

Academic Organizer, 2015-16  
B.Sc Biochemistry, Semester-I,  
Paper- I, Biomolecules I

**Lecturer: D.Rajani**

Month and No of teaching days	Unit	Name of the topic
July 18	Unit I	<b>Introduction to molecules of life</b> Origin of life, chemical evolution and rise of living systems Acid-base and electrolyte balance in the body. Water as a biological solvent and its role in biological processes. pH, Buffers, Henderson- Hasselbalch equation. Structure and classification of prokaryotes and eukaryotic cell. Biological structures.
	Unit II	<b>Amino acids and peptides:</b> Classification, structure, stereochemistry.
August 15	Unit II	<b>Amino acids and peptides</b> Classification, structure, stereochemistry. Chemical reactions of amino acids due to carboxyl and amino groups. Titration curve of glycine and pKa values. Essential and non-essential amino acids. Primary, secondary, tertiary and quaternary structure of proteins. Unusual amino acids Peptide bond – nature, Types of conformations Biologically active peptides.
	Unit III	<b>Carbohydrates</b> Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation.
September 15	Unit III	Reactions of carbohydrates (due to functional groups-hydroxyl, aldehyde and ketone). Amino sugars, Glycosides, Structure and biological importance of disaccharides (sucrose, lactose, maltose, isomaltose, trehalose), trisaccharides (raffinose, melezitose), structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen). Glycosaminoglycans, Bacterial cell wall polysaccharides. Outlines of glycoproteins, glycolipids and blood group substances.
	Unit IV	<b>Lipids</b> Classification, saturated and unsaturated fatty acids. Structure and properties of fats and oils. Acid value, saponification and iodine values, rancidity.
October 12	Unit IV	General properties and structures of phospholipids and sphingolipids. Cholesterol- structure and properties. Lipoproteins: Types and functions. Properties of lipid aggregates – micelles, bilayers. Liposomes. Composition and architecture of membranes. Fundamental properties of biological membranes. Experimental proof for fluidity and dynamic properties.

*D. Rajani*  
8/6/15

**Academic Organizer (2015-16)**  
**B.Sc Biochemistry, Semester-II**  
**Paper- II, Biomolecules ii**

**Lecturer: D.Rajani**

Month and No of teaching days	Unit	Name of the topic
November 1	Unit I	<b>Nucleic Acids</b> Introduction
December 17	Unit I	Nature of nucleic acids, Structure of purines, pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali and nucleases on DNA and RNA. Experiments showing DNA as store of genetic information. Structure of Nucleic acids - Watson-Crick DNA double helix. structure.Types of DNA/RNA. Structural variations of DNA/RNA. Palindromes, mirror repeats, hairpin and cruciform Introduction to circular DNA, super coiling. Helix to random coil transition. Denaturation and renaturation of nucleic acids. Hyperchromic effect, T <sub>m</sub> values and their significance. Reassociation kinetics, cot curves and their significance.
January 15	Unit I Unit II	Additional functions of nucleotides as energy carriers, as components of enzyme cofactors. <b>Proteins</b> classification based on solubility, shape and functions. Determination of amino acid composition of proteins. General properties of proteins. Denaturation and renaturation of proteins. Denaturation and renaturation of proteins. Structural organization of proteins- primary structure, secondary structure, tertiary and quaternary structures hemoglobin and myoglobin. Strategies of protein sequencing.
February 14	Unit III	<b>Energy transformations in the living system:</b> Enthalpy, entropy and Gibb's free energy. Reduction potentials. Free energy concept. exergonic and endergonic reactions. High energy compounds. Role of ATP in biological system. Inorganic phosphate- phosphate group. Phosphate group transfer potential. Substrate level phosphorylation.
March 13	Unit IV	<b>Bioenergetics</b> Biological oxidations: Definition, enzymes involved- oxidases, dehydrogenases and oxygenases. Redox reactions. Ultra structure of mitochondria. Electron transport chain and carriers involved. Coenzymes and proteins as electron carriers. Oxidative phosphorylation, theories of oxidative phosphorylation- Mitchell's chemiosmotic theory, F <sub>0</sub> F <sub>1</sub> - ATPase. Inhibitors of respiratory chain and oxidative phosphorylation, Uncouplers. Formation of reactive oxygen species and their disposal through enzymatic reactions.

