

SEMESTER – I BIO-ORGANIC CHEMISTRY - PBC701S**UNIT-I CARBOHYDRATES [20 hrs]**

Carbohydrates-classification, Polysaccharides – occurrence, structure and biological functions of cellulose, chitin, starch and glycogen. A brief account on fructans, arabinans and galactans., bacterial cell wall polysaccharides and blood group antigens.

Glycosaminoglycans – structure and biological role of hyaluronic acid, chondroitinsulfate and heparin. Sialic acid – structure and significance, Proteoglycans- A brief account on glycoproteins and their biological importance.

UNIT-II PROTEINS [15 hrs]

Proteins-classification. Orders of protein structure. Primary structure – determination of amino acid sequence of proteins. The peptide bond – The Ramachandran plot.

Secondary structures – α -helix, β -sheet and β -turns. Pauling and Corey model for fibrous proteins. Reverse turns and super secondary structures. Collagen triple helix Tertiary structure – α and β domains. Conformational properties of silk fibroin. Quaternary structure of proteins. The structure of hemoglobin. Models for hemoglobin allostery.

UNIT-III LIPIDS [10 hrs]

Lipids – Introduction, classification, fate of dietary lipids, simple lipid, compound lipids and derived lipids – structure and functions. Fatty acids – saturated, unsaturated and hydroxy fatty acids. Phospholipids and glycolipids – structure and functions. Plant and animal sterols – structure and functions of cholesterol. Lipoproteins – classification and composition.

UNIT-IV NUCLEIC ACIDS [15 hrs]

DNA double helical structure – Watson and Crick model. A, B and Z forms of DNA. DNA supercoiling and linking number. Properties of DNA – buoyant density, viscosity, denaturation and renaturation – The cot curve. Major classes of RNA – mRNA, rRNA, tRNA, sn RNA, hn RNA – structure and biological functions. Nucleosomes

UNIT-V NUCLEIC ACIDS IN CELLS [15 hrs]

Salient features of nucleic acid recognition by proteins. DNA binding motifs in proteins – the basic helix loop helix (bHLH) motif, zinc finger, the leucine zipper and helix-loop helix. RNA binding motifs in proteins. Techniques characterizing nucleic acid-protein complex – gel retardation assay, DNase I footprinting.

TEXT BOOKS:

Biochemistry. Voet and Voet, John Wiley, 1995

REFERENCES:

1. Lehninger Principles of Biochemistry 4th edition Nelson and Cox, Freeman Publishers, 2005
2. Harper's Biochemistry 26th edition. McGraw Hill, 2003
3. Biochemistry 4th edition. Zubay, William C. Brown Publication, 1998
4. Biochemistry. Voet and Voet, John Wiley, 1995
5. Nucleic acid structure and recognition. Neidle, Oxford University Press, 2002
6. Nucleic acids in chemistry and biology. Blackburn and Gait, IRL Press, 1996

REFERENCES:

1. Molecular cell biology 5th edition- Lodish, Berk *et al.*, Freeman and Co., 2004
2. Principles of biochemistry, Garrette, Grisham, Saunders College Publishing Co.1994
3. Molecular Cell biology 3rd edition, Lodish *et al.*, Scientific American Books.Freeman and Co.,1995
4. Molecular biology of the cell 4th edition – Alberts *et al.*, Garland Publishers, 2002
5. Harper’s Biochemistry 26th edition – Murray *et al.*, McGraw Hill, 2003
6. Cell and molecular biology- de Robertis .

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SEMESTER – I INTERMEDIARY METABOLISM- PBC703S**OBJECTIVE:**

To understand catabolic and anabolic pathways of carbohydrate, lipids, amino acids and porphyrin metabolism and its biological functions.

UNIT I BIOENERGETICS [15 hrs]

Biological oxidation-reduction reactions, redox potentials, High energy phosphate compounds – phosphate group transfer, Glycolysis-regulation and energetic- PDH complex-citric acid cycle, regulation and energetics ETC –oxidative phosphorylation-regulation and inhibition- uncouplers.

UNIT II CARBOHYDRATES METABOLISM [15 hrs]

Pentose phosphate pathway. Gluconeogenesis – glycogenesis & glycogenolysis metabolism - regulation, glyoxylate cycle and Gamma aminobutyrate shunt pathways, Cori cycle, anapleurotic reactions, glucuronate pathway. Hormonal regulation of carbohydrate metabolism. MTOR pathway

UNIT III AMINO ACID METABOLISM [15 hrs]

Amino Acids – General reactions of amino acid metabolism - Transamination, decarboxylation, oxidative & non-oxidative deamination of amino acids. catabolism of carbon skeletons of amino acids tyrosine and aliphatic amino acids. Urea cycle and its regulation

UNIT IV LIPID METABOLISM [15 hrs]

Introduction, hydrolysis of tri-acylglycerols, α -, β -, ω - oxidation of fatty acids. Oxidation of odd numbered fatty acids, PUFA- fate of propionate, role of carnitine, degradation of complex lipids. Fatty acid biosynthesis, Acetyl CoA carboxylase, fatty acid synthase, biosynthetic pathway for tri-acylglycerols, phosphoglycerides and sphingomyelin. Metabolism of cholesterol and its regulation. Energetic of fatty acid cycle.

UNIT V NUCLEIC ACID METABOLISM [15 hrs]

Nucleotides – Biosynthesis of Purines (de nova and salvage) and biosynthesis of Pyrimidines - catabolism and regulation of purine and pyrimidine biosynthesis.

Biosynthesis of NAD^+ / NADP^+ and FAD^+ .

TEXT BOOKS:

1. Nelson.D.L, Cox. M. M, Lehningers Principle of Biochemistry.4th ed. Freeman, 2004
2. DM Vasudevan, 'Textbook of biochemistry for medical students' 5th ed,Jaypee publications

REFERENCES:

1. Berg.J.M, Tymoczko.J.L, Stryer, L. "Biochemistry". 6th ed. Freeman, 2006.
2. Zubay," Biochemsitry" 4th ed. William C. Brown Publication, 1998
3. Voet and Voet. Biochemistry. 3rd ed. John Wiley, 1995.
- 4.Murray. R.K, Granner.D.K, Mayes. P. A, Rodwell. V. W.Harper s Biochemistry. 27th ed. McGraw Hill, 2006.

