ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

CUDDALORE-1

PG & RESEARCH DEPARTMENT OF BIOCHEMISTRY

PG SYLLABUS

MSc BIOCHEMISTRY
M.Sc DEGREE COURSE IN BIOCHEMISTRY
(With effect from 2016)

Semester	SUB. CODE	Subject Title		Hrs	Cr	Exam hrs
FIRST	PBC701S	Main Paper – I(Bio organic chemistry)		5	4	3
	PBC702S	Main Paper – II(Principles of Cell biology)		5	4	3
	PBC703S	Main Paper – III(Intermediary Metabolism)		5	4	3
	EPBC704S	ElectivePaper– I	Clinical Nutrition	5	4	3
	EPBC704A		Medical lab Technology			
	PBCP101	Main Practical – I		8	6	6
		Seminar/paper presentation/library		2		
		Total		**30**	**22**	
SECOND	PBC805S	Main Paper – IV Molecular biology		5	4	3
	PBC806S	Main Paper – V Enzymes		5	4	3
	PBC807S	Main Paper – VI Analytical Biochemistry		5	4	3
	EPBC808A	Elective Paper – II	Plant biochemistry	5	4	3
	EPBC808S		Advanced Endocrinology			
	PBCP202	Main Practical – II		8	6	6
		Seminar/paper presentation/library		2		
		Total		**30**	**22**	
THIRD	PBC909S	Main Paper –VII Advanced Clinical Biochemistry		5	4	3
	PBC910S	Main Paper –VIII Immunology		5	4	3
	PBC911S	Main Paper–IX Advanced Biotechnology		5	4	3
	EPBC912A	ElectivePaper III	Developmental & Inheritance Biology	5	4	3
	EPBC912B		Bio informatics &Clinical Research			
	PBCP303	Main Practical – III		8	6	6
	ECHR901S	Human Rights		2	1	3
		Total		**30**	**23**	
FOURTH	PBC1013S	Main Paper – X Molecular physiology		5	4	3
	PBC1014S	Main Paper – XI Research methodology and Biostatistics		5	4	3
	EPB1015A	ElectivePaper– IV	Pharmacology	5	4	3
	EPB1015B		Recombinant DNA Technology)			
	JPBC1016	Project work		15	11	
		Total		30	23	
		Total credits			**90**	

YEAR-I	BIO-ORGANIC CHEMISTRY (75 hrs) For the students admitted from the year 2014	PBC701S
SEMESTER-I		HRS/WK-5
CORE-I		CREDIT-4

OBJECTIVE:

To understand the structural features and functions of biological macromolecules.

UNIT-I CARBOHYDRATES [20 hrs]

Carbohydrates: classification-monosaccharaides, disaccharides-properties. 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.Amino acids- classification, properties.Orders of protein structure.Primary structure – determination of amino acid sequence of proteins.The peptide bond – The Ramachandranplot.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.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– structure and functions.Fatty acids – saturated, unsaturated and hydroxy fatty acids. Phospholipids and glycolipids – structure and functions. 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, Sno RNA – structure and biological functions.

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 foot printing, CHIP.

TEXT BOOKS:

1. Jain,J.L& Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.
2. Nelson, D.L. and Cox, M.M (2008). Lehninger Principles of Biochemistry. 5thEdition,W.H.Freeman and Company, New York.
3. Zubay, G. (1999). Biochemistry, 4th Edition, WCB. Mcgraw-Hill, New York.

REFERENCES:

1. Victor W. Rodwell, Harpers Illustrated Biochemistry 30th Edition Paper back– Import, 1 Jan 2015.
2. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2008). Fundamentals of Biochemistry, 3rd Edition. John Wiley & Sons, New Jersey.
3. Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. Freeman, 7th edn, 2011.
4. Text book of biochemistry (1997) 4th edition Thomas M devlin, A John Wiley, Inc publication, New York.
5. Bery J.M., Tymoezko J.L. and Stryer L. (2008) Biochemistry, 5th Edition, W.H. Freeman and Company, New York
6. Murray, K.R. Granner, K.D.Mayes, P.A. and Rodwell W.V. (2009).Harper's Biochemistry. 23rd Edition, Prentice Hall International Inc.,New Jersey.

YEAR-I	PRINCIPLES OF CELL BIOLOGY(75 hrs) For the students admitted from the year 2014	PBC702S
SEMESTER-I		HRS/WK-5
CORE-II		CREDIT-4

OBJECTIVE

To understand the membrane models, membrane transport, characteristics andthefunctionalorganisation of cells.

UNIT I Biomembrane and Organelles [15 hrs]

The structure and functions of nucleus, mitochondria, endoplasmic reticulum (rough and smooth), Golgi apparatus, lysosomes, Ribosomes& peroxisomes and their functions.Membrane - Models, Membrane lipids - fluidity, Asymmetry and phase transition.LiposomesMembrane proteins - Types, Orientation, proteins on RBC membrane, Lectins.

UNIT II Visualizing cell structure [10 hrs]

Purification of subcellular organelles, cell divisions-Mitosis and Meiosis, Bright field microscopy, phase contrast microscopy, SEM, TEM,AFM-Principle and applications.Marker enzyme for different organelles.

UNIT III Cell Organization and Movement [15 hrs]

Microfilaments - Actin – Structures, Assembly and disassembly. Microtubules – structure and composition. Microtubular associated proteins, MTOCs,Cilia and Flagella - Structure and functions, Intermediary filaments.

UNIT IV Cell – adhesion and cell cell interaction [20 hrs]

Cell-Cell interaction: - ECM; Collagen, hyaluronan&proteoglycans, laminin, integrins and fibronectins.Cell-Cell adhesion: Specialised junctions -- Desmosomes, Gap junctions, tight junctions Adhesion molecules - Cadherins - Connexins.

UNIT V Cell cycle, Cell Birth and death [15 hrs]

Overview of cell cycle and its control.Checkpoints in cellcycle regulation.Apoptosis (Programmed cell death) -- Pathways, regulators & effectors in apoptosis. Cancer: Properties of tumor cells & Genetic basis and onset of cancer. Tumor suppressor genes, functions and their products.

TEXTBOOKS:

1. Harvey Lodish. W. H. Freeman; Sol edition (2007), Molecular cell Biology
2. Alberts2002. Molecular Biology of the Cell 4th ed. Garland Sci.
3. Karp, G. Cell 2010,Molecular Biology: Concepts and Experiments, 6th edn, Wiley.