*U. Sai Dade*  
8/6/11

**Academic Organizer  
(2015-16)  
B.SC II YEAR**

**Biochemistry paper II: Metabolism and biochemical techniques**  
Name of the lecturer: S.Vanitha

Month & no of teaching days	Unit	Name of the topic
June 14 (2 extra)	Unit II Carbohydrate and lipid metabolism	Concepts of anabolism and catabolism, glycolysis –energy, fate of pyruvate- formation of lactate, ethanol, Pasteur effect, TCA cycle- energy and regulation, amphipathic role, gluconeogenesis, glycogen metabolism- synthesis and degradation, HMP pathway and its significance.
July 15 (3 extra)	Unit II Carbohydrate and lipid metabolism  Unit III Amino acid & nucleotide metabolism	Photosynthesis- light and dark reactions, C4 pathway. Catabolism of fatty acids ( $\beta$ -oxidation), with even & odd chain, ketogenesis, <i>denovo</i> synthesis of fatty acids, elongation in microsomes & mitochondria, synthesis & degradation of TAG, lecithin and cholesterol. General reactions of amino acids – transamination, deamination & decarboxylation.
August 11 (2 extra)	Unit III Amino acid & nucleotide metabolism	Urea cycle and its regulation, metabolism of carbon skeleton of glycogenic and ketogenic amino acids, metabolism of glycine, serine, aspartic acid, methionine, leucine and phenyl alanine. Biosynthesis of creatine.
September 12 (1 extra)	Unit III Amino acid & nucleotide metabolism	Inborn errors of aromatic and branched chain amino acids. Biosynthesis and regulation of purine and pyrimidines, <i>denovo</i> and salvage pathways, synthesis of deoxy ribonucleotides, thymidylate synthase and its significance, disorders of nucleotide metabolism – Gout and Lesch Nyphan syndrome.
October 5 (2 extra)	Unit III Amino acid & nucleotide metabolism  Unit I Bioenergetics	Biosynthesis and degradation of heme.  Introduction to bioenergetics, energy transformation in living organisms, exergonic & endergonic reactions, high energy compounds, phosphate group transfer potential, substrate level phosphorylation.
November 15 (1 extra)	Unit I Bioenergetics	Biological oxidations- oxidases, dehydrogenases, oxygenases. Redox reactions and redox potential, ultra structure of mitochondria, electron transport chain, oxidative phosphorylation, theories of OP, Mitchell's chemi osmotic theory, Fo-F1 ATPase, inhibitors of ETC & OP, uncouplers. Ultrastructure of chloroplast, cyclic and non -cyclic photophosphorylation.

A. Sai Vade  
8/6/11

December 15 (4 extra)	Unit IV Biochemical techniques	Principles and application of paper, thin layer, ion exchange, gel filtration & affinity chromatography. Electrophoresis- paper, agarose gel electrophoresis for nucleic acids, SDS-PAGE. Tracer techniques- radio isotopes,, units of radioactivity, half- life, $\beta$ and $\gamma$ emitters, applications of radio isotopes in biology. Method of tissue homogenization.
January 6	Unit IV Biochemical techniques	Principle and application of centrifugation, differential, density and gradient centrifugation, ultracentrifugation. Colorimeter and spectrophotometry- Beer – Lambert’s law, UV-Visible absorption spectra, molar extinction co efficient,, application, enzyme purification.

*H. Lai Vady*  
8/6/15

**Academic Organizer (2015-16)**  
**B.Sc Biochemistry, Semester-III**  
**Paper- III**  
**Paper - III Physiology and Clinical Biochemistry**