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SEMESTER – I CLINICAL NUTRITION- EPBC704S**OBJECTIVE:**

To study the proximate principles of nutrition and to understand the disorders and therapy associated with it.

UNIT-1 NUTRITIONAL DISORDER [15 hrs]

Introduction: source of energy-carbohydrates, fats and proteins; Diet-composition, fibre in diet. Disorders associated with protein metabolism-marasmus and kwashiorkor, Biological value of proteins, Chemical score.

Fats: sources-essential and non-essential fatty acids-disorders concerned with fatty acid metabolism-Refsum's disease, atherosclerosis, fatty liver and obesity.

UNIT II BASIC METABOLIC RATE [15 hrs]

Basal metabolic rate-factors affecting BMR-determination of BMR, direct and indirect methods, benedict's roth apparatus-respiratory quotient-BOD. SDA, Anthropometry: height, weight, skin fold thickness and arm circumference-their importance in nutrition

UNIT III VITAMINS & TRACE ELEMENTS [15 hrs]

Vitamins-Classification, fat soluble and water soluble vitamins-source, daily requirements, functions and deficiency manifestations. Micro, Macro and trace elements-daily requirements-functions-deficiency manifestations.

UNIT IV NUTRITIONAL MANAGEMENT [15 hrs]

Objectives of diet therapy-regular diet and rationale for modifications in energy and other nutrients, texture-fluid, soft diets etc. Metabolic and clinical complications, prevention and recent advances in the medical nutritional management on :obesity, cardiovascular diseases, Diabetes mellitus, Renal disorders and neurological disorders (parkinson's disease, alzheimer's disease). Nutrition at different stages of life-during infancy, adolescence, pregnancy, lactation and old age.

UNIT V Recent Advances in Clinical Nutrition [15 hrs]

Neutraceuticals-Adverse effects of certain neutraceuticals, dietary supplements & neutraceuticals used in functional medicine. Functional foods-Health benefits of functional foods in Immune function & mental health. Probiotics and prebiotics - Types & Health benefits. Antioxidants-Role of antioxidants in human health (Vit E, Vit C & Zinc).

TEXTBOOKS:

1. Swaminathan, M.S (1985): Principles of Nutrition, J.L Publishers, New Delhi
2. Mahan, L. Kand Escott-Stump, S (2000): Krause's Food Nutrition and Diet therapy, 10th ed, W-13 Saunders Ltd

REFERENCES:

1. Mahan, L. Kand Escott-Stump, S (2000): Krause's Food Nutrition and Diet therapy, 10th ed, W-13 Saunders Ltd
2. Shills, M.E, Olson, J.A, Shike, M and Ross, A.C (1999): Modern Nutrition in Health and Disease, 9th ed, A. Vaiti and Willons
3. Williams, S.R (1993): Nutrition and Diet Therapy, 7th ed, Times Mirror/Mosby College Publishing
4. Davidson and Passmore (2000): Human Nutrition and Dietetics
5. Anthony A. Albanese (1972), Newer Methods of Nutritional Biochemistry, Academic Press
6. Swaminathan, M.S: "Food and nutrition", vol I & II, J.L Publishers, New Delhi

SEMESTER – I PRACTICAL- PBCP101

1. Qualitative Analysis of Carbohydrates
2. Qualitative Analysis of Amino acids
3. Estimation of Protein by Lowry's Method
4. Estimation of Ash Content
5. Estimation of Moisture Content
6. Determination of Glycogen in Liver
7. Extraction and Estimation of Total Lipid
8. Estimation of Ascorbic Acid (Vitamin C)
9. Determination of Protein by Bradford Method
10. Estimation of Pyruvate
11. Estimation of Tryptophan
12. Isolation and Estimation of DNA
13. Extraction and Estimation of DNA
14. Extraction and Estimation of RNA
15. Separation of Amino acids by Paper Chromatography
16. Separation of Sugars by Paper Chromatography
17. Separation of Plant Pigment by Column Chromatography

SEMESTER – II MOLECULAR BIOLOGY PBC805S**UNIT-I CHROMOSOME [20 hrs]**

DNA-genetic material-Griffith, Avery et al and Hershey and Chase experiment value, C value paradox, Cot value, organization of chromosomes and nucleosomes, Euchromatin, heterochromatin, centromeres and telomeres (brief description), central dogma of molecular biology. The genomes of bacteria, viruses, mitochondria and chloroplast. Gene transfer in microorganisms- conjugation-Hfr transfer, chromosomal transfer and the mediation by F plasmids, transformation-competence, transduction - protoplasmic fusion.

UNIT –II REPLICATION [15 hrs]

Replication-conservative and semiconservative- experimental proof for semiconservative replication-factors involved in prokaryotic and eukaryotic replication-DNA polymerases in prokaryotes and eukaryotes-inhibitors of replication-Discontinuous replication, replication of circular DNA and linear DNA. Mitochondrial replication

UNIT-III TRANSCRIPTION [10 hrs]

Transcription-promoters, RNA polymerase in prokaryotes and eukaryotes-initiation, elongation and termination of transcription process -inhibitors of transcription-post transcriptional modification of mRNA, tRNA and rRNA, RNAi; antisense RNA

UNIT-IV GENETIC CODE AND TRANSLATION [15 hrs]

Genetic code-features and deciphering of genetic code. Translation- activation of amino acids, initiation, elongation and termination process in prokaryotes and eukaryotes. Inhibitors of protein synthesis in prokaryotes and eukaryotes-post translational modification. Operon concept-lac, arabinose and trp operon, wobble hypothesis.