REFERENCES:

1. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry.McGraw Hill
2. De Robertis and De Robertis. Cell and Molecular Biology. Lea and Febiger 8th ed.
3. Nelson, D.L. and Cox, M.M (2008). Lehninger Principles of Biochemistry. 5th Edition, W.H.Freeman and Company, New York
4. Kelein Smith, and M Kish, (1995).Principles of cell biology, 2nd Edition, Harper and Row Publisher.

YEAR-I	INTERMEDIARY METABOLISM (75 hrs) For the students admitted from the year 2014	PBC703S
SEMESTER-I		HRS/WK-5
CORE-III		CREDIT-4

OBJECTIVE:

To understand various 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 energetic.ETC– oxidative phosphorylation-regulation and inhibition- uncouplers.

UNIT II CARBOHYDRATE 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.Energetics 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. Lehninger Principles of Biochemistry. Freeman, 5th edn, 2008
2. U.Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
3. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.

REFERENCES:

1. Berg, J. M.,Tymoczko, J. L. and Stryer, L, 2011.Biochemistry. Freeman, 7th edn,
2. Zubay, Biochemsitry" 1998, 4th ed. William C. Brown Publication,
3. Voet, D. &Voet, 2010. J. G. Biochemistry. 4th edn,
4. Victor W. Rodwell, 2015.Harpers Illustrated Biochemistry 30th Edition Paper back– Import, 1 Jan
5. West, E.S. and Todd, W.R., 1985, Textbook of Biochemistry, MacMillan, Germany.

YEAR-I	CLINICAL NUTRITION (75 hrs) For the students admitted from the year 2014	EPBC704S
SEMESTER-I		HRS/WK-5
ELECTIVE-I		CREDIT-4

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'sdisease,atherosclerosis,fatty liver and obesity.

UNIT II BASAL 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 and 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 and 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,cardiovasculardiseases,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. M. Swaminathan,1987, "Food and Nutrition Vol I&II", Second edition, Bangalore, Bappco Publishers.
2. Mahan ,L. KandEscott-Stump ,S (2000):Krause's Food Nutrition and Diet therapy,10thed, W-13 Saunders Ltd
3. U.Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.

REFERENCES:

1. Williams, SR(1993):Nutrition and Diet Therapy,7thed, Times Mirror/Mosby College Publishing
2. Shills,ME,Olson,JA,Shike,M and Ross,A.C(1999):Modern Nutrition in Health and Disease,9thed,A.Vaiiams and willons
3. Davidson and Passmore(2000):Human Nutrition and Dietetics
4. Anthony A.Albanase(1972),Newer Methods of Nutritional Biochemistry, Academic Press
5. Patricia Trueman, 2007, "Nutritional Biochemistry" (I edition), Chennai, MJ publishers
6. M.N Chatterjea and RanaShinde," Text book of Medical biochemistry",4th edition, Jaypee Publishers, New Delhi

YEAR-I	MEDICAL LAB TECHNOLOGY	EPBC704A
SEMESTER-I	(75hrs)	HRS/WK-5
ELECTIVE-I	For the students admitted from the year 2010	CREDIT-4

OBJECTIVE:
To provide an insight into the basic techniques in medical diagnostics.

UNIT-I LABORATORY CARE AND INSTRUMENTATION [15 hrs]
Laboratory setup, quality control concept, good laboratory practices.Instrumentation to laboratory equipment's and basic laboratory operation and role of laboratory technician.Types of specimen collection and collection procedure-blood, urine, sputum, throatswab, stool and CSF.Unit of measurement,reagent preparation and laboratory calculation-metric system.Reagentsolution,preparation of reagent solution.

UNIT-II HEMATOLOGY [15 hrs]
Blood grouping and Rh factor, cross matching, clotting time,bleedingtime,hemoglobin estimation, total count-RBC count and WBC count, Differential WBC count, Erythrocyte Sedimentation Rate (ESR),Hematocrit value (Packed Cell Volume).Screening test-HIV,HBs Ag, TPHA etc.Anemia-types.

UNIT-III CLINICAL PATHOLOGY [15 hrs]
Brief outline of histopathology: Tissue cutting,fixation,embedding,tissue slicing by microtome,slide mounting and staining techniques.

UNIT-IV CLINICAL BIOCHEMISTRY [15 hrs]
Blood glucose, urea, uric acid, triglycerides,SGOT,SGPT,serum alkaline and acidic phosphates, calcium,phosphorous,totalprotein,albumin,electrolytes-sodium, potassium, amylase,lactic dehydrogenase- its role and abnormalities.

UNIT-V MICROBIOLOGY [15 hrs]
Culturing of organisms from various specimens, culture media and antibiotic sensitivity test (pus, urine, blood, sputum, throat swab).Gram stain,Ziehl-Neilson staining (TB,Lepra bacilli). Safety procedure in microbiological techniques.

TEXTBOOKS :

1. Kanai L. Mukherjee, Medical Laboratory Technology Vol. I.Tata McGraw Hill 1996,New Delhi.
2. Gradwohls, 2000. Clinical laboratory methods and diagnosis ed.Alex.C.

3. Sonnenwirth& Leonard Jarret.M.D.B.I.Publications, New Delhi,

REFERENCES

1. Henry, John Bernard, Todd Sanford and Davidson, 2002. Clinical diagnosis andmanagement by laboratory methods. W.B. Saunders & Co.
2. Fischbach Francis A, 2003. Manual of laboratory and diagnostic tests.
3. Philadelphia,J.B. Lippancott& Co, N.Y.
4. Sood, R, 2005, Medical Laboratory methods and interpretation, Jaypeebrothersmedical publications, New Delhi.

YEAR-I	MOLECULAR BIOLOGY (75 hrs) For the students admitted from the year 2014	PBC805S
SEMESTER-II		HRS/WK-5
CORE-IV		CREDIT-4

OBJECTIVE

To understand the complete blue print of life and its central Dogma.

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,central dogma of molecular biology , mitochondria and chloroplast DNA-Gene transfer in microorganisms- conjugation-Hfrtransfer,chromosomal transfer and the mediation by F plasmids, transformation-competence, transduction .Repetitive DNA-Highly repetitive moderately repetitive and unique DNA sequences, Satellite DNA, Telomerase.

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-replication of circular DNA and linear DNA. Mitochondrial replication.

UNIT-III TRANSCRIPTION AND GENE REGULATION. [10 hrs]

Transcription-promoters, RNA polymerase in prokaryotes and eukaryotes-intiation, elongation and termination of transcription process -inhibitors of transcription-post transcriptional modification of mRNA, tRNA and rRNA, Antisense RNA .Operon concept-lac, arabinose and trp operon.

UNIT-IV GENETIC CODE AND TRANSLATION [15 hrs]

Genetic code-features and deciphering of genetic code.wobblehypothesis.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.

