PSG College of Arts & Science

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# M.Sc. BIOCHEMISTRY

## 2016 - 2018

**MSc BIOCHEMISTRY PROGRAMME**
**SCHEME OF EXAMINATIONS**
***(For students admitted from 2014-2015 onwards)***

| Code No. | Subject | Duration (Hrs) | Max. Marks | | | Credit Points |
|---|---|---|---|---|---|---|
| | | | CA | CE | Total | |
| **First Semester** | | | | | | |
| 14BCP01 | Chemistry of Biopolymers | 3 | 25 | 75 | 100 | 5 |
| 14BCP02 | Analytical Biochemistry | 3 | 25 | 75 | 100 | 5 |
| 14BCP03 | Enzymes and Enzyme Technology | 3 | 25 | 75 | 100 | 5 |
| 14BCP04 | Cellular Biochemistry | 3 | 25 | 75 | 100 | 5 |
| | Biochemistry Practical I & viva | - | - | - | - | - |
| **Second Semester** | | | | | | |
| 14BCP05 | Metabolic Regulation | - | 100 | - | 100 | 5 |
| 14BCP06 | Microbial Biochemistry | 3 | 25 | 75 | 100 | 5 |
| 14BCP07 | Advanced Plant Biochemistry | 3 | 25 | 75 | 100 | 5 |
| 14BCP08 | Molecular Genetics | 3 | 25 | 75 | 100 | 5 |
| 14BCP09 | Biochemistry Practical I & Viva | 6 | 40 | 60 | 100 | 7 |
| 14SBP01 | **Skill Based Subject** : Cyber Security | --- | 100 | --- | 100 | 2 |
| On Job training for 15 days in summer vacation (Mandatory) | | | | | | |
| **Third Semester** | | | | | | |
| 14BCP10 | Bioinformatics | 3 | 25 | 75 | 100 | 5 |
| 14BCP11 | Biostatistics | 3 | 25 | 75 | 100 | 5 |
| 14BCP12 | Molecular Biotechnology | 3 | 25 | 75 | 100 | 5 |
| 14BCP13 | Biochemistry practical II and Viva | 6 | 40 | 60 | 100 | 4 |
| 14BCP14A/ 14BCP14B | ***Core Elective-I*** : Immunology OR Endocrinology | 3 | 25 | 75 | 100 | 5 |

| Code No. | Subject | Duration (Hrs) | Max. Marks | | | Credit Points |
|---|---|---|---|---|---|---|
| | | | CA | CE | Total | |
| | ***Cluster IDC : (Theory)*** | | | | | |
| 14BCP15A/ | Pharmaceutical chemistry | | | | | |
| | OR | | | | | |
| 14BCP15B/ | Food chemistry and quality control | 3 | 25 | 75 | 100 | 2 |
| | OR | | | | | |
| 14BCP15C/ | Clinical Microbiology | | | | | |
| | OR | | | | | |
| 14BCP15D | Environmental Pollution and Management | | | | | |
| | ***Cluster IDC : (Practical)*** | | | | | |
| 14BCP16A/ | Pharmaceutical Chemistry Practical | | | | | |
| | OR | | | | | |
| 14BCP16B/ | Food Chemistry and Quality Control Practical | 3 | 25 | 75 | 100 | 2 |
| | OR | | | | | |
| 14BCP16C/ | Clinical Microbiology Practical | | | | | |
| | OR | | | | | |
| 14BCP16D | Environmental Pollution and Management Practical | | | | | |
| **Fourth Semester** | | | | | | |
| 14BCP17 | Advanced Clinical Biochemistry | 3 | 25 | 75 | 100 | 4 |
| | ***Core Elective-II*** **:** | | | | | |
| 14BCP18A/ | Biochemistry of drugs | 3 | 25 | 75 | 100 | 5 |
| | OR | | | | | |
| 14BCP18B | Nanobiotechnology | | | | | |
| 14BCP19 | Project and Viva | - | 80 | 120 | 200 | 4 |
| | | | | | **Total credits** | **90** |

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***Cluster IDC Offered by the Department***

***CLUSTER IDC:***

| | |
|---|---|
| 14CHP19B/14NDP15B/ 14MBP19C/14ESP17C | Clinical Biochemistry - Theory (for MSc Chemistry, MSc Food & Nutrition, MSc Applied Microbiology & MSc Env. Science) |
| 14CHP20B/14NDP16B/ 14MBP20C/14ESP18C | Clinical Biochemistry - Practical (for MSc Chemistry, MSc Food & Nutrition, MSc Applied Microbiology & MSc Env. Science) |

## CHEMISTRY OF BIOPOLYMERS

**14BCP01** 72 Hours

**Objectives**: To learn the structural aspect of macromolecules

**UNIT I** 14.5 hrs

Polysaccharides

Homoglycans :- Occurrence, structure, isolation, purification, properties and biological functions of glucans.A brief account of chitin, fructans, mannans, xylans, arabinans, galactans and galacturonans.

Heteroglycans and Complex Carbohydrates

Occurrence, stucture , isolation, purification, properties and biological functions of Glycosaminoglycans - heparin, sialic acids and blood group substances. A brief account of polysaccharides with xylose backbone, with glucose and mannose backbone and with galactose backbone.

**UNIT II** 14.5 hrs

Proteins- I

Proteins as biological machinery: peptide bond. Primary structure and its determination.

Physical interactions that determine the properties of proteins:-Short range repulsions, electrostatic forces. Vander waals interactions, hydrogen bonds and hydrophobic interactions.

Conformational properties of polypeptide chains:-

Local restrictions on flexibility:- The Ramachandran plot, cross-links , the alpha helix., β Sheets, the 310 and Π helices, polyglycine conformations, secondary structure, reverse turns and super secondary structure ; tertiary and quarternary structures.

**UNIT III** 14.5 hrs

Proteins-II

Conformational properties of proteins:-

Silk fibroin, coiled coils, keratins, elastin, collagen triple helix, myoglobin and hemoglobin. Denaturation of proteins. Lysozyme: - (A Case study) Structure, enzymic activity, mechanism of lysozyme action. The ionization states of side chains and denaturation of lysozyme. Renaturation of proteins – renaturing agents.

.**UNIT IV** 14.5 hrs

Nucleic acids :- I

The stucture of double stranded DNA (B, A, C, D and Z DNA) .The biological significance of double strandedness . Physical properties of double stranded DNA. Chemicals that react with DNA. DNA sequencing procedures – (Maxam and Gilbert chemical method and Sanger's Dideoxy ribonucleotide sequencing methods only).

DNA bending: Introduction: The Wedge model and Junction Model for DNA bending, Protein induced DNA bending.

DNA Supercoiling :

Introduction, heterogenicity in forms of DNA molecule. Supercoiled forms of DNA. DNA knots and catenanes. The energetics of supercolied DNA . Effects of temperature and salt on helical winding and DNA supercoiling.

Types of RNAs and their biological significance.

**UNIT V** 14 hrs

Triplex DNA:- Introduction, formation and stability of intra molecular triple- stranded DNA. Miscellaneous alternative conformations of DNA:-Slipped, mispaired DNA , and parallel stranded DNA . Four stranded DNA, anisomorphic DNA. nodule DNA, and higher order Pu-Py Structures. Triplet repeats. DNA structure and Human genetic diseases.

DNA Protein interactions:-

Introduction, general considerations on protein binding. Specfic DNA-Protein Interactions. Helix-turn-helix motif, Zinc finger motif and Leu Zipper.