UNIT-V DNA REPAIR [15 hrs]

DNA repair-photoreactivation, Excision repair, recombination and SOS repair. Protein targeting-Heat shock proteins, glycosylation; SNAPS and SNAREs. Repetitive DNA-Highly repetitive, moderately repetitive and unique DNA sequences. satellite DNA, transposons, retrotransposons and IS elements in bacteria, Gene dosage and gene amplifications

TEXT BOOKS:

1. Lewin B(2004): Genes VIII, Oxford University Press, New York
2. Watson. J. D, Baker. T. A, Bell. S. P, Gann. A, Levine. M, Lodish. R. Molecular Biology of Gene. 5th The Benjamin /Cummings Pub. Co. Inc, 2003

REFERENCES:

1. Darnell, Lodish and Baltimore. Molecular Cell Biology, Scientific American Publishing Inc, 2000
2. Weaver. R. F. Molecular Biology. 3rd ed. Mc Graw Hill publication, 2005
3. Weaver R.F and Philip.P.W(1989): Genetics, WMC Brwn Publishing, USA
4. Nelson Cox. Lehninger's Principle of Biochemistry. 3rd ed. MacMillian Worth Publ, 2000

SEMESTER – II ENZYMES PBC806S**UNIT I****ENZYME & THERMODYNAMICS****[15 hrs]**

Introduction –classification and nomenclature of enzymes, Factors affecting enzyme activity- Active site-definition: Investigation of active site structure, Trapping ES complex, Use of substrate analogues. Modification of amino acid side chain by single chemical procedures, Enzyme modification by treatment with proteases, Enzyme modification by site directed mutagenesis. General characteristics of enzyme activity, Turnover number.

UNIT II**KINETICS OF ENZYME ACTION****[15 hrs]**

Concept of ES complex, Active site, specificity, derivation of Michaelis Menten equation for uni substrate reaction. Different plot for the determination of K_m , V_{max} & K_{cat} and their significance. Collision, transition state theories and energy of activation. The rate of expression for bisubstrate reaction for ping pong, random and ordered bi- bi mechanisms.

UNIT III**MECHANISM OF ENZYME ACTION****[15 hrs]**

Acid base catalysis, covalent catalysis, metal ion catalysis, proximity, orientation effect. Strain and distortion theory. Lock and chemical modifications of active site groups. Site directed mutagenesis of enzyme. Mechanism of action of Chymotrypsin, Lysozyme, glyceraldehydes 3-phosphate dehydrogenase, and ribonuclease.

UNIT IV**ENZYME REGULATION****[15 hrs]**

General mechanism of enzyme regulation, product inhibition. Reversible (glutamine synthase and phosphorylase) and irreversible (protease) covalent modification of enzymes. Feed back inhibition and feed forward stimulation. Allosteric enzymes, Flipflop mechanism, positive and negative cooperativity with special reference to aspartate transcarbamoylase and PFK. Protein ligand binding measurement, analysis of binding isotherms, Hill and Scatchard plot.

UNIT V**ENZYME INHIBITION****[15 hrs]**

Irreversible-reversible –competitive, non competitive, uncompetitive inhibition-Kinetic differentiation and graphical analysis. Suicide inhibition. Immobilized enzymes –methods of immobilization –applications of immobilized enzymes.

TEXTBOOKS:

1. T.Palmer. Understanding enzymes. Prentice Hall.
2. Dixon and Webb. Enzymes 3rd ed. Longmans, 1979.

REFERENCES:

1. Zubay ,”Principles of Biochemistry”,4th ed. 1998, William C.Brown Publ.
2. Stryer.” Biochemistry “,5th ed. Freeman, 2002.
3. Uhlig H. Industrial enzymes and their applications. John Wiley, 1998.
4. Balasubramanian et al. Concepts in Biotechnology Universities Press (India) Ltd., 1998.
5. Chapline, Bucke, ,”Protein Biotechnology “,1st edition , Cambridge University Press,1990
6. Price, Stevens ,”Fundamentals of enzymology “,2nd edition –, Oxford University Press, 1999
7. Marangoni “Enzyme kinetics. A modern approach”, John Wiley, 2002

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SEMESTER – II ANALYTICAL BIOCHEMISTRY PBC807**UNIT 1 SPECTROSCOPIC TECHNIQUES [20 hrs]**

Laws of absorption and absorption spectrum. Principle, instrumentation and applications of UV-visible spectrophotometry and spectrofluorimetry. Basic principles of turbidimetry and nephelometry. Principle, instrumentation and applications of luminometry. Flame spectroscopy– principle and applications of atomic absorption and flame emission

UNIT II CENTRIFUGATION TECHNIQUES [10 hrs]

Centrifugation–principle, types of centrifuges ,rotors-types, preparative centrifugation– types, instrumentation and applications Analysis of subcellular fractions - Analytical ultracentrifuge– instrumentation and applications -sedimentation velocity and sedimentation equilibrium.

UNIT III ELECTROPHORESIS AND ELECTROCHEMICAL TECHNIQUES [15 hrs]

Electrophoresis: General principles. Support media. Electrophoresis of proteins– SDS-PAGE, native gels, gradient gels, isoelectric focusing, 2-D PAGE. Cellulose acetate electrophoresis. Detection, estimation and recovery of proteins in gels. Electrophoresis of nucleic acids– agarose gel electrophoresis, DNA sequencing gels.

UNIT IV CHROMATOGRAPHY [15 hrs]

Principle, instrumentation and applications of thin layer and gas chromatography. Column chromatography–packing, loading, elution and detection. Ion-exchange chromatography–preparation of resins, procedure and applications. Molecular exclusion chromatography–principle, gel preparation, operation and applications. Affinity chromatography– principle, materials, procedure and applications. HPLC– principle, materials, instrumentation and applications.

UNIT V RADIOISOTOPE TECHNIQUES [15 hrs]

Units of radioactivity. Detection and measurement of radioactivity– GM counter, solid and liquid scintillation counting, quenching and quench correction, scintillation cocktails and sample preparation. Cerenkov counting. Autoradiography. Applications of radioisotopes in biology. Radiation hazards.

TEXTBOOKS:

Upadhyay, Upadhyay and Nath. Biophysical Chemistry Principles and Techniques. Himalaya Publ. 1997.