UNIT-V DNA REPAIR& TRANSPOSONS [15 hrs]

DNA repair-photorectivation, Excision repair, Post replication and mismatch repair, base and nucleotide excision recombination and SOS repair. Protein targeting-Heat shock proteins, glycosylation; SNAPs and SNAREs, transposons, retroposons.

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
3. Ajoypaul. 2007. Text book of cell and molecular biology. Books and allied. Kolkata,
4. Krebs.J.E.et. al., 2011, lewin'sgenes X (Ed:10), Jones and Barett publishers, US.
5. David Freifelder, 2008. Molecular Biology. (Ed: 2). Narosa Publications, New Delhi.
6. Twyman. 2003. Advanced Molecular Biology. Bios Scientific Publishers LTD. Oxford, UK.

REFERENCES:

1. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J, 2012.Molecular Cell Biology ,7th edn, Freeman.
2. Weaver. R. F. 2005. Molecular Biology. 3rd ed. McGraw Hill publilcation.
3. WeaverR.F and Philip.P.W(1989):Genetics,WMCBrwnPublishing,USA
4. Nelson, D. L. & Cox, M. M. Lehninger, 2008.Principles of Biochemistry. 5th edn, Freeman.
5. Primrose (2001) - Principles of gene manipulation. 6th Edition Blackwell Scientific Publishers. UK
6. Karp, 2010. Cell and Molecular Biology: Concepts and Experiments. 6th edn, Wiley.
7. Alberts B. 2002. Molecular Biology of the Cell, (Ed: 3) Garland Science, NY.

YEAR-I	ENZYMES (75 hrs) For the students admitted from the year 2014	PBC806S
SEMESTER-II		HRS/WK-5
CORE-V		CREDIT-4

OBJECTIVE:

To understand the kinetics of enzyme-catalysed reactions and mechanism of enzyme action.

UNIT I ENZYMES [20 hrs]

Introduction, Classification and Nomenclature of enzymes - General characteristics of enzyme activity,Factors affecting enzyme activity. First Law & Second Law of thermodynamics. ∆G, characteristics of free energy, entropy and enthalpy.Law of mass action-Zero and first order reaction.

UNIT II KINETICS OF ENZYME ACTION [15hrs]

Concept of ES complex, collision, transition state theories and energy of activation, derivation of Michaelis-Menten equation for uni- substrate reactions. Different plots for the determination of K_{m} , V_{max} and their significance. Turn over number. The rate of expression for Bisubstrate reactions for Ping Pong, random & ordered Bi-Bi mechanisms.

UNIT III MECHANISM OF ENZYME ACTION [10hrs]

Acid-base catalysis, covalent catalysis, metal ion catalysis, proximity, orientation effect. Active site – definition , common features of active site – Investigation of active site structure – trapping ES complex,Use of substrate analogue. Modification of aminoacid side change by single chemical procedure.Strain& distortion theory.Lock and Chemical modification of active site groups. Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin and lysozyme.

UNIT IV ENZYME REGULATION [15hrs]

General mechanisms of enzyme regulation, product inhibition.Reversible and irreversible.Covalent modifications of enzymes.Allosteric enzymes - positive and negative co-operatively with special reference to aspartate transcarbamoylase& Phosphofructokinase.

UNIT V ENZYME INHIBITION [15hrs]

Irreversible, reversible- competitive, noncompetitive, uncompetitive inhibition.Kinetic differentiation and Graphical analysis- Suicide inhibition. Immobilized enzymes-methods of immobilization-applications of immobilized enzymes K_i,IC_{50}.

TEXT BOOKS:

1. Trevor Palmer, (2004). Enzymes. 5th edition, Affiliated East –West press (P)Ltd. New Delhi.
2. Dixon, E.C.Webb , (1979). Enzymes. 3rd Edition, CJRthorne and K.F.Tipton, Longmans Green & Co , London and Academic Press, New York.
3. Nicholas, C. Price , (1998).Fundamentals of Enzymology. 2nd Edition, Oxford UniversityPress. UK

REFERENCES

1. Zubay,1998“ Principles of Biochemistry”, 4th ed.. William C.Brown Publ.
2. Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. Freeman, 7th edn, 2011.
3. Uhlig H.1998. Industrial enzymes and their applications. John Wiley,
4. Balasubramanian. 1998. Concepts in Biotechnology Universities Press (India) Ltd.,
5. Chapline, Bucke,,1990. “Protein Biotechnology,”1st edition, Cambridge University Press,
6. Marangoni ,2002. Enzyme kinetics. A modern approach, John Wiley.
7. Bohinski, R.C, 1987, Modern concepts in Biochemistry, Alllyn and Bascon Inc., Boston

YEAR-I	ANALYTICAL BIOCHEMISTRY (75 hrs) For the students admitted from the year 2016	PBC807S
SEMESTER-II		HRS/WK-5
CORE-VI		CREDIT-4

OBJECTIVE

To understand the principles, techniques and applications of various biochemical techniques in biochemical analysis.

UNIT I 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, UPLC, UHPLC and software's used to interpret chromatogram.

UNIT IIELECTROPHORETIC AND ELECTROCHEMICAL TECHNIQUES [15 hrs]

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

UNIT III 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 IV SPECTROSCOPIC TECHNIQUES [20 hrs]

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

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 and safety aspects.

TEXTBOOKS:

1. AvinashUpadhyaye, and NirmalendheNath, (2002). Biophysical Chemistry Principles and Techniques. 3rd edition, Himalaya Publishers,New Delhi.

2. Keith Wilson, and John Walker, (2010). Principles and Techniques of Practical Biochemistry. 7th edition, Cambridge University Press. UK.

REFERENCES:

1. Boyer, R. 2000.Modern Experimental Biochemistry. 3rd ed. Addison Weslery Longman,
2. Simpson CFA &Whittacker, M. Electrophoretic techniques.
3. Sambrook, 2001.Molecular Cloning. Cold Spring Harbor Laboratory.
4. Friefelder and Friefelder, 1994. Physical Biochemistry – Applications to Biochemistry andMolecular Biology. WH Freeman & Co.
5. Pavia, 2000. Introduction to Spectroscopy. 3rd ed. Brooks/Cole Pub Co.

YEAR-I	ADVANCED ENDOCRINOLOGY (75 hrs) For the students admitted from the year 2016	EPBC808S
SEMESTER-II		HRS/WK-5
ELECTIVE-II		CREDIT-4

OBJECTIVE:

To understand the mechanism of action of various hormones and its effect on humans.