**References**

1. Nelson,D.L& Cox,M.M (2005) " Lehninger Principles of Biochemistry", W.H. Freeman and Company, New York.
2. Voet,D., Voet,J.G & Pratt,C.W. (1999) "Fundamentals of Biochemistry", John Wiley & Sons Inc., New York.
3. Thomas Creightn. (1984). Proteins. W.H. Freeman and Company. Second Edition.
4. Cristopher K. Mathews and K. Mathews and K.E. Van Holde . (1996). "Biochemistry", The Benjamin/Cummings Publishing Company, Inc. Second Edition.
5. Richard R. Sinden. (1994). "DNA Structure and Function", Academic Press, Inc.

**14BCP02 ANALYTICAL BIOCHEMISTRY**

**60 Hours**

**Objective:** To emphasizes methods in the biological and biochemical sciences.

**UNIT I** 12 hrs

General methods of extraction, identification and characterization of proteins, carbohydrates, lipids and nucleic acids.

Extraction of secondary metabolites.

Separation of DNA fragments – pulsed field gel electrophoresis. Autoanalyser- principle, instrumentation and applications. Isoelectric point-2D gel electrophoresis

**UNIT II** 12 hrs

Enzyme monitoring techniques - Assay methods, immobilized enzymes.

Centrifugation: Principle, preparative and analytical ultracentrifuges.

Radiochemical methods – Basis concepts, counting methods and application.

Autoradiography.

**UNIT III** 12 hrs

HPLC – principle, components, limitations and applications.

HPTLC-technique and applications

Optical rotatory dispersion , circular dichroism, X-ray diffraction, nuclear magnetic resonance, electron spin resonance and mass spectrometry - basic principle and applications, MALDI-TOF, Q-TOF, ion-trap MS. Flow cytometry and cell separation.

**UNIT- IV** 12 hrs

Restriction endonucleases, Restriction mapping, Nucleic acid probes – cloned probes, oligonucleotide probes and labelling of nucleic acid probes. Membrane blotting and hybridization of nucleic acids – Southern, Northern, Western, dot-plot and Fluorescent insitu hybridization. RFLP – Technique & applications.

PCR- basic principle, Diagnostic and laboratory applications of PCR. RAPD technique and applications.

Construction of DNA and Oligonucleotide microarray.

**UNIT V** 12 hrs

Diagnostic applications of nucleic acid probes - sicklecell anaemia, thalassemia, haemophilia and lymphoid malignancy. Mutagenecity Testing – Ames test. Comet assay and DNA fragmentation assay. Identifying Protein – DNA interactions-DNA foot printing, DNA finger printing - Technique and applications. HLA typing - applications.

**REFERENCES**


1. Keith Wilson and John Walker (2006) "Principles and techniques of Biochemistry and Molecular Biology", Cambridge University Press, 6th Edition.
2. Boyer R. (2000) "Experimental Biochemistry'', Addison Wesley, 3rd Edition.
3. Bernard R. Glick and Jack. J. Pasternak (2003) "Molecular Biotechnology'', ASM Press Washington 3rd Edition.
4. D W Brown (1998) "Organic Spectroscopy "Wiley New York 1st Edition
5. M.Valcatcel (2000 ) Principles of analytical chemistry-A Text book. Springer
6. David James Holme and Hazel Pack (1994) Longman.

**14BCP03 ENZYMES AND ENZYME TECHNOLOGY**

60 Hours

**Objectives:** To demonstrate and understanding the kinetics of enzymes catalysed reactions. Use of enzymes in laboratory and industry

**UNIT I** 12 hrs

Active site. Definition. Investigation of active site structure. Identification of intermediates – trapping, isotope exchange methods. Photo oxidation. Enzyme modification using chemicals. Modification using proteases. Affinity labeling using active site directed reagents- TPCK, TLCK. Multienzyme complexes and multifunctional enzymes, Requirements for conducting enzyme assay – coupled enzyme assay.

**UNIT II** 12 hrs

Coenzymes and cofactors. Structure, function and mechanism of action of pyridine nucleotides, flavin nucleotides, coenzyme A, pyridoxal phosphate, thiamine pyrophosphate, biotin, tetrahydrofolic acid and B12 coenzymes. Ascorbic acid and vitamin K as coenzymes; Non vitamin derived coenzymes – ATP, Glutathione as examples. Metalloenzymes and metal – dependent enzymes.

**UNIT III** 12 hrs

Enzyme kinetics:- Steady state theory. Michaelis-Menten equation. Linear transformations of Michaelis-Menten equation. Lineweaver –Burk plot. Eadie plot. Hane's plot.Two substrate reactions. Kinetic mechanisms in bisubstrate reactions. Enzyme inhibition, Irreversible inhibitors and Suicide inhibitors and their uses. Reversible inhibition – competitive, non-competitive, un-competitive and their kinetic differentiation. Therapeutic, diagnostic and industrial applications of enzyme inhibitors.

**UNIT IV** 12 hrs

Allosteric enzymes, cooperativity. R and T states. K and V series of enzymes. Sequential and concerted models of allosterism. Aspartate transcarbamoylase as a model allosteric enzyme. Feedback regulation.. Amplification in metabolism. Feed forward stimulation.

Mechanism of enzyme action- general acid, general base catalysis, nucleophilic(covalent), Metal assisted catalysis- lysozyme and carbonic anhydrase as examples.

**UNIT V** 12 hrs

Immobilized enzymes. Methods of immobilization. Impact of immobilization on enzyme activity. Industrial applications of immobilized enzymes. Medical enzymology- diagnostic enzymology, therapeutic enzymology, analytical enzymology.Enzymes as biosensors- calorimetric, potentiometric, optical and immuno biosensors. Enzyme reactions in liquid biphasic systems. Enzyme engineering. Industrial applications of enzyme engineering, artificial enzymes. Creation of artificial enzymes. Protein and Non-protein synzymes.Various methods of enzyme stabilization.

**REFRENCES:**

1. Fersht,A. (1999) “Structure and Mechanism s in Protein Science ; A Guide to Enzyme Catalysis and Protein Folding” , W. H. Freeman & Company, New York.
2. W.W. Cleland (2002) “ Nature Encyclopaedics of Life Sciences”, Vol.6, Nature Publishing & Company, London.
3. Trevor Palmer (2004) “Enzymes – Biochemistry, Biotechnology & Clinical Chemistry”, Affiliated East-West Press Private Limited, New Delhi.
4. D. Voet & J G Voet (2004) “Biochemistry” 3rd Edition, John Wiley & Sons inc.
5. R. Eisenthal & M.J. Danson (2006) “Enzyme Assays”, 2nd Edition, Oxford University Press.
6. klaur buchholz,Volker kasche and une T.bornshener(2005) “Biocatalysts and enzyme technology”2 nd edition WILEY- VCH Verlag Gmbh& co,KGaA.
7.Chaplin and bucke. 2 nd edition.

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**14BCP04 CELLULAR BIOCHEMISTRY**

72 Hours

**Objectives:** To emphasizes on membrane biochemistry, basis of membrane transport, mitochondrial electron transport, cell signaling, cell cycle and cancer.

**UNIT I** 14.5 hrs

Biomembranes: Structural organization and functions – Membrane lipids, membrane proteins and membrane carbohydrates.

Transport across cell membranes – Passive diffusion. Facilitated diffusion; glucose transport in erythrocytes. Receptor mediated endocytosis. Active transport mechanism : Na+ - K+- ATPase ; Ca2+ ATPase ; gastric H+, K+ A TPase .