REFERENCES:

1. Wilson and Walker. A biologist's guide to principles and techniques of practical biochemistry. 5th ed. Cambridge University Press 2000.
2. Boyer, R. Modern Experimental Biochemistry. 3rd ed. Addison Wesley Longman, 2000.
3. Simpson CFA & Whittacker, M. Electrophoretic techniques.
4. Sambrook. Molecular Cloning. Cold Spring Harbor Laboratory, 2001.
5. Friefelder and Friefelder. Physical Biochemistry – Applications to Biochemistry and Molecular Biology. WH Freeman & Co. 1994.
6. Pavia et al. Introduction to Spectroscopy. 3rd ed. Brooks/Cole Pub Co., 2000.

SEMESTER – II ENDOCRINOLOGY EPBC808**OBJECTIVE:**

To provide much information about hormones and the mechanism of action of various hormones with its effect on human due to their hypo and hyper secretion.

UNIT I SIGNAL TRANSDUCTION [15 hrs]

Introduction to Endocrinology: anatomical aspects of mammalian endocrine system. Definition of a hormone – classification, circulation in blood and Feed back regulation. Fundamentals concepts and definitions of signals, ligands and receptors, endocrine, paracrine and autocrine signaling. Receptors and signaling pathways – cell surface receptors, ion channels, G-protein coupled receptors, Signaling molecules- cAMP, cGMP, IP₃, Ca²⁺, DAG, and NO , Signal transmission via Ras proteins and MAP kinase pathways. Crosstalk in signaling pathways

UNIT II HYPOTHALAMIC AND PITUITARY HORMONES. [15 hrs]

Hypothalamic releasing factors. Anterior pituitary hormones: biological actions, regulation and disorders of growth hormones, ACTH, gonadotrophins prolactin. and Leptin. Posterior pituitary hormones – vasopressin and Oxytocin- biological actions, regulation and disorders ,MSH

UNIT III THYROID AND PARATHYROID HORMONES [15 hrs]

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Hyper and hypothyroidism. Hormonal regulation of calcium and phosphate metabolism. Secretion and biological actions of PTH, calcitonin and calcitriol. Hypercalcemia and hypocalcemia Rickets and osteomalacia.

UNIT IV ADRENAL HORMONES [15 hrs]

Adrenal cortical hormones. Synthesis, regulation, transport, metabolism and biological effects. Cushing's syndrome, aldosteronism, congenital adrenal hyperplasia, adrenal cortical insufficiency. Adrenal medullary hormones – synthesis, secretion, metabolism, regulation and biological effects of catecholamines. Pheochromocytoma.

UNIT V GONADAL AND PANCREATIC HORMONES [15 hrs]

Gonadal hormones: Biosynthesis, regulation, transport, metabolism and biological actions of androgens. Hypogonadism and gynecomastia. Biosynthesis, regulation, transport, metabolism and biological effects of oestrogen and progesterone. The menstrual cycle. Amenorrhoea.

Pancreatic hormones – cell types of islets of langerhans -synthesis, regulation, biological effects and mechanism of action of glucagon and insulin.

TEXT BOOKS:

1. Harper's Biochemistry – Murray et al. 26th ed. McGraw Hill, 2003.
2. Williams Textbook of Endocrinology – Wilson and Foster 8th ed.

REFERENCES:

1. Mechanisms of hormone action – Autind and Short.
2. Principles of Biochemistry – Mammalian Biochemistry – Smith et al. McGraw Hill 7th ed
3. Nelson.D.L, Cox. M. M. Lehninger s Principle of Biochemistry. 4th ed. Freeman, 2004

SEMESTER – II PRACTICAL-II- PBCP202

1. Preparation of buffers
2. Titration curve
3. Activity of alkaline phosphatase
4. Effect of ph on the activity of alkaline phosphatase
5. Effect of temperature on the activity of alkaline phosphatase
6. Effect of substrate concentration on the activity of alkaline phosphatase
7. Specific activity of alkaline phosphatase
8. Effect of ph on the activity of salivary amylase
9. Effect of temperature on the activity of salivary amylase
10. Effect of substrate concentration on the activity of salivary amylase
11. Determination of specific activity of salivary amylase
12. Effect of ph on the activity of urease
13. Effect of temperature on the activity of urease
14. Effect of substrate concentration on the activity of urease
15. Determination of specific activity of urease
16. Separation of proteins by sds page method
17. Separation of amino acid by thin layer chromatography

SEMESTER-III CLINICAL BIOCHEMISTRY PBC909**UNIT- I BLOOD SUGAR HOMEOSTASIS [15 hrs]**

Role of tissues and hormones in the maintenance of blood sugar. Diabetes mellitus – classification, stages of diabetes-metabolic abnormalities-acute complications – diabetic ketoacidosis –hyper osmolal non-ketotic coma. Immediate and Long-term complications – diabetic retinopathy, neuropathy and nephropathy, cataract - diagnosis-GTT- role of HbA1C- Hypoglycemia

UNIT-II HEME METABOLISM [15 hrs]

Jaundice- classification-biochemical findings. Liver function test based on bile pigments- plasma proteins- A: G ratio, prothrombin time- detoxification function - hippuric acid excretion , BSP dye test and metabolic functions. Galactose tolerance test- gall stones. Disorders of hemoglobin – thalassemia, sickle cell anemia. Anemias –types of anemia

GASTRIC FUNCTION TESTS: Physical examination of gastric contents-basal and maximal secretion-renal concentration test-Stimulation tests – histamine, alcohol and pentagastrin-Fractional test meal analysis-Azure A test-analysis of gastric contents-disorders of gastric function. Peptic ulcer, gastritis and hypoacidity and hyper acidity.

UNIT- III RENAL FUNCTION TEST [15 hrs]

Renal concentration test-PSP dye test-clearance test-inulin clearance-urea clearance-creatinine clearance - NPN-Biochemical findings in glomerulonephritis, renal failure and nephrotic syndrome. Renal stones –types of renal stones-factors influencing renal calculi formation and treatment

DISORDERS OF LIPID METABOLISM – hypo and hyperlipoproteinaemia. Lipid storage diseases – Gaucher's, and TaySach's, Niemann Pick disease. Fatty liver. Atherosclerosis. Risk and anti risk factors

UNIT- IV INBORN ERRORS IN METABOLISM [15 hrs]

Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Fanconi syndrome-cystinuria-galactosemia

CLINICAL ENZYMOLOGY: Serum enzymes and isoenzymes-. Enzyme patterns in disease- Liver, pancreas, and myocardial infarction.