UNIT IORGANIZATION OF MAMMALIAN ENDOCRINE SYSTEM [15 hrs]

Definition &Classification - Mechanism of hormone action . Definition of signals, ligands and receptors, endocrine, paracrine and autocrinesignalling.Receptors and signaling pathways – cell surface receptors, signal transduction and second messengers –adenylatecyclase system, cAMP, G-protein coupled receptors. G-protein as cellular transducer, inositol triphosphate and calcium, DAG and NO, ion channels, Signal transmission via Ras proteins and MAP kinase pathways. Crosstalk in signaling pathways

UNIT IIHYPOTHALAMIC, PITUITARY & PINEAL GLAND HORMONES [15 hrs]

Pituitary Hormones: Anatomy of pituitary gland, hormones of the pituitary, 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. Pineal gland - melatonin hypothesis, melatonin secretion and circulation, proposed role of pineal gland and mechanism of action.

UNIT III THYROID & PARATHYROID HORMONES [15 hrs]

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions.Antithyroidagents.Parathyroid hormone - Synthesis, Secretion and biological actions.Calcitonin and calcitriol - Hormonal regulation of calcium and phosphate metabolism.Hypercalcemia and hypocalcemia , Rickets and osteomalacia

UNIT IVADRENAL & GASTRO INTESTINAL HORMONES [15 hrs]

Adrenal gland structure.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.Phaeochromocytoma .

G.I. Tract hormones – chemical nature & functions of Gastrin ,Enterogastin , Secretin & Cholecystokinin

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. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry.
2. Williams Textbook of Endocrinology – Wilson and Foster 8th ed.
3. Devlin, 1997, Textbook of Biochemistry (with clinical correlation), John Wiley, USA.

REFERENCES:

1. Principles of Biochemistry – Mammalian Biochemistry – Smith. McGraw Hill 7th ed
2. Nelson, D. L. & Cox, M. M,2008. Lehninger Principles of Biochemistry. 5th edn, Freeman.
3. Wilson and Foster, 1992, Textbook of Endocrinology, (8th edn), W.B. Saunders, USA.
4. Mac. E. Hadley and Jon. E. Levin, 2009, Endocrinology 6th ed., Darling Kindersly Pvt. Ltd., India
4. Guyton, A.C. and Hall, J.E (2006), Textbook of Medical Physiology, 11th Edition, Saunders Co. Pennsylvania.

YEAR-I	PLANT BIOCHEMISTRY (75 hrs) For the students admitted from the year 2016	EPBC808A
SEMESTER-II		HRS/WK-5
ELECTIVE-II		CREDIT-4

OBJECTIVE:
To understand and study the important pathways of plant metabolism.

UNIT I PLANT CELL & ABSORPTION [10 hrs]
Discovery and definition of plant cell – cell wall, plasmadesmata, meristematic cells, and secretary systems. Mechanism of absorption .Ion exchange passive absorption. Active absorption .The carrier concept.Donnan's equilibrium.

UNIT II PLANT HORMONES [10 hrs]
Structure, biosynthesis, mode of action &physiological effects of auxins, giberellins, cytokinins and IAA.Biochemistry of seed dormancy, seed germination,fruit ripening and senescence.

UNIT III PLANT PIGMENTS & PHOTOSYNTHESIS [15 hrs]
Structure &synthesis of chlorophyll, phycobilins and carotenoids. Photosynthesis photosystem –I & II-Lightabsorption,Hill reaction, Red drop & Emerson's enhancementeffect.Cyclic and non-cyclic photophosphorylation,calvincycle.Photosynthesis-factors and regulation. Chloroplast ATP synthase, complexes associated with thylakoid membranes, and light harvesting complexes.

UNIT IV SECONDARY METABOLITES &STRESS METABOLISM [15 hrs]
Secondary metabolites in plants –classification & function of alkaloids, terpenoids, tannins, lignin and pectin.Stress metabolism in plants - Environmental stresses, salinity, water stress, heat, chilling and their impact on plant growth. Heavy metals, radiations and their impact on plant growth, criteria of stress tolerance**.**

UNIT V NITROGEN FIXING ORGANISMS [10 hrs]
Nitrogenfixing organisms: Structure and mechanism of action of nitrogenase: Rhizobium symbiosis .Leghaemoglobin; strategies for protection of nitrogenase against the inhibitory effect of oxygen; nif genes of klebsiellapnemoniae including their regulation. Nitrate Assimilation: Nitrate reductase; regulation of nitrate assimilation.

TEXTBOOKS :

1. Jain.V.K., 2005. Fundamentals of Plant Physiology,revised 1st edition S.Chand and Co.
2. Pandey.S.N.,andSinha.B.K.,Plant Pysiology,1999,Vikas Publishing House.
3. Heldt, HW. (2005), Plant Biochemistry. 3rd Edition, Elserveir Academic Press Publication, USA.

REFERENCES:

1. Solisbury and Ross,Plant Physiology,3rd edition,CBS Publishers and Distributors.
2. Hans-Walter Held,Plant Biochemistry, 3rd edition,Elsevier India Pvt.Ltd.
3. Bonner and Varner, Plant Biochemistry, 3rd edition,Academic Press.
4. Bowsher, C, Steer, M. and Tobin, A (2008). Plant Biochemistry. Garland Science,Taylor and Francis Group, LLC. New York.
5. Verma,2001. Plant physiology, 7th Revised edition, Emkay Publications.
6. S. N. Pandey and B.K. Sinha, 1999.Vikas Publishing House Pvt. Ltd, 3rd edition, Plant Physiology.

YEAR-II	ADVANCED CLINICAL BIOCHEMISTRY (75 hrs) For the students admitted from the year 2016	PBC909S
SEMESTER-III		HRS/WK-5
CORE-VII		CREDIT-4

OBJECTIVES

To gain knowledge about the basis of various diseases and their assay procedure

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 osmolar, non-ketotic coma. Long-term complications – diabetic retinopathy, Neuropathy and Nephropathy, Cataract, GTT, $HbA1_C$ and its significance.

UNIT-II LIVER & GASTRIC FUNCTION TEST [15 hrs]

Heme metabolism -Jaundice- classification, biochemical findings -Liver function tests based on bile pigments, SGOT, SGPT, plasma proteins- A: G ratio, Prothrombin time. **Detoxification function**: Hippuric acid excretion, BSP dye test and metabolic functions -Galactose tolerance test, Gall stones. **Gastric Function Test**: Physical examination of gastric contents-basal and maximal secretion-Stimulation tests – histamine,alcohol and Pentagastrin-FTM 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 [10hrs]

Renal concentration test-PSP dye test, clearance tests - Inulin clearance, Urea clearance, Creatinine clearance, NPN, Biochemical findings in Glomerulonephritis, renal failure and nephrotic syndrome. Renal stones –types, factors influencing renal calculi formation and treatment.