ATPases that transport peptides and drugs. Transport processes driven by light; lactose permeases in E.coli., Group translocation. Specialised membrane pores; porins in Gram – negative bacterial membranes.

Ionophores.

**UNIT II** 14.5 hrs

Biochemical energetics biological oxidation - reduction reactions , standard reduction potentials and free energy change. Biological energy transformations and laws of thermodynamics .

Electron transport – type of carriers, electron transport complexes. Translocation of protons and the establishment of a proton motive force. Machinery for ATP formation and chemiosmotic mechanism.

Shuttle systems of mitochondria- Glycerol phosphate shuttle and malate-aspartate shuttle. Light driven proton translocation in purple bacteria. Proton translocating complexes in chloroplast.

**UNIT III** 14.5 hrs

Cell Signaling: Signaling molecules and their receptors; functions of cell surface receptors; pathways of intracellur signal transduction, G Protein coupled receptors; receptor tyrosine kinases; importance of Ras; MAP kinase pathways.

Calcineurin and NFAT signalling in the deveopment and function of the brain. The role of CREB and CBP in Brain Function: CREB family of transcription activity and CREB downstream genes. CREB and neurodegenerative disorders

**UNIT IV** 14.5 hrs

Cell cycle: Overview of cell cycle and its control. Biochemical studies with oocytes, eggs and embryos. Genetic studies with *S.pombe*. Check points in cell cycle regulation. Apoptosis and apoptotic pathways**.** Loss of cell cycle control and cancer.

**UNIT V** 14 hrs

Cancer:Chemical carcinogenesis; pathogenesis of Cancer and tumor angiogenesis.Properties of cancer cells; transformation of cells in culture.Tumor Viruses – DNA & RNA Viruses and mechanisms; Reteroviral life cycle Reteroviral oncogenes : oncogenes in human cancer.Activation of proto oncogenes – function of oncoproteins.Tumor suppressor genes and function of their products Molecular diagnosis of cancer.

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**REFERENCES:**


1. R. H . Garrett and C.M. Grisham (2004) "Biochemistry'' Brooks/Cole.
2. James Darnell, Harvey Lodish, David Baltimore (2007) "Molecular Cell Biology'' Scientific American Books, 6th Edition.
3. Bruce Alberts, Dennis Bray, Julian Lewis(2008) "Molecular Biology of the Cell'' Garland Publishing, Inc, 5th Edition.
4. Harold Varmus and Robert A. (1992). Weinberg. "Genes and Biology of Cancer.
5. Gerald Karp (2005). "Cell and Molecular Biology. Scientific American Library Publications.

**14BCP05**

## METABOLIC REGULATION

60 Hours

**Objectives:** To understand the intricate and conmplex mechanism involved in the regulation of metabolic pathways and maintainence of homeostasis in living organism.

**UNIT I** 12 hrs

Introduction to control of enzyme activity, Allosteric interactions ; Reversible Covalent modification, examples of phosphorylation, methylation, adenylation, uridylation, glycosylation and ADP-ribosylation, Control of amount of enzymes. Induction and control of rate of enzyme degradation.Feedback inhibition and feed forward stimulation.Compartmentation .Hormonal control of metabolism.

**UNIT II** 12 hrs

Regulation of rate limiting enzyme in glycolysis. Role of fructose-2,6-biphosphate in liver and muscle. Futile cycle. Reciprocal regulation of glycolysis and gluconeogenesis .Mechanism of pyruvate dehydrogenase multi -enzyme complex and the regulation of this enzyme through allosteric regulation and reversible covalent modification.Tissues involved in gluconeogenesis. Importance of gluconeogenesis. Frutose –1,6-biphosphatase as a regulatory enzyme. Molecular makeup of glucose-6-phosphatase.

**UNIT III** 12 hrs

Regulation of TCA cycle. Citrate synthase,isocitrate dehyrogenase and α-ketoglutarate dehydrogenase. Glycogen metabolism. Role of glycogen in liver and muscle. Blood glucose levels and control by hormones.Reversible covalent modification for control of glycogen phosphorylase and synthase ;multiple forms of glycogen synthase D. Role of calcium and hormones in the modulation of glycogen metabolism.Different modes of HMP shunt. Regulation of HMP shunt. Biochemical roles of NADPH.

**UNIT IV** 12 hrs

Lipogenesis.Control of acetyl CoA carboxylase. Role of hormones. Effect of diet on fatty acid biosynthesis.Regulation of biosynthesis of triacylglycerol, phospholipids and cholesterol.Metabolism of triacylglycerol during stress.Oxidation of fatty acids. Role of carnitine cycle in the regulation of β-oxidation. Ketogenesis and its control. Lipoprotein metabolism-exogenous and endogenus pathways.
Regulation of biosynthesis of Purine and Pyrimidine nucleotides.

**UNIT-V** 12 hrs

Gamma-glutamyl cycle-Regulation of ureogenesis,Regulation of Glutamine synthetase.
Key junctions in metabolism – glucose-6-phosphate,pyruvate and acetylCoA Metabolic profiles of brain, muscle, liver, kidney and adipose tissue. Metabolic inter relationships in various nutritional and hormonal states –obesity, aerobic, anaerobic endurance, exercise, pregnancy, lactation, IDDM, NIDDM and starvation.

**REFERENCES:**

1. Gibson,D.M&Harris,R.A (2002) " Regulation in Mammals", Taylor and Francis, New York.

2. Ochs,R.S, Hanson,R.W&Hall,J (1985) " Metabolic Regulation ", Elsevier Science Publishing Co. Inc**.,** New York**.**

3.Fell, D.A. (1997) "Understanding the control of Metabolism ", Portland Press, London.
4. Charles M. Grisham and Reginald H. Garrett (2012) Biochemistry, Brooks/Cole, 5edition

**14BCP06**

## MICROBIAL BIOCHEMISTRY

72 Hours

**Objectives:** To study microbial metabolism and microbial cell wall biosynthesis, also learn about bioreactors and commercial preparation of enzymes

**UNIT I** 14.5 hrs

Specific transport systems- Phospho tranferase system of E Coli. Glucose Metabolism-Fructose bi phosphate aldolase pathway,HMP pathway,PK pathway , Oxidative pentose phosphate cycle, Entner-Doudoroff pathway. Aerobic pathways of pyruvate metabolism-TCA Cycle,Anaplerotic and glyoxylic pathway bypass ,Pathways for utilization of sugars other than glucose, pectin and Aldohexuronate pathway.Utilization of starch, glycogen and related compounds. Interrelationship between EMP, HMP and ED pathways.

**UNIT II** 14.5 hrs

Metabolism of Lipids: Microbial lipids, Oxidation of fatty acids with odd and even number of carbon atoms, oxidation of branched chain fattyacids.Biosynthesis of straight chain and branched chain fattyacids. Synthesis of unsaturated fattyacids and hydroxy fattyacids and ring containing fattyacids.Biosynthesis of superchain fatty acids. Biosynthesis. of lipids, phospholipids and glycolipids. Biosynthesis of mevalonate, squalene and sterols.

**UNIT III** 14.5 hrs

Microbial cell wall biosynthesis- prokaryotic cell surface, structure and synthesis of bacterial peptidoglycan, teichoic acids and lipoteichoicacids, lipo polysaccharides, porins.

