniques in Biochemistry and Molecular Biology; DNA sequencing (Vol 10). **By** J Hindley. Elsevier Biomedical.
4. Methods of DNA and RNA sequencing. **By** Sherman M. Weissman. Pub: Praeger
5. RNA isolation and analysis **By** P. Jones, J Qiu and D. Rickwood. Bios Scientific Publishers.
6. Advanced Organic Chemistry of Nucleic Acids (Paperback) **By** Zoe A. Shabarova and Alexey A. Bogdanov. Pub: VCH Publishers, Inc., New York, NY (USA).
7. Analytical Techniques in DNA sequencing **By** Brian Nunnally. Pub: Taylor and Francis.
8. Genomics: Fundamentals and Applications. **By** S Choudhuri and DB Carlson. Informa Healthcare.
9. Gene and Probes: A practical approach series **By** BD Hames and SJ Higgins. Oxford university Press.
10. Gel Electrophoresis of nucleic acids: A practical approach **By** D Rickwood and BD Hames. Oxford University Press.
11. Gene Cloning and DNA Analysis: An Introduction (Paperback) **By** T. A. Brown. WileyBlackwell.
12. Gene V **By** Benjamin Lewin. Oxford University Press.
13. Non-isotopic methods in Molecular Biology **By** ER Levy and CS Herrington. Oxford University Press