UNIT- IV METABOLIC DISORDERS [20hrs]

Disorders of amino acid & carbohydrate Metabolism - Albinism, Tyrosinosis, Maple syrup urine disease and Glycogen storage diseases.**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.

Clinical Enzymology: Isoenzymes, Enzyme patterns in disease– Liver, pancreas and myocardial infarction.

UNIT- V ENDOCRINE FUNCTIONAL TEST [15 hrs]

Thyroid function test- Radioactive Iodine uptake, serum PBI.Dynamic function test - T_3 suppression test, TSH & TRH stimulation Test, dexamethasone suppression test, Metyrapone test.

TEXT BOOKS:

- M.N Chatterjea and RanaShinde," Text book of Medical biochemistry",8th edition,2012, Jaypee Publishers, New Delhi
- Devlin, T.M. (2002) Textbook of Biochemistry with Clinical Correlations. John Wiley and sons, INC. New York
- Mayne ,"Clinical chemistry in diagnosis and treatment",6th edition , ELBS Publications, 1994

REFERENCES:

- William J Marshall et al 2014. " Clinical Biochemistry: Metabolic and Clinical Aspects". 3rd edition, Elsevier Health Sciences.
- Robert M. Cohn and Karl S.M.D. Roth "Biochemistry and disease:Bridging Basic Science and clinical practice", 1st ed, 1996, Williams and Wilkins.
- Victor W. Rodwell, Harpers Illustrated Biochemistry 30th Edition, 2015.
- Michael Bishop, 2000. Clinical Chemistry – Principles, procedures and correlations, 4th Ed, Lippincott,Williams and Wilkins..
- Harold Varley et al 1980. Practical clinical biochemistry, Volume I & II, CBS publishers.
- Teitz 'Text book of Clinical Biochemistry' 3rd edition – Burtiset al., William Heinmann medical books, Ltd., 1999
- Harrison's Principles of Internal Medicine Vol. I and II. 14th edition, McGraw Hill

YEAR-II	IMMUNOLOGY (75 hrs) For the students admitted from the year 2016	PBC910S
SEMESTER-III		HRS/WK-5
CORE-VIII		CREDIT-4

OBJECTIVE

To understand the molecular and cellular components of immune system, including their functions and interaction.

UNIT I CELLS AND ORGANS OF IMMUNE SYSTEM [15 hrs]

Cell of the immune system-structure &function of mononuclear phagocytes - Phagocytosis. dendritic cells, granulocytes, kupffers cell, osteoclasts, microglial cells, null cell, mast cell & APC. Organs of the immune system- structure and function of primary & secondary lymphoid organs.-bone marrow, thymus, lymph node, spleen. Types of Immunity-innate, acquired, Humoral& Cell mediated immunity - lymphocyte development. Antigen processing & presentation by B-cell and T-cell.

UNIT II ANTIGEN & IMMUNOGLOBULINS [15 hrs]

Antigen-properties, immunogenicity & antigenicity.Factors that influence immogenicity- adjuvants, Epitopes &Haptens.Antibodies- Basic structure of immunoglobulins& classes.Antigenic determinants on immunoglobulin-isotype, allotype&idiotype, Immunoglobulin -organization, expression & rearrangement of heavy & light chains.Antibody Diversity.Clonal selection theory. Monoclonal Antibodies – Formation, selection, production & clinical uses.

UNIT III IMMUNE SYSTEM IN HEALTH & DISEASE [15 hrs]

MHC: structure & function of MHC- I, II & III in human and mouse. Gene organization: HLA type. Immunological memory, immunotolerance, immunosuppression Transplantation immunology- immunologic basis of graft rejection, hyper, acute & chronic rejection.Clinical transplantation-kidney. Complement components and its pathway.

UNIT IV HYPERSENSITIVITY &AUTOIMMUNITY [15 hrs]

Type-I : components, mechanism & consequences of type-I, type II-transfusion reaction, and hemolytic disease of the newborn, Type III & Type IV. Auto immunity- organ specific & autoimmune diseases (eg.Grave's disease, Hashimoto's thyroiditis, Systemic Lupus Erythematous & rheumatoid arthritis), treatment of autoimmune diseases.

UNIT V IMMUNO TECHNIQUES [15 hrs]

Principle & application of precipitation reaction in fluids & gels (radial& double immunoelectrophoresis).Agglutination reaction- hemagglutination, bacterial, passive & agglutination inhibition reaction.FISH.Immunofluorescence, Complement fixation test.

TEXT BOOKS:

1. Ian Tizard, "Immunology –An introduction", Saunders College Publishing Harcourt Brace College Publishers, USA
2. Abbas, Lightman and Pober, 1994.Cellular and Molecular Immunology,"2nd edition, W.B. Saunders.
3. Kuby Richard A.Goldsby,ThomasJ.Kindt, Barbara A.Osborne "Immunology" , 6th edition, Freeman publications

REFERENCES:

1. IvonRoitt,2006 . "Essential Immunology", 7th edition ,Blackwell publishers
2. Mark Peakman, Diegovergani "Basic & Clinical Immunology"
3. David Male, Brian Champion, Anne Cooke & Michael Owen "Advanced Immunology" 2nd edition
4. P.M.Lydyard, A.Whelan and M.E.Finger "Immunology"
5. Vergani et al 2009. Basic & Clinical Immunology. 2nd Ed. Churchill Livingstone publisher
6. David Male et al 1991. "Advanced Immunology", 2nd Ed. Lippincott Williams & Wilkins Publishers

YEAR-II	ADVANCED BIOTECHNOLOGY (75 hrs) For the students admitted from the year 2016	PBC911S
SEMESTER-III		HRS/WK-5
CORE-IX		CREDIT-4

OBJECTIVE:

To understand the basic concepts and applications of biotechnology in diverse fields such as agriculture, medicine and the environment

UNIT I BASICS OF BIOTECHNOLOGY [15 hrs]

Manipulation of DNA – Restriction and Modification enzymes, Design of linkers and adaptors. Characteristics of cloning and expression vectors based on plasmid (pBR322) and bacteriophage (λ), Vector for yeast (pPIC), insect (Baculo virus) and plants (Ti) systems, Prokaryotic and eukaryotic expression host systems.

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. 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.Gene manipulation in pest resistance and diseases resistance.

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 B_{12} & Penicillin.

UNIT V ENVIRONMENTAL BIOTECHNOLOGY [20 hrs]

Industrial waste management- aerobic and anaerobic processes.Solid waste management.Composting.Municipal sewage treatment.Biogas, Biofertilizer, Bioremediation of hydrocarbons and pesticides.