Iron –Sulfur clusters-2Fe-2S,4Fe-4s and 3Fe-4s clusters.

Microbial Kinetics,Electron transport in bacteria, photosynthetic pigments, photosynthic apparatus in photosynthetic bacteria and cyanobacteria. Autotrophic $CO_2$ fixation and mechanism of photosynthesis.

**UNIT IV** 14.5 hrs

Aminoacid biosynthesis: Glutamate family- glutamine, arginine and proline pathway: aspartate and pyruvate families , aspartate, lysine and threonine isoleucine and methionine pathway. Serine- glycine pathway : Common aromatic aminoacid pathway. Biosynthesis of purines and pyrimidines.

Microbial degradation of cellulose, lignin.

**UNIT V** 14 hrs

Bioreactors- types, media preparation ,. Screening for industrially important microbes- primary and secondary screening. .Strain improvement- protoplast fusion, rDNA technology, mutant study. Down stream Processing
SSF-methods and advantages.
Commercial preparation of enzymes- Amylase, Protease and their commercial applications
Synthesis of microbial polysaccharides- homopolysaccharides, heteropolysaccharides bacterial polysaccharides.
Biosensors – Types and applications

**References:**

1. Albert G. Moat and John. W. foster, (1995), "Microbial Physiology", 4th edition, Wiley-Liss, New York.

2. H W Doelle, (1974), "Microbial Metabolism", 2nd edition, Dowden and Ross.

3. A Borem, F R Santos and D E Bowen, (2003), "Understanding Biotechnology,", 1st edition, Prentice Hall.

4. Georges N.Cohen,(2011),Microbial biochemistry,Springer,Second edition.

**14BCP07**

## ADVANCED PLANT BIOCHEMISTRY

72 hours

**Objective:** To learn cell wall biosynthesis, importance of photosynthesis, photorespiration, and role of plant hormones, gene expressions and response of plant pathogens

**UNIT-I** 14.5 hrs

Cell wall: Macromolecules of cell wall. Cell wall architecture. Cell wall biosynthesis.
Photosynthesis:- Photosynthetic apparatus, pigments of photosynthesis, light harvesting complexes. Hill's reaction- Photosynthetic electron transport and ATP formation, cyclic photophosphorylation. Pathways of carbon in photosynthesis- C3, C4 pathways of carbon reduction and its regulation, Photorespiration.

**UNIT-II** 14.5 hrs

Plant hormones: Structure, Biosynthesis and functions of Auxin, Gibberellins, Cytokinins, ethylene and Abscissic acid. Elicitor molecules- Biological functions of Polyamines, Jasmonic acid and Brassinosteroids.
Secondary metabolites: Biosynthesis and functions of Terpenoids, Flavanoids and Alkaloids.

**UNIT-III** 14.5 hrs

Nitrogen metabolism: Symbiotic nitrogen fixation - Infection and nodule development. Nitrogenase enzyme and biochemistry of nitrogen fixation. Structure of Nif genes and its regulation. Nitrate reduction- Enzymes and regulation of nitrate and nitrite reductase. Ammonia assimilation - GOGAT pathway.
Sulphur metabolism- sulfate activation, reduction and incorporation of sulphur into amino acids.

**UNIT-IV** 14.5 hrs

Mode of pathogen attack in plants- mechanical force, chemical weapons of pathogen- enzymes, toxins and growth regulators in plant diseases. Plant defensive mechanism- induced structural and biochemical defenses. Plant pathogen interaction- R genes and R gene mediated disease resistance. Effect of pathogens on plant physiological functions- photosynthesis, respiration, translocation, cell membrane, transcription and translation.

**UNIT-V** 14 hrs

Structure and expression of Plastome- Chloroplast DNA, Chloroplast ribosomes; structure of transit peptide, Protein Transport into plastids- targeting to stroma and thylakoid membrane. Structure of plant mitochondrial DNA-size and composition, promiscuous DNA and cyoplasmic male sterility. Protein transport into mitochondria- mitochondrial matrix, inner membrane, and intermembrane space.

**REFERENCES:**


1. William G Hopkins, (1999), "Introduction to plant physiology", 2nd edition, John Wiley & Sons.
2. Buchanan, Gruissern and Jones I K, (2000), "Biochemistry and Molecular Biology of Plants", I K International Pvt Ltd, Delhi.
3. S K Verma, (1999), "A text book of plant physiology and Biochemistry", 3rd edition, S.Chand and company.
4. John W Anderson and John Beardall, (1991), "Molecular activities of Plant cells, An Introduction to Plant Biochemistry", Blackwell Scientific Publishers.
5. P M Dey and J B Harborne, (1997), "Plant Biochemistry", 1st edition, Academic Press.
6. Hans-Walter Heldt, (1998), "Plant Biochemistry and Molecular Biology", 1st edition, Oxford University Press, USA.

**14BCP08**

## MOLECULAR GENETICS

60 Hours

**Objectives**: to learn DNA synthesis in pro and eukaryotes, regulation of gene expression, genome projects and DNA microarray

**UNIT I** 12 hrs

Eukaryotic chromosome structure – c value paradox; cot curve; repetitive sequences. Multigene families. Transposons; IS and bacterial transposons, Maize and Drosophila system. Mutant generation, mutagenesis.

**UNIT II** 12 hrs

Organelle genome: Plastid, mitochondrial, kinetoplast DNA. Endosymbiont therapy. Cytoplasmic inheritance. Recombination: homologous, mismatch and illegitimate.

**UNIT III** 12 hrs

DNA, RNA binding motifs in Protein. Molecular aspects of binding Techniques.

**UNIT IV** 12 hrs

Roles of Hes bHLH Factors in Neural Development , Phox2a and Phox2b: Essential Transcription Factors for Neuron Specification and Differentiation , Functions of LIM-Homeodomain Proteins in the Development of the Nervous System , The Roles of Serum Response Factor in Brain Development and Function, Transcriptional Control of the Development of Central Serotonergic Neurons, The Role of c-Jun in Brain Function, ROR a: An Orphan that Staggers the Mind . The Role of NF- kB in Brain Function , Calcineurin/NFAT Signaling in Development and Function of the Nervous System , Stimulus-Transcription Coupling in the Nervous System: The Zinc Finger Protein Egr–1, Transcriptional Abnormalities in Huntington's Disease.

**UNIT V** 12 hrs

Viral infection strategy : Entry into the cell, Baltimore classification of replication strategy. Strategies for viral gene expression. Sub-viral agents. HIV and the molecular biology of AIDS. Drug discovery for HIV.

**REFERENCES:**

1.Benjamin Lewin, "Genes VII", Oxford Univ. Press.
2.Lodish *et al*., (1999), "Molecular Cell Biology", 4th edition, WH Freeman.
3.Griffith, (2000), "An introduction to Genetic analysis", 7th edition, WH Freeman.
4. Klug and Cummins, (2000), "Concepts of Genetics", 6thedition, Prentice Hall International.
5. Richard M. Twyman, (1998)."Advanced Molecular Biology – A concise Reference", Viva books Private limited.