UNIT- V ENDOCRINE DISORDER [15 hrs]

Endocrine function test-Thyroid function test-Radioactive Iodine uptake, serum PBI ,.Dynamic function test- T3 suppression test, TSH &TRH stimulation test ,ACTH stimulation Test,dexametasone suppression test, Metyrapone test, GnRH stimulation test

TEXT BOOKS:

- 1) MN Chatterjea "Textbook of Medical Biochemistry ", Jaypee, 5th Edition, Jaypee Brothers, Medical Publishers (P) Ltd.
- 2) Devlin," Clinical biochemistry with clinical correlation", Wiley - LISS A John Wiley & Sons, Inc., Publication
- 3) Mayne ,"Clinical chemistry in diagnosis and treatment",6th edition , ELBS Publications, 1994

REFERENCES:

1. Marshall "Clinical Chemistry", 3rd edition, Mosby. .
2. Cohn and Roth "Biochemistry and disease" 1996, Williams and Wilkins.
3. Murray. R.K, Granner.D.K, Mayes. P. A, Rodwell. V. W. Harper s Biochemistry. 27thed. McGraw Hill, 2006.
4. Montgomery et al "Biochemistry" A case oriented approach.. Mosby.
5. Bishop, Lippincott, 2000-Clinical Chemistry - Principles, procedures, correlations-.
6. Varley *et. al.*, "Practical Clinical Biochemistry", volume I and II, 5th edition -CBS Publishers, 1980
7. Teitz 'Text book of Clinical Biochemistry' 3rd edition - Burtis *et al.*, William Heinmann medical books, Ltd., 1999
8. Clinical biochemistry - Metabolic and clinical aspects, Pearson Professional Ltd.1999
9. Harrison's Principles of Internal Medicine Vol. I and II. 14th edition, McGraw Hill

SEMESTER-III IMMUNOLOGY PBC910**UNIT I CELLS AND ORGANS OF IMMUNE SYSTEM [15 hrs]**

Types of Immunity-innate, acquired, humoral & cell mediated immunity -lymphocyte development. Antigen processing & presentation by B-cell & T-cell. Cell of the immune system-structure & function of mononuclear phagocytes- phagocytosis process, dendritic cells, granulocytes, Kupffer's cell, osteoclasts, microglial cell, mast cell, APC. Organs of the immune system- structure and function of primary & secondary lymphoid organs.-bone marrow, thymus, lymph node, spleen

UNIT II ANTIGEN & IMMUNOGLOBULINS [15 hrs]

Antigen-properties, immunogenicity & antigenicity. Factors that influence immunogenicity, adjuvants, epitopes, haptens. Antibodies- Basic structure of immunoglobulins & classes. Antigenic determinants on immunoglobulin-isotype, allotype, idiotype, Immunoglobulin-organization expression & rearrangement of heavy & light chains sequencing. Diversity. clonal selection theory. Monoclonal Antibodies - formation, selection, production & clinical uses.

UNIT III IMMUNO TECHNIQUES [15 hrs]

Cytokines - properties, structure & function, Complement components and its path way. Principle & application of precipitation reaction in fluids & gels (radial, double immunoelectrophoresis). Agglutination reaction- hemagglutination, bacterial, passive & agglutination inhibition reaction. Widal test, Radio Immuno Assay ELISA, FISH. Immuno fluorescence, Immuno blotting, complement fixation test.

UNIT IV THE IMMUNE SYSTEM IN HEALTH & DISEASE [15 hrs]

MHC-structure & function of MHC-I,II,III in human and mouse, gene organization-HLA Cytotoxicity- immunological memory, immunotolerance, immunosuppression Transplantation immunology- immunologic basis of graft rejection, hyper acute, chronic rejection. Clinical transplantation-kidney and skin.

UNIT V HYPERSENSITIVE REACTION & AUTOIMMUNITY [15 hrs]

Type-I-components, mechanism & consequences of type-I, type II-transfusion reaction, and hemolytic disease of the newborn, drug induced hemolytic anemia, Type III, & Type IV. Autoimmunity- organ - specific & systemic autoimmune diseases, (eg, Grave's disease, Hashimoto's thyroiditis, SLE & rheumatoid arthritis), treatment of autoimmune diseases.

TEXT BOOKS:

- 1) Ian Tizard, "Immunology –An introduction", Saunders College Publishing
Harcourt Brace College Publishers, USA
- 2) Abbas, Lightman and Pober."Cellular and Molecular Immunology,"2nd edition,
W.B. Saunders ,1994.

REFERENCES:

1. Ivon Roitt "Essential Immunology", 7 th edition ,Blackwell publishers , 2006
2. P.M. Lydyard, A.Whelan &M.W Fnger "Immunology"
3. Kuby Richard A.Goldsby,Thomas J.Kindt, Barbara A.Osborne "Immunology" , 6th
edition, Freeman publications
4. Mark Peakman, Diegovergani "Basic & Clinical Immunology"
5. David Male, Brian Champion, Anne Cooke & Michael Owen "Advanced
Immunology" 2nd edition

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SEMESTER-III RESEARCH METHODOLOGY & BIostatISTICS EPBC911**UNIT I DATA COLLECTION AND PRESENTATION [15 hrs]**

Introduction: Collection of data, primary data and secondary data-different methods of collecting primary data-classification and tabulation of statistical data-Frequency Distribution: Simple and Cumulative. Displaying data-Histogram, Bar chart, Frequency polygon, Pie chart

UNIT II MEASURES OF CENTRAL TENDENCY [15 hrs]

Measurement of Central Value: Mean, Median, Mode, Geometric Mean(G.M) and Harmonic Mean(H.M), Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation and their coefficients.