TEXT BOOKS:

1. U.Sathayanarayana,(2006). Biotechnology. 3rd Edition, Books and Allied (P) Ltd., India.
2. P.K. Gupta,1998. 'Elements of Biotechnology', Rastogi Publication,
3. R C Dubey, 1993. A Textbook of Biotechnology, 6th edition

REFERENCES:

1. J.E. Smith,1996. 'Biotechnology', Cambridge University Press Glick and Pasternak, 'Molecular Biotechnology', PanimaPubl
2. S.Ignacimuthu,'PlantBiotechnology',Oxford,IBH.Watson, RecombinantDNA Technology', Scientific American Publ.
3. Slater A, NW Scott, MR Fowler, 2003. 'Plant Biotechnology', Oxford University Press.
4. Glick R. and J. J. Pasternak. 2002. Molecular Biotechnology (3rd Edition). ASM Press, Washington, USA

YEAR-II	**DEVELOPMENTAL AND INHERITANCE BIOLOGY (75 hrs) For the students admitted from the year 2016**	**EPBC912A**
SEMESTER-III		**HRS/WK-5**
ELECTIVE III		**CREDIT-4**

- **OBJECTIVES:**
- To understand the steps involved in morphogenesis and organogenesis in plants and animals.
- To know about the basic concepts about gene mapping and ageing in humans.

UNIT I GENE MAPPING AND HUMAN GENETICS [15 hrs]

Linkage maps, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Pedigree analysis, LOD score for linkage testing, karyotypes. Polygenic inheritance, heritability and its measurements, QTL mapping.

UNIT II GAMETOGENESIS, FERTILIZATION AND EARLYDEVELOPMENT [15 hrs]

Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; mammalian cleavage and gastrulation.

UNIT III MORPHOGENESIS AND ORGANOGENESIS IN ANIMALS [15 hrs]

Eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

UNIT IV MORPHOGENESIS AND ORGANOGENESIS IN PLANTS [15 hrs]

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum.

UNIT V AGEING AND STEM CELLS [15 hrs]

Ageing- theories of ageing, senescence, programmed cell death (Apoptosis). Stem cells- properties, markers commonly used in stem cells, embryonic stem cells and applications.

TEXTBOOKS:

1. Twyman, 1998. Advanced Molecular biology, Viva books private limited.
2. William H. Elliot & Daphne C. Elliott, Biochemistry and Molecular biology.
3. Biological sciences, Taylor.
4. Gilbert S.F. 2010. Developmental biology Eds 9, SINACER ASSOCIATES Inc, Massachuseets,
5. Balinsky, B.I. An introduction to embroyology.W.B.Saunders Publishing Componey.

REFERENCES:

1. S.B. Primrose & R.M. Twyman, Principle of gene manipulation and genomics
2. Gurbarchan& S. Miglani.Basic genetics, Narosapublishing house
3. David Freifelder, 1987. Molecular biology, 2nd edition.
4. Instant notes in genetics, Winter. P. C., 1999. Bios scientific publishers limited.

YEAR-II	MOLECULAR PHYSIOLOGY (75 hrs) For the students admitted from the year 2016	PBC1013S
SEMESTER-IV		HRS/WK-5
CORE-X		CREDIT-4

OBJECTIVE

To gain knowledge about the structure & functions of various organ.

UNIT I DIGESTIVE SYSTEM [15 hrs]

Digestion- Digestive processes at various regions of digestive system(Liver,stomach,pancreas,gallbladder&intestine) composition, functions and regulation of saliva, gastric, pancreatic, and 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,fibrinolysis,anticoagulants.

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&Blood regulation of respiration.Role of 2,3-diphosphoglycerate, Bohr's effect and chloride shift, oxygen toxicity& therapy, artificial respiration.

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,countercurrentmechanism.Regulation of acid-base balance.Role of renin-angiotensin&ADH, renal failure.

UNIT V 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. Mechanism of transmission of impulse -synaptic transmission,neuromusculartransmission&junction.Central nervous system-Cerebrospinal fluid.Basis of EEG, sleep, learning & memory.

TEXT BOOKS:

1. Ganong W. E, 2003. Review of Medical Physiology", 21st ed, Mc. GrawHill.
2. Guyton. A.C, Hall. J.E, 2005."Textbook of Medical Physiology", 11th ed. Saunders Company.
3. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.
4. DM.Vasudevan,2008. Textbook of Biochemistry for medical students, 5th edition,Jaypee publishers.

REFERENCES:

1. Meyer, HS Meij, AC Meyer,' Human Physiology', AITBs Publishers and Distributors.
2. K.SaradhaSubramanyam,"A Hand Book of Basic Human physiology", S.Chand&Co.,Ltd.
3. Y.Rajalaskshmi,'Guide to Physiology', S.Chand&Co.,Ltd
4. Smith et al,' Mammalian Biochemistry', 7thedn.,Mc. Graw Hill.
5. C.C.Chatterjee,1985. Human physiology, 11_{th} edition
6. Gerard J. Tortora and Sandra Grabowski. Principles of Anatomy and Physiology 10th Edition By Publisher: John Wiley and Sons.
7. Bhagavan.N.V(2004),"Medical Biochemistry",(4thed) Noida, Academic press

YEAR-II	RESEARCH METHODOLOGY & BIOSTATISTICS (75 hrs)	PBC1014S
SEMESTER-IV		HRS/WK-5
CORE XI	For the students admitted from the year 2016	CREDIT-4

OBJECTIVES

- To provide knowledge and skills to understand the role of statistics in research.
- To develop skill in scientific writing and recent techniques.
- To provide sufficient background to be able to interpret statistical results inresearch papers

UNIT I SCIENTIFIC RESEARCH [15 hrs]

Research definition, importance & need for research ethics, selection of topic, review of literature, preparation of manuscript, scientific writing, features of abstract, mode of collection of literature, yearbooks, books & monograph, journals,conference proceedings, abstracting and indexing journals, notes & index cards, internet, magazines. Research design.

UNIT II BIOCHEMICAL TECHNIQUES [15 hrs]

FPLC, HPTLC, Capillary electrophoresis, Mass spectrometry, Circular dichroism - DNA sequencing, FISH - RFLP& RAPD -techniques & application. PCR Technique- Basic principle, RT-PCR, Quantitative PCR &*in Situ* PCR.Applications of PCR.

UNIT III BIOETHICS AND PATENTING [15hrs]

Ethics in animal experimentation.CPCSEA guidelines - Animal care, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia.Ethics in food and drug safety. Patenting - definition of patent. Product and process patents.