**14BCP09**

## BIOCHEMISTRY PRACTICAL I AND VIVA (I & II SEMESTER)

8 hrs/wk

SEMESTER I

1. Estimation of Glucose by Ortho toludine method
2. Estimation of maltose by dinitrosalicylic acid method
3. Estimation of Fructose using Seliwanoff's method
4. Estimation of pentose by Orcinol method
5. Estimation of Cellulose using Anthrone reagent
6. Estimation of Protein by Lowry's method
7. Estimation of Total free aminoacid using ninhydrin reagent
8. Estimation of Methionine
9. Estimation of Tryptophan
10. Estimation of Inorganic phosphorus by Fiske Subbarow method
11. Estimation of Iron by thiocyanate method
12. Estimation of Pyruvate using 2,4 Dinitrophenyl hydrazine
13. Estimation of Vitamin C
14. Separation of sugars by TLC
15. Separation of aminoacids by circular chromatography
16. Separation of aminoacids by ion-exchange chromatography
17. Isolation of chloroplast from leaf tissue
18. Separation of plant pigments by column chromatography

SEMESTER II

Enzyme studies:

19. Extraction and determination of specific activity of acid phosphates from Potato.
20. Effect of substrate concentration on acid phosphatase from potato.
21. Determination of specific activity of acid phosphatase from potato.
22. Effect of pH on catalase.
23. Effect of temperature on catalase.
24. Demonstration of enzyme activation/ effect of ascorbic acid on $\alpha$ and $\beta$- amylases from germinating seeds.

Microbiology:

25. Preparation of media. Isolation of microorganisms from soil and air.
26. Basic microbiological techniques-streak plate and slant cultures.
27. Staining of bacteria – endospore staining.
28. Biochemical tests to identify bacteria.
29. Growth curve of any bacterium.
30. Antibiotic sensitivity tests.

Plant Metabolism:

31. Effect of GA3 on Germination.
32. Proline accumulation in stress.
33. Estimation of SOD in plant tissues.
34. Altered biochemistry in saline stress.

**On Job training**

It should be taken up during First year summer holidays for 15 days in any research institution/R&D laboratory pertaining to the subjects studied and attendance certificate produced. A typed report will be submitted individually. The performance of the students will be evaluated by the respective research Institute/laboratory (not less than Head of the Institute or an appropriate designated authority).

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**14BCP10**

**BIOINFORMATICS** **48 Hours**

**Objective:** To emphasize the use of various algorithms in biological sciences and to introduce various online software in biological sciences.

**UNIT I** 10 hrs

Introduction: Objectives and scope of bioinformatics; internet and worldwideweb; search engine; workstation- Unix system, Linux, FTP.

Vector NT1, EMBOSS,GCG.

Introduction about commercial software-Schrodinger, Systems biology markup language.

Scripting languages- Perl and its application to bioinformatics, Mark up languages- HTML, XML.

**UNIT II** 10 hrs

Biological Databases: sequence and structure databases, annotations. Specialized organism databases, HGP.

Sequence retrieval and analysis of sequence, information retrieval through Entrez, SRS and PubMed.

**UNIT III** 10 hrs

Data base search and sequence analysis, alignment, similarity, homology and analysis. Global and local- methods of alignment-- dotplot, scoring matrices, dynamic programming, PAM and Blossum matrices.

Tools: Fasta, BLAST: PSI BLAST, Alignment of multiple sequences; CLUSTAL W, phylogenetic analysis.

Pattern and motif analysis, Transmembrane Region analysis, Isoelectric Point analysis, Interpretation of the results.

**UNIT IV** 9 hrs

Gene prediction methods and tools: Nucleic acid structure and function analysis. Computer tools for gene mapping, sequencing, PCR; primer and probe design. ORF Prediction. Restriction Enzyme analysis. Emerging areas: Structure based Drug design. Pharmacogenomics.

Genetic network analysis: Functional genomics. Metabolomics. ECell. Medical informatics.

**UNIT V**

Protein structure databases and visualization tools. **8 hrs**

Visualization of Protein structure.

Introduction to X-ray and NMR in structure analysis.

*in silico* protein structure prediction*:*

Secondary structure prediction; 2D and 3D prediction.

Homology modeling, threading and *ab-initio* tools – Ramachandran plot.

Force field and energy landscape, Truncation of non-bonded interaction. Introduction to Conformational sampling, Minimization, algorithms, molecular dynamics, Ensembles (Statistical Mechanics) and Mote Carlo simulations

**REFERENCES:**

1. Baxevanis and Ouellette, (1988), "Bioinformatics- A Practical guide to the analysis of genes and proteins", Wiley Inter science.

2. S.C.Rastogi, Namita, Mendiratta Parag Rastogi, (2003), "Bioinformatics- Concepts, Skills and applications", 1st edition, CBS publishers.

3. Dr.S.Sundara Rajan, & R.Balaji, (2002), "Introduction to Bioinformatics", 1st edition, Himalaya Publishing House.

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**14BCP11**

## BIOSTATISTICS

**48 Hours**

**Objectives:** Biostatistics is the application of statistical methods to the solution of biological problems

**UNIT I** **10 hrs**

Data presentation: Type of numerical data ,Nominal data ,Oridinal data, Ranked data, Discrete data and Continuous data.

Data collection: Primary and secondary data (biological sources), Methods of collecting primary data.

Report writing: Define Scientific research, steps in conducting scientific research, Writing methods, article publication in a scientific journal , Lay out of thesis .

Tables: Frequency distribution.

Diagrammatic and graphic presentation of data; one dimensional diagrams: two dimensional diagrams; three dimensional diagrams , Histograms, Line graphs, Ogive and frequency polygons.

**UNIT II** **10 hrs**

Descriptive stastistics : Measurement of central value- Mean weighted average, Median and Mode.

Measures of Dispersion: The Range, Quartile deviation, Mean deviation and Standard deviation, Coefficient of variation , Skewness and Kurtosis- simple problems.

**UNIT III** **10 hrs**

Events and Probability: Addition rule, Multiplication rule and Conditional Probability-Baye's Theorem: Appilications of Baye's Theorem: Random variables – Theoretical Probability distributions: Binomial distributions, properties, importance of Binomial distribution.

The Poisson distribution - properties and role of Poisson distribution.

Normal distribution - properties.

Fitting of Poisson and Normal (Area method) distribution.

**UNIT IV** **9 hrs**

Concept of Estimation and Interval estimation- Confidence interval for mean for large and small samples, Hypothesis- Null hypothesis, Alternative hypothesis, Sampling statistics, Sample mean, Standard error – One-sided test , Two- sided test; Student's 't' test for mean and two means.

Chi- square test- goodness of fit.

Analysis of Variance: One way classification, Two way classification, Duncan's multiple Range test.

Non-parametric test: WiLcoxon signed Rank test

**UNIT V** **9 hrs**

Correlation: Simple correlation, Scatter diagram method, Spearman's Rank Correlation Coefficient , Concurrent deviation method – partial and multiple Correlation involving three variables only.

Regression Analysis: simple linear regression, regression equation.Partial Linear Regression, multiple Linear Regression, Principle component analysis.

Applications of Computer in Biostatistics with SPSS (Statistical Package for the Social Sciences).

**REFERENCES:**


1. S P Gupta, (2004), "Statistical Methods", Sultan Chand & Sons.
2. A Indrayan and L Sathyanarayana, (2006), "Biostatistics-For Medical, Nursing and Pharmacy students", Prentice Hall of India Pvt Ltd., Noida.
3. N Gurumani, (2005), "An Introduction to Biostatistics", 2nd reviewed edition, MJP Publishers, Chennai.
4. Biostatistics principle and practice B Antonisamy, Solomon Christopher P.Prasanna Samuel (2010). Published by Tata Mc Craw Hill Education private Ltd New Delhi.