UNIT III STATISTICAL ANALYSIS [15 hrs]

Small sample Tests - Student 't' test for mean, difference of two means, test for correlation and regression coefficients. Chi-square test for goodness of an independence of attributes. F test for equality of variances .ANOVA -one way and two way classification.

UNIT IV RESEARCH METHODOLOGY [15 hrs]

Literature collection ,Literature citation, writing review of literature, Report writing: formatting & typing. Technique of interpretation, writing abstract ,summary &conclusion. Scientific writing ,Blotting technique - southern ,western, northern & dot-blot ,RFLP& RAPD -techniques & application.

UNIT V SPECTROSCOPIC TECHNIQUES [15 hrs]

Spectroscopy-- principles, technique & application of NMR, ORD & Circular dichroism. PCR Technique- Basic principle, RT-PCR, Quantitative PCR & In Situ PCR. Diagnostic & laboratory application of PCR,DNA finger printing, . MALDI TOF-principle &application,DNA Sequencing.

TEXT BOOKS:

1. Green. R. H. 'Sampling Design and Statistical Methods for Environmental Biologists' .John Wiley & Sons, 1979.
2. Dr.A.Wilson Aruni,Dr.P.Ramadass "Research and writing: Across the disciplines", MJP Publishers
3. Gupta.S.C & Kapoor. V.K. "Fundamental of Applied Statistics" (2nd ed) ,MJP Publishers, 1978

REFERENCES:

1. Dr.G.Vijayalashmi, Dr.C.Sivapragasam "Research methods: Tips and Techniques",MJP Publishers
2. Matthews,' Sucessful Scientific writing: A step-by step guide for Biomedical Scientists'. 2nd ed. Cambridge University Press, 2001.
3. Thomas Glover, Kevin Mitchell,' Introduction to Biostatistics', 1st ed. McGraw Hill Science, 2001.
4. Dr N .Gurumani, "An Introduction to Biostatistics",MJP Publishers
5. Dr N .Gurumani, "Thesis writing and paper presentation", MJP Publishers
6. Wilson & Walker,' Principles and Techniques in Practical Biochemistry' 5th ed.. Cambridge Univ. Press, 2000.
7. Pavia et al.' Introduction to Spectroscopy', 3rd ed. Brooks/Cole Pub Co., 2000.
8. Upadhyay, Upadhyay and Nath,' Biophysical Chemistry- Principles and Techniques'
Himalaya Publ. 1997.

SEMESTER-III BIOTECHNOLOGY EPBC912**UNIT I GENE TRANSFER METHODS [15 hrs]**

Basic principles, use of restriction enzymes for production of DNA fragments. Cloning vectors—plasmids (pBR 322, pUC 18), phages (λ and M13) and cosmids. YACs, BACs, PACs. Splicing of DNA— cohesive end method, blunt end ligation, linkers and adaptors. Selectable markers and reporter genes used for gene transfer - GUS gene, Lux gene, *npt II* and GFP protein. Co-integrate and binary vectors, Agrobacterium mediated gene transfer- Ti plasmid, the process of T DNA transfer and integration, direct gene transfer methods - particle bombardment, PEG transformation, Electroporation.

UNIT II PLANT BIOTECHNOLOGY [15 hrs]

Introduction to cell and tissue culture—media, composition and preparation. Culture types— callus culture, cell suspension culture, protoplast culture etc., Somatic embryogenesis, organogenesis, embryo culture and embryo rescue. Micropropagation, Protoplast isolation, protoplast culture and fusion, selection of hybrid cells, cybrids, somaclonal variation. Germplasm storage and cryopreservation

UNIT III ANIMAL BIOTECHNOLOGY [15 hrs]

In vitro fertilization and embryo transfer. Vaccines —types, subunit recombinant vaccine – hepatitis B and vector recombinant vaccine – vaccinia Development of transgenic animals— retroviral, microinjection and embryonic stem cell methods. Applications of transgenic animals. Gene therapy—ex vivo and in vivo.

UNIT IV BIOPROCESS TECHNOLOGY [10 hrs]

Bioprocess— Basic principles of microbial growth. Types, design and operation of fermenters. Fermentation culture medium— carbon, nitrogen and vitamin sources. Downstream processing— separation, concentration, purification and modification .Production of vitamin B₁₂ & penicillin.

UNIT V ENVIRONMENTAL BIOTECHNOLOGY [20 hrs]

Management of industrial waste— aerobic and anaerobic processes. Solid waste management. Composting ,municipal sewage treatment, pollution control. Biogas, Biofertilizer, Bioremediation. Microbial degradation of xenobiotics.

TEXT BOOKS:

1. U.Sathyanarayana, 'Biotechnology', Allied publishers
2. P.K. Gupta, 'Elements of Biotechnology', Rastogi Publication, 1998

REFERENCES:

1. J.E. Smith, 'Biotechnology', Cambridge University Press 1996.
2. Glick and Pasternak, 'Molecular Biotechnology', Panima Publ
3. S. Ignacimuthu, 'Plant Biotechnology', Oxford, IBH.
4. Watson, 'RecombinantDNA Technology', Scientific American Publ.
5. Slater A, NW Scott, MR Fowler, 'Plant Biotechnology', Oxford University Press, 2003

**SEMESTER - III CLINICAL BIOCHEMISTRY & IMMUNOLOGY PRACTICAL
PBCP303**

St. Joseph's College, Chudhalore.

SEMESTER – III HUMAN RIGHTS - ECHR901S**Unit I**

Definition of human rights-nature content-characterizes of human rights-classification of human rights-historical development of human rights-reasons for human rights studies today

Unit II

International human rights norms-humanitarian law-declaration covenants-international covenant on economic, social and cultural rights,international covenants on civil and political rights-optional protocol to the international covenant on civil and political rights-human rights treaties,enforcement of human rights law ,universal jurisdiction.

Unit III

International bodies-the united nation organization ,human rights council,other treaty bodies-amesty international –helsinki declaration –regional human rights-africa,America,asia,Europe&oceania.