UNIT IV DATA COLLECTION AND PRESENTATION [15 hrs]

Collection and classification of data - diagrammatic and graphical representation of data.Tabulation of statistical data-Frequency Distribution-

Simple and Cumulative. Displaying data-Histogram, Bar chart, Frequency polygon, Pie chart, less than & more than Ogives. Measures of Central tendency. Mean (arithmetic, harmonic & geometric) median and mode. Measure of Averages – Mean, Median and mode.

UNIT V STATISTICAL ANALYSIS [15 hrs]

Measures of Dispersion for biological characters – Quartile Deviation, Mean Deviation and Standard deviation. Correlation & regression Co-efficient, levels of significance, Student t test, Chi square test. F test for equality of variances, Six sigma and Minitab, ANOVA –one way and two way classification.

TEXT BOOKS:

1. Green. R. H. 1979. 'Sampling Design and Statistical Methods for Environmental Biologists' .John Wiley & Sons.
2. Dr.A.WilsonAruni,Dr.P.Ramadass "Research and writing: Across the disciplines", MJP Publishers
3. Gupta.S.C&Kapoor. V.K. 1978. "Fundamental of Applied Statistics" (2nd ed) ,MJP Publishers,
4. Ethics and the use of alternatives to animals in research and education, ShiraneePereira, CPCSEA.
5. CPCSEA guidelines for laboratory animal facility (CPCSEA) - No.13 Seaward road, Valmiki Nagar, Chennai-41.
6. Ethical guidelines for biomedical research on human subjects.2000. ICMR, New Delhi.
7. Wayne W, Daniel 2006, biostatistics: a foundation for analysis in the health sciences (9th edition), John Willey and Sons Inc., USA.
8. Upadhyay, Upadhyay and Nath,1997. Biophysical Chemistry- Principles and Techniques' Himalaya Publ.

REFERENCES:

1. Dr.G.Vijayalashmi, Dr.C.Sivapragasam "Research methods: Tips and Techniques",MJP Publishers
2. Matthews,2001.Sucessful Scientific writing: A step-by step guide for Biomedical Scientists'. 2nd ed. Cambridge University Press
3. Thomas Glover, Kevin Mitchell.,2001. Introduction to Biostatistics', 1st ed. McGraw Hill Science
4. Dr N .Gurumani, "An Introduction to Biostatistics",MJP Publishers
5. Dr N .Gurumani, "Thesis writing and paper presentation", MJP Publishers
6. Pavia et al.2000. Introduction to Spectroscopy', 3rd ed. Brooks/Cole Pub Co.

YEAR-II	BIOINFORMATICS AND CLINICAL RESEARCH (75 hrs)	EPBC912B
SEMESTER-IV		HRS/WK-5
CORE-XI		CREDIT-4

OBJECTIVES

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

To understand the basics involved in clinical research and its importance.

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, TreEMBL, PIR.Structural – PDB, MMDB.Sequence retrieval – Entrez.Human Genome Project.

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 &Wuncsh, Smith& Waterman algorithms for pair wise alignments. Basic concept of a scoring matrix, 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. Gene prediction in prokaryotes and eukaryotes, SNPs, Methods for gene prediction – GenScan, GRAIL, FGENESH/FGENES, Metabolic pathways-KEGG.

UNIT IV CLINICAL RESEARCH [15 hrs]

Introduction to clinical research, technologies and definition in clinical research, origin and history of clinical research, difference between clinical research and

clinical practice, types of clinical research, phases of clinical research, clinical trial in India – the national perspective, pharmaceutical industry – global and Indian perspective, clinical trial market, career in clinical research, ethical prospective.

UNIT V PHARMACOLOGY AND DRUG DEVELOPMENT [15 hrs]

Emerging technologies in drug discovery, preclinical testing, investigational new Drug application, clinical trials, new drug application and approval, Principle and applications of pharmacokinetics, pharmacodynamics, pharmacogenomics and protein based therapies.

TEXT BOOKS:

1. Arthur M.Lesk ,(2002). Introduction to Bioinformatics Oxford University press.
2. Alexander *et al.,* 1995. Microbial biotechnology', W.H. Freeman Publishers,
3. Microbial Genetics 2ed, by David Freifelder, David M. Freifelder, John E. Cronan, 1st 1994 by Jones & Bartlett Publishers.
4. S.Ignacimuthu, 2005.Basic Bioinformatics,Narosa publications

REFERENCES:

1. Attwood & Parry-Smith, "Introduction to Bioinformatics", Pearson Education
2. Jean-Michel Claverie, "Bioinformatics-A Beginner's guide", John Wiley & Sons.
3. Rastogi,S.C. Mendiratta, N. and Rastogi P ,"Bioinformatics-Methods and applications", Prentice-Hall of IndiaPvt. Ltd, New Delhi
4. Mount DW ,"Bioinformatics – Sequence and Genome analysis", Cold Spring Harbour Laboratory Press, New York
5. Madigan et al.,2002 'Biology of microorgansisms' ,Prentice Hall.
6. K.Mani&N.Vijayaraj, 2004. "Bioinformatics- a practical approach"Aparnapublications,Coimbatore
7. Ananthanarayanan.K and JayaramanPaniker, 1996. Textbook of Microbiology.
8. West, E.S. and Todd, W.R., 1985. Textbook of Biochemistry, MacMillan, Germany.

YEAR-II	PHARMACOLOGY (75 hrs) For the students admitted from the year 2016	PBC1015S
SEMESTER-IV		HRS/WK-5
ELECTIVE VII		CREDIT-4

OBJECTIVE:

To understand the various route of drug administration, distribution, metabolism and excretion.

UNIT I INTRODUCTION [15 hrs]

Drug: Definition. Classification of drugs based on their sources (plant, animal,& synthetic).Dosages-single and multiple. Routes of administration & absorption. Factors modifying drug absorption.Distribution of Drugs – structural features and pharmacological activity, prodrug concept.Metabolism and excretion of drugs-phase-I, II reaction, action of cytochrome P_{450}.Microsomal & non-microsomal metabolism of drugs, drug metabolising enzymes.

UNIT II DRUG –RECEPTOR INTERACTIONS [10 hrs]

Drug receptor- localization, types and sub types, models and theories. Examples of drug –receptor interactions-G-protein coupled receptor, Acetylcholine receptor, Tyrosine kinase receptor, steroid hormone receptor. Agonist and Antagonist.