**14BCP12 MOLECULAR BIOTECHNOLOGY**

60 hours

**Objectives:** Biotechnology emphasizes how rDNA technology can be used to create various useful products. It illustrates the basic concepts and explain how molecular biotechnology operates as the scientific venture

**UNIT I** 12 hrs

Laboratory tools: Enzymes used in Genetic Engineering- restriction enzymes- their types and target sites; Cutting and joining DNA molecules- linkers, adapters, homopolymers; Cloning vehicles and their properties- natural plasmids, cosmid, M13 filaments phage, Yeast vectors- BAC, YAC, viral vectors- SV40 and retrovirus.

**UNIT II** 12 hrs

Cloning strategies – cDNA synthesis and cDNA expression libraries; Recombinant selection and screening methods; *In vitro* Mutagenesis of cloned DNA sequences; Identification of translation product of a cloned gene- Hybrid released translation (HRT) and Hybrid arrest translation (HARTn), Microarray techniques

**UNIT III** 12 hrs

Expression vectors; reporter genes; Gene transfer methods to animals- Ca transfection, Microinjection, and shotgun. Transgenic mice- Gene knock outs and transgenic animals- Transgenic live stock and animal pharming, cloning in sheep (dolly) by nuclear transfer.

**UNIT IV** 12 hrs

Gene manipulation in plants: Markergenes, Gene transformation techniques. Transformation through *agrobacterium tumefaciens*; Co-cultivation with protoplast, leaf disc transformation, lipofection, biolistics and electroporation. Transgenic plants- Herbicide, insect and viral resistance. Plant as Bioreactors - Genetically Modified food (GMOs). Biosafety of GM food.

**UNIT V** 12 hrs

Gene therapy- somatic cell gene therapy-*Ex-vivo* and *In-vivo* methods, vector used for gene therapy, gene therapy for diseases. Stem cells: unique properties, Embryonic stem cell, Adult stem cell. Culture, maintenance and differentiation. Advantages and disadvantage of stem cells. Neural stem cells- Implications in Parkinson's and Alzheimer's diseases.

**REFERENCE:**


1. T A Brown, (1996), "Gene Cloning"3rd edition, Chapman and Hall, London.
2. Christopher Howe, (1995), "Gene cloning and Manipulation", 1st edition, Cambridge University press.
3. Miesfeld, (1998), "Applied Molecular Genetics", Wiley liss.
4. R W Old and S B Primrose, (2001), "Principles of Gene Manipulation-An introduction to Genetic Engineering", 6th edition, Blackwell Scientific Publications.
5. Kingsman, S M, (1998), "Genetic Engineering", Blackwell Scientific Publications.
6. D Balasubramanian, C F A Bryce, K Dharmalingam, J Green, KunthalaJayaraman, (2002), "Concepts in Biotechnology", University press.
7. J M Walker and Gingold, (1993), "Molecular Biology and Biotechnology", 1st edition, Panima Educational Book Agency.
8. Slater et al., 2008, plant biotechnology, Oxford university press, London.
9. Ernest L Winnacker, From Gene to clones introduction to Gene technology Panima publishing Coproration New Delhi/Bangalore Ist edition 2003.

**14BCP13 BIOCHEMISTRY PRACTICAL II AND VIVA**

**III SEMESTER** 8 hrs/wk

**CLINICAL ESTIMATIONS IN BLOOD**

**Estimation of:**

1. Blood sugar
2. Total proteins
3. A/G Ratio
4. Fibrinogen
6. Iron and iron binding capacity
7. Chloride
8. LDL, HDL and total cholesterol
9. Phospholipids.
10. Triacylglycerol

**Activities of following enzymes in serum:**

11. LDH
12. Acid phosphatase
13. Alkaline phosphatase
14. Hexokinase
15. Aspartate amino transferase
16. Alanine amino transferase
17. 5' Nucleotidase
18. Amylase

**Immunology**:

19. Identification of blood group and Rh typing
20. Immunodiffusion techniques
21. Immunoassay of an infectious disease

**Molecular biology:**

22. Preparation of competent E.Coli and transformation
23. Isolation of genomic DNA
24. Plasmid isolation by mini-preparation method
25. Restriction digestion of DNA

**CA components for practicals**:

| | | |
|---|---|---|
| Experiment | 15 marks | |
| Record | 5 marks | |
| Test (2) | 20 marks | (each test for 10 marks) |
| | 40 marks | |

**CE components for practicals**:

| | |
|---|---|
| 1. Record | 10 marks |
| 2. Experiment | 50 marks |
| | 60 marks |

**14BCP14A** **CORE ELECTIVE-I : IMMUNOLOGY** **48 Hours**

**Objectives:** To study the detailed role of the immune system in health and diseases.
To understand the function of the immune system for the development of new types of vaccines.
To highlight the technological aspects of immunology.

**UNIT I** 10 hrs

Experimental animal models: inbred strains SCID Mice, Nude mice, knock out mice.
Cell culture system: Primary lymphoid culture, cloned lymphoid cell lines.
Cells of the immune system: Haematopoiesis, haematopoietic growth factors; regulation of haematopoiesis ; clinical uses of stem cells.
Lymphoid cells- Lymphoblasts, B cell receptors: T cell membrane molecules.
Null cells: granulocytes; dendritic cells.
Leucocyte adhesion molecules.

**UNIT II** 10 hrs

Antigens: B cell epitopes; T cell epitopes. Haptens; viral and bacterial antigens.
Mitogens. Immunoglobulins: Immunoglobulin domains; membrane Igs: B cell receptor complex: antigenic determinants on Immunoglobulins. Antibody isotypes.
Antigen antibody interactions in vitro – quantitative precipitin curve.
Immunoglobulin genes: Multigene family; rearrangements: antibody diversity.
MHC :Organization , Class I, II and III. MHC restriction.
Antigen processing and presentation.

**UNIT III** 10 hrs

Complement system: Pathways; biological consequences of complement activation.
Cytokines; structure and function of IL, IFN, TNF. Cytokines in inflammation and in disease.
Immunoassay: RIA: Principle and applications; IRMA (Immuno radiometric assay): Principle, comparison with RIA.
Types and applications of ELISA
Fluorescence immunoassay: Principle, advantages.

**UNIT IV** 9 hrs

Hypersensitivity; Type I, II, III and IV.
CMI: CTL mediated toxicity. NK cell mediated toxicity.
Delayed type hypersensitivity.
Immunological tolerance.
Active and Passive immunization: DNA based immunization.
Immunodeficiency diseases.

**UNIT V** 9 hrs

Autoimmunity: Autoimmune diseases in human, mechanism for immunity.
Transplantation(host vs graft; graft vs host); clinical manifestations.
Bone marrow transplants: organ transplants.
Cancer immunity. Tumor antigens; immune response to tumors; Cancer immunotherapy; tumor vaccines.
AIDS. Structure of HIV; envelope glycoproteins.
Destruction of T cells; immunologic symptoms of AIDS; AIDS vaccine; Gene therapy for treatment.

**REFERENCES:**


1. Janeway and Travers, (1996). "Immunobiology –The immune system in health and diseases", Current Biology; II Ed.
2. Roiit, Bronstall, Male, C.V, (2006). "Immunology", Mosby Company, IV Ed.
3. Tizard, (1995). "Immunology", Saunders College Publishing IV Ed.
4. Janis Kubey. (2000). "Immunology". WH. Freeman and Company. 7th edition.