Unit IV

Contemporary issues on human rights-human right violations-children's rights-women's rights-scheduled caste-minority rights –bonded labour and wages, torture and death.

Unit v

Human rights and the Indian constitution, fundamental rights in Indian constitution – directive principles of state policy-fundamental duties.

Various commission; National Human Rights Commission- National commission for Women-Women's Rights in India-Consumers protection Act-Rights to information Act- Public Litigation Act and Rights to Education Act.

Reference Books;

1. Human rights in developing society-Sankar Sen
2. Teaching of human rights-Sergio Baradat Swaronjali Ghosh

SEMESTER-IV MOLECULAR PHYSIOLOGY PBC1013**OBJECTIVE**

To gain knowledge about the structure & functions of various organs in the molecular level.

UNIT I DIGESTIVE SYSTEM [15 hrs]

Digestion- Digestive processes at various regions of digestive system, composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids.

UNIT II CARDIO PHYSIOLOGY [15 hrs]

Cardiac system – physiologic anatomy of heart- genesis and spread of cardiac impulses-coronary cycle, cardiac cycle, heart sound, cardiac output, cardiovascular regulatory mechanisms, E.C.G-Measurement Of ECG. Composition of blood, blood coagulation – mechanism and regulation.

UNIT III RESPIRATORY PHYSIOLOGY [15 hrs]

Respiratory system – functional anatomy of air, passages and lung respiratory muscles, mechanism of respiration, pulmonary ventilation, alveolar surface tension, lung volumes and capacities. Gas-exchange in the lungs, regulation of respiration. Role of 2,3-diphosphoglycerate, Bohr's effect and chloride shift.

UNIT IV RENAL PHYSIOLOGY [15 hrs]

Renal system- structure of kidney & nephron- glomerular filtration, tubular reabsorption of glucose, water and electrolytes and tubular secretion. Mechanism of formation of urine- homeostatic regulation of water and electrolytes, counter current mechanism. Regulation of acid-base balance.

UNIT MUSCLE & NERVE PHYSIOLOGY [15 hrs]

Muscles - types of muscle -skeletal and smooth muscle- mechanism of muscle contraction-. Nervous system-structure of neuron and synapse-basic functions of synapses & neurotransmitters. Mechanim of transmission of impulse -synaptic transmission, neuromuscular transmission. Central nervous system-Cerebrospinal fluid. Basis of EEG.

TEXT BOOKS:

1. Ganong W. E." Review of Medical Physiology", 21st ed, Mc. GrawHill, 2003.
2. Guyton. A.C, Hall. J.E. "Textbook of Medical Physiology", 11th ed. Saunders Company, 2005

REFERENCES:

1. Meyer, HS Meij, AC Meyer,' Human Physiology', AITBs Publishers and Distributors.
2. GIES, Cell biology 5th edition, W.B Saunders company, Tokyo, Japan.
3. K.A. GOEL, K.V. Sastri, "A Text book of Animal Physiology, Rastogi publications, Meerut.
4. K.Saradha Subramanyam,"A Hand Book of Basic Human physiology", S.Chand & Co.,Ltd.
5. Y.Rajalaskhmi,'Guide to Physiology', S.Chand & Co.,Ltd
6. Smith et al,' Mammalian Biochemistry', 7th edn.,Mc. Graw Hill.

St. Joseph's College, Bangalore.

SEMESTER-IV BIOINFORMATICS PBC1014**OBJECTIVE**

To gain knowledge in using software techniques and internet resources to handle and compare sequence and structure information and search databases .

UNIT I INTRODUCTION**[15 hrs]**

Bioinformatics, Goal, Scope, Applications, Limitations. Database, Types of Databases, Biological Databases, Pitfalls of Biological Databases .Sequence databases – Nucleic acid – GenBank, EMBL, DDBJ. Protein – Swissprot, TrEMBLPIR. Structural – PDB, MMDB. Sequence retrieval – Entrez.

UNIT II SEQUENCE ALIGNMENT**[15 hrs]**

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues. Basic concepts of sequence alignment, Needleman & Wunchsh, Smith & Waterman algorithms for pairwise alignments. Basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, Sequence alignment – pairwise-local and global - Dot Matrix Method and Dynamic Programming Method. BLAST and FASTA

UNIT III PHYLOGENETICS & MSA**[15 hrs]**

Multiple sequence alignment (MSA) – Tools for MSA on open source CLUSTALW. Phylogenetics, Parsimony, forms of tree representation ,rooted and unrooted, Boot trapping, phylogenetic programs-PHYLIP

UNIT IV GENE PREDICTION**[15 hrs]**

DNA micro arrays and uses. Gene prediction in prokaryotes and eukaryotes, SNPs, Methods for gene prediction – GenScan, GRAIL, FGENESH/FGENES, Metabolic pathways-KEGG, Pharmacogenomics (Brief Description)

UNIT V HUMAN GENOME PROJECT**[15 hrs]**

Introduction and need of Human Genome Project, rough and final draft of the Human Genome Project, Goals of the HGP, uses and applications. Applications of bioinformatics in various fields: Environment, biotechnology, molecular biology, neurobiology, agriculture, drug designing, biomedical genome medicines, medical microbiology.

TEXT BOOK:

Arthur M.Lesk ,'Introduction to Bioinformatics '(2002) , Oxford University press.

REFERENCES:

1. Attwood & Parry-Smith, "Introduction to Bioinformatics", Pearson Education
2. Jean-Michel Claverie, "Bioinformatics-A Beginner's guide", John Wiley & Sons.
3. Philip E. Bourne and Helge Weissing , "Structural Bioinformatics", Wiley
4. 4. Rastogi,S.C. Mendiratta, N. and Rastogi P , "Bioinformatics-Methods and applications", Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Jin Xiong , "Essential Bioinformatics", Cambridge University Press
6. Mount DW , "Bioinformatics - Sequence and Genome analysis", Cold Spring Harbour Laboratory Press, New York
7. BaxevanisAD & Quellette BFF , "Bioinformatics", John Wiley & Sons Inc.