UNIT III PHARMACOKINETICS [15 hrs]

Drug tolerance and dependence.Principles of basic pharmacokinetics.Adverse response to drugs, drug intolerance, pharmacogenetics, drug allergy, tachyphylaxis, drug abuse, factors modifying drug potency.Drug assay & types - 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-chlorpheniranime,Diphenhydramine,bronchial-asthma-eg.,salbutamol, methylxanthines, pulmonary tuberculosis),-General principles& mechanism involved in the chemotherapy of cancer(antimetabolites, alkylating agents,

antibiotics.Anti-thyroid drugs eg. carbimazole, insulin and oral Antidiabetic drugs eg-sulfonylurea, biguanide. Anti-BP drugs (adrenergic blockers).

UNIT V DRUG THERAPY-II [15 hrs]

Antimalarial drugs –mode of action of chloroquine, quinine, antifungal drugs – mode of action of chlorphenesin, griseofulvin and candicidin. Antiviral drugs - mode of action of idoxuridine, acyclovir and amantadine hydrochloride. Anti-microbial drugs- sulfonamides, trimethoprim, penicillin, aminoglycosides.

TEXT BOOKS:

1. G.R.Chatwal, "Pharmaceutical Chemistry -vol-1&II",Himalaya Publishing House ,New Delhi
2. JayasreeGhosh "Text book of Pharmaceutical Chemistry", S.Chand& Company, Ltd., New Delhi
3. MantTimothy,G.K.Ritter,Jemes,M and Lewis Lionel,D:A Text Book of Clinical Pharamacology.

REFERENCES:

1. Joseph R.Palma,JohnDiGregorio"Basic Pharmacology in Medicine",McGraw Hill Publishing Company,New York
2. Good man, Gilman "The Pharmacology, volume I and II".
3. Katzung ,"Basic and Clinical Pharmacology", 7th edition- ,Prentice hall ,New Delhi.
4. M.Atherden ,"Text book of Pharmaceutical Chemistry", 8th edition.
5. Herfuidal and Gourley, 1996. Textbook of Therapeutics (Williams and Wilkins)

YEAR-II	RECOMBINANT DNA TECHNOLOGY (75 hrs) For the students admitted from the year 2016	EPBC1016
SEMESTER-IV		HRS/WK-5
ELECTIVE VIII		CREDIT-4

OBJECTIVES

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

UNIT I AN INTRODUCTION TO r DNA TECHNOLOGY [15 hrs]

Role of enzymes in recombinant DNA technology–Restrictionendonucleases - types, DNA polymerases, Reverse transcriptase, Ligases, Polynucleotide kinase, Alkaline phosphatase, Nucleases, Klenow fragment, Terminal deoxynucleotidyltransferase, RNase. Homopolymer tailing, Ligation of cohesive termini, Blunt-end ligation, Linker and adaptor molecules.Vectors - plasmids (pBR 322,pUC 18), phages (λ and M13) cosmids,Phagemid. YACs, BACs and Ti.

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 phosphatemediated transformation; Liposome mediated transformation, Microinjection, Electroporation.

UNIT III CLONING STRATEGIES [15 hrs]

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

UNIT IV EXPRESSION SYSTEMS [15 hrs]

Expression systems - Gene expression based on bacteriophage T7 RNA polymerase,Eukaryotic expression systems- Fused genes, Unfused genes. Antisense RNA technology- SiRNA, miRNA.

UNIT V TECHNIQUES IN rDNA TECHNOLOGY [15 hrs]

Techniques in recombinant DNA technology- Hybridization technique, Site directed mutagenesis, DNA profiling in forensic science, Chromosome walking, Chromosome jumping, DNA sequencing.

TEXT BOOKS:

1. Primrose S. B., Twyman, R.M., and Old, R.W.2003. Principles of gene manipulation.Sixth edition. Blackwell Publishers.
2. SandhyaMitra, 2005. Genetic Engineering. Macmillan India Limited.
3. U.Sathayanarayana, 2006. Biotechnology. 3rd Edition by Books and Allied (P) Ltd., India

REFERENCES:

1. Watson. Recombinant DNA. 1992.Second edition. American Publishers.
2. Sambrook, J., Fritsch, E. F., and T. Maniatis, Molecular Cloning,
3. A Laboratory Manual,1989. Second edition. Cold Spring Harbor Laboratory Press, New York,
4. Joseph M. Fernandez and James P. Hoeffler. 1999.Gene expression systems.Academic Press,
5. Krebs.J.E.et. al., 2011, Lewin'sGenes X (Ed:10), Jones and Barett publishers, US.

YEAR – I	PRACTICAL - I	PBCP101
SEMESTER – I		HRS / WEEK: 8
PRACTICAL – I		CREDITS: 6

SEMESTER-I

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

YEAR – I	PRACTICAL - II	PBCP202
SEMESTER – I		HRS / WEEK: 8
PRACTICAL – II		CREDITS: 6

SEMESTER-II

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

References

1. Harold Varley, (1980). Practical Clinical Biochemistry, Volume I and II. 5th Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). Laboratory Mannual in Biochemistry. 2nd Edition .New Age International (P) Limited. New Delhi.
3. Sadasivam S and Manickam P. (2004) Biochemical Methods. 2nd Edition. New Age International (P) Limited. New Delhi.
4. David, T. Plummer, (1988). An Introduction to Practical Biochemistry. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
5. Pattabiraman, T.N. (1998). Laboratory Manual in Biochemistry. 3rd Edition. All India Publishers and Distributors. Chennai.

PBCP303 - CLINICAL BIOCHEMISTRY PRACTICALS
PRACTICAL III

1. Estimation of blood glucose by OT method
2. Estimation of serum cholesterol
3. Estimation of serum triglycerides
4. Estimation of phospholipids
5. Estimation of serum creatinine
6. Estimation of LDL/HDL cholesterol
7. Estimation of SGPT and SGOT in serum
8. Estimation of alkaline phosphatase in serum
9. Estimation of acid phosphatase in serum
10. Estimation of glutathione peroxidase
11. Estimation of blood urea
12. Estimation of vitamin A
13. Estimation of vitamin E
14. Estimation of vitamin C
15. Estimation of SOD & Catalase

HEMATOLOGY

1. Collection of Blood
2. Blood Grouping
3. Clotting Time
4. Bleeding Time
5. ESR
6. RBC Count
7. WBC Count
8. Hb Estimation

URINE ANALYSIS-Normal and abnormal constituents

TECHNIQUES:

1. Immunoelectrophoresis
2. Separation of DNA by submarine electrophoresis

REFERENCES

1. Harold Varley, (1980). Practical Clinical Biochemistry, Volume I and II. 5th Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). Laboratory Mannual in Biochemistry. 2nd Edition .New Age International (P) Limited. New Delhi.

3. Sadasivam S and Manickam P. (2004) Biochemical Methods. 2nd Edition. New Age International (P) Limited. New Delhi.
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