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**14BCP14B**

## CORE ELECTIVE-I

## ENDOCRINOLOGY

**48 hrs**

**Objectives:** To understand the biochemical mechanisms behind the functioning of various mammalian hormones.

**UNIT I** **10 hrs**

Classification of hormones. Mechanism of action steroid hormones and peptide hormones. .Intracellular second messengers- role of cAMP, cGMP, calcium and inositol phospholipids in signal transduction.

**UNIT II** **10 hrs**

Thyroid gland- thyroglobulin, synthesis of thyroid hormones and regulation of secretion. Biological actions.
Disorders of secretion-hypothyroidism and hyperthyroidism.
Hormones involved in calcium homeostasis-
Parathyroid hormone-synthesis, regulation of secretion and biological actions. Disorders of secretion-hyperparathyroidism, hypoparathyroidism and pseudohypoparathyroidism.
Role of calcitonin. Synthesis of calcitrol and its role.

**UNIT III** **10 hrs**

Pancreas-chemistry of insulin, synthesis, regulation of secretion and biological actions. Metaolic complications due to insulin deficiency.
Glucagon –stimuli for secretion and metabolic actions.
Gastrointestinal hormones- gastrin.secritin,cholecystokinin and gastric inhibitory peptide-site of secretion, stimuli for secretion and biological functions .
Candidate hormones- defintion and their role.
Adrenal cortex- biosynthesis and regulation of secretion of cortisol and aldosterone.
Their metabolic actions and pathophysiology associated with hyper and hyposecretion.
Adrenal medulla-synthesis and biological action of catecholamines.

**UNIT IV** **9 hrs**

Pituitary -biological actions of anterior pituitary hormones , their control of secretion by hypothalamus and disorders of secretion. Posterior pituitary hormones-functions and disorders.
Gonads-synthesis, secretion and biological action of testosterone and estrogens.Pathophysiology of male and female reproductive system.

**UNIT V** **9 hrs**

Prostaglandins- chemistry and Nomenclature.

Cyclo-oxygenase pathway- synthesis and biological actions of Prostaglandins,.Thromboxane and Prostacyclin.

Lipoxygenase pathway- synthesis of Leukotrienes and significance of SRS-A compounds.

**REFERENCES:**


1. Robert Murray and Peter A. Mayes, (2006). "Harpers biochemistry", 26th edition, McGraw Hill Company
2. Emil L.Smith and Robert L Hill, (1983). "Principles of biochemistry", 6th edition , McGraw Hill international. Book Company.
3. Arthur.C.Guyton and John.E.Hall, (200). "Textbook of medical physiology", 10th edition, W.B.Saunders company
4. Brook, CGD and Marshal, WJ (1996). "Essential Endocrinology", Blackwell Science. 3rd edition.
5. James VHT. (1992). " The human adrenal cortex". Raven Press. New York. 2nd Edition.
6. G J Tortora (1982) "Principles of Human Physiology'', Harper & Row. New


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**14BCP17**

## ADVANCED CLINICAL BIOCHEMISTRY

60 Hours

**Objective:** To study the advanced level of clinical pathology and the diagnosis in human being

**UNIT-I** 12 hrs

Serology: Rheumatoid arthritis (RA) test, immunologic test for pregnancy.
Haematology: ESR . Prothrombin time – Coagulation test and clinical significance.
Blood transfusion: Blood collection, Processing and transfusion process.
Cerebrospinal fluid: Composition, analysis and diagnostic importance.
Amniotic fluid: Origin, composition and analysis of amniotic fluid.

**UNIT-II** 12 hrs

Diagnostic bacteriology: Laboratory approaches to the identification of pathogenic microbes.
Sputum and biochemical investigation.
Stool- chemical examination and clinical significance.
Examination of gastric and duodenal contents
Urine analysis: Collection and types of urine specimens, physical examination, chemical tests, clinical significance of urine components with reference to sugar, protein, ketone bodies, bilirubin and porphyrins.
Composition of kidney stones and procedures for stone analysis, biliary calculi.

**UNIT-III** 12 hrs

Hormone assay and endocrine function: general principle of hormone assay and clinical significance of steroid hormones, protein hormones and thyroid hormones (experimental details not required). Laboratory methods for evaluation of hypo and hyper functions of pituitary, adrenal cortex, medulla, thyroid and parathyroid.

**UNIT-IV** 12 hrs

Gastric function tests, renal function tests, cardiac function tests.- Troponins as markers.
Liver disorders: Cirrhosis: aetiology and types of cirrhosis, Hepatitis and fatty liver.
Gall stones: aetiology, diagnosis and treatment, free radicals in disease.
Factors responsible for enzyme levels, in blood, Clinical significance of AST, ALT, LDH, CPK, alkaline and acid phosphatase, 5'nucleotidase ,Glucose-6-phosphate.dehydrogenase. Enzyme patterns in diseases: myocardial infarction, hepatobiliary disease.

**UNIT-V** 12 hrs

Oncology: Metabolism in cancer cells, Cyclic nucleotides in growth and malignancy.
α- fetoprotein, carcinoembryonic antigens.
Leukemia.
Disorders of mineral metabolism- Ca, P, Fe, electrolytes and trace elements.
Abnormalities in lipid, carbohydrates and protein metabolism-diagnostic, biochemical parameters.

**REFERENCES:**


1. Marshall WJ and Bangert, (1995). " Clinicial Biochemistry: Metabolic and Clinical Aspects ". Churchill Livingstone, UK.

2. Smith AL. Beckett GJ., and Walker SW. (1998). "Lecture notes in Clinical Biochemsitry". Blackwell scientific publications. London. 6th edition.

3. Marshall WJ. (1995). "Clinical Chemsiry". Moby, London. 3rd edition.

4. Bhagvan, NC. (1992). "Medical Biochemsitry". Jones and Bartlett Publishers. London.

5. Muller, RF and Young, ID . (1995). "Emery's Elements of medical Genetics". Churcill Livingstone. London.

6. E.A .Stroev. V.G.Makarova,(1989), "Laboratory Manual in Biochemistry", Mir publishers, Moscow.

7. Ira Thabrew, Ruth. M. Ayling. (2001), "Biochemistry for clinical medicine", Greenwich Medical Media Ltd. 137, Enston Road, London.


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**14BCP18** **PROJECT WORK**

It is a one semester project work done individually pertaining to Biochemistry Subject.

## CORE ELECTIVE-II : BIOCHEMISTRY OF DRUGS

**14BCP18A** 60 Hours

**Objectives:** Focus on drugs structure, receptors, action, molecular mechanism and metabolism. Also their side effects, toxicity and assay methods

**UNIT I** 12 hrs

Classification of drugs. Site of drug action ; methods of location sites of drug action. Drug absorption, distribution and elimination Consequence of drug- protein interaction. Dose response relationship, LD50, ED50, IC50; drug receptor interactions and binding forces.

**UNIT II** 12 hrs

Drug discovery;-therapeutic targets for drug discovery. Combinatorial chemistry in drug development- principles. Computer assisted drug design- anti AIDS drug design. Quantitative structure activity relationship (QSAR), structure based drug design, denovo drug design; methods. Pharmacogenomics based drug design, Lipinskis Rule of 5.

**UNIT III** 12 hrs

Chemical pathway of drug metabolism. Phase I and Phase II reactions. Characteristics and intracellular localization. Microsomal metabolism of drugs. Role and mechanism of action of cytochrome P450. Non-microsomal reactions of drug metabolism. Conjugation and other Phase II reactions. Induction of drug metabolizing enzymes.