Web sites

<http://www.ensembl.org>

<http://www.ncbi.nlm.nih.gov/genbank>

<http://www.123genomics.com>

<http://www.expasy.ch>

SEMESTER-IV PHARMACEUTICAL BIOCHEMISTRY PBC1015**OBJECTIVE:**

To understand various routes of drugs administration, distribution, metabolism and excretion.

UNIT I INTRODUCTION [15 hrs]

Drug - sources, dosages forms and routes of administration. Drugs - structural features and pharmacological activity, prodrug concept, absorption, factors modifying drug absorption. Distribution, metabolism and excretion of drugs, phase-I, II reaction, action of cytochrome P₄₅₀

UNIT II DRUG -RECEPTOR INTERACTIONS [10 hrs]

Drug receptor- localization, types and sub types, models and theories. G-protein coupled receptor and ion- channel linked receptor, Examples of drug -receptor interactions. Agonist and Antagonist.

UNIT III PHARMACOKINETICS [15 hrs]

Drug tolerance and drug dependence. Principles of basic pharmacokinetics. Adverse response to drugs, drug intolerance, pharmacogenetics, drug allergy, tachyphylaxis, drug abuse, vaccination against infection, factors modifying drug potency: chemical, bio assay and immunoassay.

UNIT IV DRUG THERAPY-I [20 hrs]

Mechanism of action of drugs used in therapy of respiratory system (cough- eg- chlorpheniramine, Diphenhydramine, bronchial-asthma-eg., salbutamol, methyl xanthine, pulmonary tuberculosis), anti-microbial drugs-sulfonamides, trimethoprim, penicillin, aminoglycosides -General principles involved in the chemotherapy of cancer -anti thyroid drugs eg carbimazole, insulin and oral antidiabetic drugs eg-sulphonylureas, biguanides

UNIT V DRUG THERAPY-II [15 hrs]

Anti malarial drugs -mode of action of chloroquine, quinine, anti fungal drugs - mode of action of chlorophenesisin, griesofulvin and candididin. Anti viral drugs - mode of action of idoxuridine, acyclovir and amantadine hydrochloride.

TEXT BOOKS:

1. G.R.Chatwal, "Pharmaceutical Chemistry -vol-1",Himalaya Publishing House , New Delhi
2. G.R.Chatwal, "Pharmaceutical Chemistry -vol-2",Himalaya Publishing House , New Delhi
3. Jayasree Ghosh "Text book of Pharmaceutical Chemistry", S.Chand & Company, Ltd., New Delhi

REFERENCES:

1. Joseph R.Palma,John DiGregorio"Basic Pharmacology in Medicine",McGraw Hill Publishing Company,New York
2. 2.Good man, Gilman "The Pharmacology, volume I and II".
3. Katzung ,"Basic and Clinical Pharmacology", 7th edition- ,Prentice hall ,New Delhi.
4. Satoskar et al ,"Pharmacology and Pharmaco therapeutics", Popular Purashar,Mumbai.
5. M.Atherden ,"Text book of Pharmaceutical Chemistry", 8th edition.

SEMESTER-IV GENETIC ENGINEERING**OBJECTIVE**

To equip the students to learn and apply the recent advances in the various techniques of GE to introduce a new characteristics to introduce a novel trait or enhancing existing ones, or produce a new protein or enzyme.

UNIT I AN INTRODUCTION TO GENETIC ENGINEERING [15 hrs]

Enzymes used in genetic engineering- Restriction endonucleases, DNA polymerases, Reverse transcriptase, Ligases, Polynucleotide kinase, Alkaline phosphatase, Nucleases, Klenow fragment, Terminal deoxynucleotidyl transferase, RNase. Vectors for cloning- Plasmids, Bacteriophage, Filamentous phage vectors, Cosmids, Phagemids, YACs. Ligation of DNA fragments with vectors - Homopolymer tailing, Ligation of cohesive termini, Blunt-end ligation, Linker molecules.

UNIT II GENE TRANSFER METHODS [15 hrs]

Introducing genes into prokaryotes- Natural gene transfer methods- Transformation, transduction, calcium chloride mediated transformation, Transfection with phage vectors. Introducing genes into eukaryotes- Gene transfer by viral transduction, Calcium phosphate mediated transformation; Liposome mediated transformation, Microinjection, Electroporation.

UNIT III CLONING STRATEGIES [15 hrs]

Cloning strategies: Producing genomic libraries in cloning vectors, Genomic libraries in high-capacity vectors, cDNA cloning, Shotgun cloning, Cloning in *E.coli*, Identifying the recombinant DNA and its products- Immunochemical screening, Hybrid arrested translation, Nucleic acid probes.

UNIT IV PROKARYOTIC EXPRESSION SYSTEMS [15 hrs]

Prokaryotic expression systems Gene expression based on bacteriophage T7 RNA polymerase, Eukaryotic expression systems- Fused genes, Unfused genes, Secreted proteins, Gene expression by transcription factors- Nfkb, PPAR, Antisense RNA technology- SiRNA, miRNA.

UNIT V TECHNIQUES IN GENETIC ENGINEERING [15 hrs]

Techniques in genetic engineering- Hybridization technique, Southern, Northern- Western blotting techniques, Site directed mutagenesis, Restriction mapping, DNA profiling in forensic science, Chromosome walking, Chromosome jumping, DNA sequencing, PCR. Basic concepts of Intellectual property rights.

TEXT BOOKS:

1. Primrose s. B., Twyman, R.M., and Old, R.W. Principles of gene manipulation. Sixth edition. Blackwell Publishers.2001.
2. Sandhya Mitra, Genetic Engineering. Macmillan India Limited. 2005.

REFERENCES:

1. Primrose, Principles of Genome analysis. Blackwell Sciences.2003.
2. Watson. Recombinant DNA. Second edition. American Publishers.1992.
3. Sambrook, J., Fritsch, E. F., and T. Maniatis, Molecular Cloning,
4. A Laboratory Manual, Second edition. Cold Spring Harbor Laboratory Press, New York, 1989.
5. Joseph M. Fernandez and James P. Hoeffler. Gene expression systems.Academic Press, 1999.

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