**Lecturer: D.Rajani**

Month and No of teaching days	Unit	Name of the topic
June 11	Unit I	<b>Physiology</b> Organization of endocrine system. Classification of hormones. Mechanism of hormonal action - signal transduction pathways for adrenalin, glucocorticoids and insulin. Outlines of chemistry, physiological role and disorders of pituitary and hypothalamic hormones, thyroid and parathyroid hormones and hormones of gonads and placenta.
July 11	Unit I	Chemistry, physiological role and disorders of pancreatic and adrenal hormones. Gastrointestinal hormones. Digestion and absorption of carbohydrates, lipids and proteins.
August 11	Unit I  Unit II	Composition of blood. Hemoglobin and transport of gases in blood. Structure of the heart, cardiac cycle, cardiac factors controlling blood pressure. Muscle - kinds of muscles, structure of myofibril, and mechanism of muscle contraction. Nervous system - structure of neuron, resting potential, action potential, propagation of nerve impulse, synapse, synaptic transmission, excitatory and inhibitory neurotransmitters. Physiology of vision pigments and visual cycle. <b>Nutrition:</b> Introduction to nutrition, RDA values of different foods, balanced diet.
September 14	Unit II	Energy requirements, BV of proteins, Obesity and starvation, bulk and trace elements, kwashiorkor and marasmus. Fat soluble and water soluble vitamins. Trace elements.
October 5	Unit II Unit III	Pantothenic acid <b>Clinical Biochemistry</b> Disorders of lipid metabolism- plasma lipoproteins, lipoproteinemias, fatty liver, atherosclerosis.
November 14	Unit III	LFTs, hypercholesterolemia, HDL/LDL, normal and abnormal constituents of urine, role of kidneys in maintaining acid-base balance, RFTs, plasma proteins in health and disease, anemias, hemoglobinopathies, thalasemias and sickle cell anemia.
December 16	Unit III Unit IV	Different approaches to the classification of anemias. <b>Immunology</b> Organization of immune system, Organs and cells of immune system. Innate and acquired immunity. Cell mediated & humoral immunity, activation of T& B - cells. Classification and structure of immunoglobulins. Structure of IgG. Epitopes / antigenic determinants. Concept of haptens. Adjuvants. Theories of antibody formation- clonal selection theory. Monoclonal antibodies and their applications.
January 6	Unit IV	Modern vaccines - recombinant and peptide vaccine. Hypersensitivity reactions and autoimmune diseases. Fundamentals of graft rejection and MHC proteins

-A. Sai Reddy  
8/6/16

**Academic Organizer**  
**(2015-16)**  
**B.SC III YEAR**

**Biochemistry paper IV: Microbiology and Molecular biology**  
Name of the lecturer: S.Vanitha

Month & no of teaching days	Unit	Name of the topic
June 10	Unit II replication	Organization of prokaryotic and eukaryotic genome. Experiment to prove DNA as genetic material, Models of DNA replication, Meselson and Stahl experiment , Nature and structure of a gene, enzymology of DNA replication, helicases, topoisomerase, ligase, primase, DNA pol I,II & III
July 12	Unit II Replication Transcription	Initiation, elongation & termination of DNA replication, leading & lagging strand synthesis, bidirectional model, okazaki fragments, inhibitors of DNA replication. Introduction to transcription, central dogma, initiation, elongation & termination of transcription, RNA polymerase, promoters, RNA pol I,II & III, eukaryotic transcription.
August 10	Unit II Transcription Unit III Protein synthesis and regulation of gene expression	Processing of mRNA, splicing, capping & tailing. Inhibitors of transcription Introduction to translation, genetic code, deciphering genetic code- Nirenberg's and Khorana experiment, structure of tRNA & ribosomes, Activation of amino acids – aminoacyl tRNA synthetases.
September 10 (1 extra)	Unit III Protein synthesis and regulation of gene expression	Initiation, elongation & termination of translation, post translational modifications- signal hypothesis, inhibitors of translation. Regulation of gene expression, introduction to induction and repression, lac operon- catabolite repression, Trp operon- attenuation.
October 4 (1 extra)	Unit IV rDNA technology	Outline of cloning strategy, Enzymes- REN, ligase, DNA modifying enzymes, S1 nuclease.
November 11 (2 extra)	Unit IV rDNA technology	DNA sequencing, Vectors, host – <i>E.coli</i> , <i>Saccharomyces cerevisiae</i> , <i>Agrobacterium tumefaciens</i> , construction of cDNA and genomic libraries, isolation & sequencing of cloned gene- colony, nucleic acid hybridization, HRT, HART using $\beta$ galactosidase, green fluorescent protein, PCR- principle and applications, blotting techniques and applications of rDNA technology( Bt cotton, insulin)
	Unit IV rDNA technology	Application of rDNA technology (Edible vaccines). Bioinformatics- databases, definition of genomics and proteomics, sequence alignment using BLAST & FASTA

-H. Sai Vada  
8/6/15

December 11 (4 extra)	Unit I Microbiology	Introduction, classification of prokaryotic & eukaryotic organism, isolation and cultivation of bacteria, selective and enriched media, bacterial growth curve and kinetics, batch, continuous and synchronous culture, gram staining, motility and sporulation. Industrial uses of <i>spirulina</i> , <i>yeast</i> , <i>Aspergillus</i> .
January 5	Unit I Microbiology	Structure and composition of viruses, Isolation and cultivation of viruses, one step growth and plaque assay, life cycle of lambda phage, TMV, retro viruses – HIV, prions and mycoplasma.

*M. bi Pady*  
8/6/11