**UNIT IV** 12 hrs

Chemotherapy. Metabolic antagonism by enzyme inhibition. Mode of action of sulphonamides. Anti metabolites of folate, purines, pyrimidines and nucleosides. Anti viral substance and anti malarials. Cancer chemotherapy. Biochemical mechanisms involved in drug resistance. Immune response inhibitors and stimulators.

**UNIT V** 12 hrs

Introduction about Preclinical and Clinical trials.

Adverse reactions to drugs: side effects. Drug toxicity in man. Drug intolerance. Idiosyncracy. Allergic reactions, and clinical manifestations of drug allergy. Treatment of acute drug poisoning. Factors modifying the effect of a drug. Drug tolerance. Tachyphylaxis. Drug abuse. Assay of drugs: chemical and bioassay.

**REFERENCES:**


1. W O Foye, (1981), "Principles of Medicinal Chemistry", Ed.Foye WO.BI Warely, New Delhi, India.
2. A Burger, (1960), "Medicinal Chemistry", Inter Science Publishers Inc, New York.
3. K D Tripathi, (2002), "Pharmacology", Jaypee Brothers.
4. Glick and Pastenak, (2002), "Molecular Biotechnology", 2nd edition, Panima publications.
5. John M.Pezzuto, Michael E.Johnson and Henri R. Manasse, (1993), "Biotechnology and pharmacy", Chapman & Hall Publications.
6. Sunil Maulik, Salil D.Patel, (1997), "Molecular biotechnology, Therapeutic applications and Strategies", John Wiley and sons, Inc publication.
7. G I David Kurupudanam, D.Vijayaprasad, K.Varaprasad Rao, KLN Reddy, C. Sudhakar, (2001), "Drugs", University Press.

## CORE ELECTIV-II
## NANOBIOTECHNOLOGY

60 hours

**14BCP18B**

**OBJECTIVES:**

- to understand the basics of nanoscience and nanophysics
- to get an exposure to the history and developments
- to find its application in various fields

**UNIT I:** 12 hrs

Introduction: Definition of nanoscience and nanotechnology; Importance of nanoscale science and technology. History of nanotechnology – Contributiion of different scientists and different timelines of nanotechnology. Basicis of nano chemistry – introduction, family of self assembling materials – Porous solids, bio-mineralization, nanowires, nanomachines and soft lithography. Nanoparticles- introduction, approaches in production, types, characterization and application of nanoparticles.

**UNIT II:** 12 hrs

Benefits and challenges of molocular manufacturing; visions and objective of nanotechnology. Biosensors; Nano structure fluid; Computers; Plastic electronics; Light emitting diodes; Solar cells. Convergence of nanotechnology. Ethical issues in nanotechnology- with special reference to nanomedicine; economic impacts.

**UNIT III:** 12 hrs

Carbon nanotubes – introduction, chemistry, types and techniques in carbon nanotubes. Gictionalization, characterization and applications of carbon nanotubes. Nano composites – introduction, polymer as matrix – types. Nano materials as a filler – Nano fibre and nano clay. Fabrication and processing of composites. Benefits to ultimate physical, mechanical and termal properties. Nanostructured materials and applications.

**UNIT IV:** 12 hrs

Nanotechnology in computing – quantum computing, molecular computation. Nanotechnology in electronics – computional nanotechnology. Nanotechnology in defense. Nanotechnology in health and life sciences – nanotechnology in medicine, drug delivery, drug encapsulation, tissue repair and implantation, bioresorable materials. Nanotechnology in environment, Nanorobotics.

**UNIT V:** 12 hrs

Characterization of nanopartciles: SEM- Theory, instrumentation and its applications,TEM- Theory, instrumentation and its applications. X-Ray diffraction- Basics and its applications to size analysis of nanomaterials. Atomic force Microscopy- mode of operation and its application. NMR- Basics and Application to nanomaterials. Elemental analysis- EDX spectra.

**REFERENCES**


1. "Understanding Nanotechnology" by scientific American, ISBN; 0446679569.
2. Niemeyer and CA Mirkin (2004) " Nanobiotechnology-Concepts, Applications and Perspectives" edited by CM, Willey – VCH ISBN 3-527-30658-7.
3. Ratner, M. and Ratener, D. (2003) Nanotechnology A Gentle introduction to The Next Big Idea, Prentice hall, ISBN; 0131014005.Tuszynski, J.A. & Kurzynski, M (2004) "Introduction to Molecular Biophysics". CRC Press. Boca Raton.

**Clinical Biochemistry – Cluster IDC (Theory)**

**14CHP19B/14NDP15B/**
**14MBP19C/14ESP17C** 36 Hours

(Optional for MSc Chemistry, MSc Foods & Nutrition, MSc Applied Microbiology & MSc Environmental Science )

**Objective:** To learn basic clinical biochemistry, so that the students get the clinical orientation right from the beginning.

**UNIT I**

Design of a modern clinical lab. Component and types of automated instruments. Specimen collection, preservation, storage and transport. Chemical, biological and radioactive hazards. First aid and prevention of occupational infections. Legal, medical and ethical issues. Kits, manuals and various methodologies for assay and reference values. Quality control and trouble shooting. Factors affecting the results such as age, diet, medications, pregnancy. Variations in different methodologies.

( the following aspects have to be followed while dealing with each topic in UNIT II, III, IV and V: Aim, principle, choice of specimen, reagent preparation, instruments needed, methodologies; choice, advantages and disadvantages of methods. Protocol, calculation, sensitivity of the method. Interpretation of results, reference values, false results and interference of other disease conditions and discussion.

**UINT II**

Routine urine analysis, urine glucose, acetone, albumin. Renal function test, Blood urea, bilirubin, creatinine, creatine, albumin, uric acid, serum total protein, A:G ratio, cholesterol, triglyseride, blood sugar and G.T.T, haemoglobin.

**UNIT III**

Acetylated haemoglobin, fructosamine, phosphorous, magnesium, calcium, blood iron.

**UNIT IV**

Blood electrolytes: $Na^+$, $K^+$, $Cl^-$ and bicarbonate. Acid base disorders and renal mechanism of acid balance disorders, blood pH. Blood gas analysis -$PCo_2$ and $Po_2$.

**UNIT V**

Serum enzymes: Aspartate aminotransferase, alanine aminotransferase, acid phosphatase, alkaline phosphatase, lactate dehydrogenase, CPK and amylase.

**REFERENCES:**

1. Carl A Burtis, (1999), "Tietz Text Book of Clinical Chemistry", ed.Edward R M D Ashwood, Norbent W Tietz, 3rd edition, W B Saunders Company.
2. Biswajit Mohanty and Sharbari Basu, (2006), "Fundamentals of Practical Clinical Biochemistry", B I Publications pvt ltd., New Delhi.

**Clinical Biochemistry Practical – Cluster IDC**

**14CHP20B/14NDP16B/**
**14MBP20C/14ESP18C** 2 hrs/wk

(Optional for MSc Chemistry, MSc Foods & Nutrition, MSc Applied Microbiology & MSc Environmental Science )

Estimation of the following (any 12)

1. Urine sugar
2. Urine albumin
3. Blood urea
4. Serum albumin
5. Serum creatinine
6. Serum uric acid
7. Serum total protein
8. Blood glucose
9. Serum cholesterol
10. Serum phosphorous
11. Serum iron
12. Aspartate amino transferase
13. Alanine amino transferase
14. Acid phosphatase
15. Alkaline phosphatase