

Academic organizer 2017-18

M.Sc SEMESTER I

Biochemistry: PAPER I: Chemistry and Metabolism of proteins, lipids and porphyrins

Name of the lecturer: Dr.S.Padma

MONTH/No of Teaching days	Unit	Name of the topic
AUGUST/ 15+1	<b>I: Chemistry of Amino Acids, &amp; Proteins</b>	Classification and structure of 20 aa, essential, non-essential, unusual and non-protein General properties of aa, acid – base titrations, pKa Peptide bond – stability and formation, Primary structure, GN Ramachandran plots Secondary structure and motifs, $\alpha$ helix, $\beta$ sheet, 3-10 helix Leucine zipper, Zinc finger, Trans-membrane regions, $\beta$ LHL Tertiary & Quaternary structure (myoglobin, hemoglobin) Protein-protein interactions (actin, tubulin) Small peptides (glutathione, peptide hormones), Cyclic peptides (Gramicidin) Classification of proteins-globular, fibrous, membrane, metallo-proteins, SCOP, CATH Denaturation (pH, temperature, chaotropic agents), refolding
SEPTEMBER/ 11	<b>II: Metabolism of Amino acids, &amp; Proteins</b>	Metabolic fate of dietary proteins and amino acids Degradations to glucose and ketone bodies Amino acids degraded to Pyruvate, Oxaloacetate Amino acids degraded to Acetyl-CoA, Succinyl-CoA Metabolism of branched chain amino acids Role of glutamate cycle information & circulation of ammonia Glucose alanine cycle, urea cycle.
OCTOBER/ 15+2	II  <b>III: Chemistry of Lipids Porphyrins</b>	Linking of citric acid and urea cycles, regulation of urea cycle,. Genetic defects in metabolism of amino acids and urea metabolism Classification & biological significance of lipids & fatty acids. Steroids, Sterols, relation to vitamin D and steroid hormones Bile acids and salts, Phospholipids, Oils, waxes, isoprene units, Lipoproteins Glycolipids, Sphingolipids Structure & function of porphyrins (e.g. Heme, chlorophyll) Cerebrosides, gangliosides Prostaglandins, Prostacyclins Thromboxanes, Leukotrienes

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NOVEMBER / 15+1	<b>IV: Metabolism of Lipids &amp; Porphyrins</b>	Fate of dietary lipids and Apo-lipoproteins Fatty acid biosynthesis, Desaturation of fatty acids Beta oxidation, breakdown of odd chain fatty acids, energy yields Regulation of $\beta$ - oxidation, $\omega$ - oxidation & $\alpha$ - oxidation Metabolism of phospholipids & Sphingolipids Regulation and Biosynthesis of cholesterol and other steroids Fate of acetyl CoA, formation of ketone bodies and ketosis Biosynthesis of prostaglandins, Prostacyclins, Thromboxanes, Leukotrienes Role of HDL, LDL, and Very-low-density lipoprotein (VLDL) and cholesterol levels in body Metabolism of Porphyrins and associated porphyrias
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A. Sai Jadhav  
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## Academic Organizer (2017-18)

### M.Sc Biochemistry

#### Semester-I

Paper –II, BI 102T: Chemistry and Metabolism of Carbohydrates, Vitamins and Nucleic Acids

Lecturer: Dr. A.Sai padma

Month/ No of Teaching Days	Unit	Name of the topic
August 15	<b>Unit – I: Chemistry of Carbohydrates</b>	Classification, monosaccharides (aldoses & ketoses), Configuration and conformation of monosaccharides (pyranose & furanose, chair & boat), Reducing and optical properties of sugars, Stability of glycosidic bond disaccharides, oligosaccharides, Structural polysaccharides-cellulose, hemicellulose, pectin, lignin, chitin, chitosan, Storage polysaccharides; starch, glycogen, inulin, Steric factors in polysaccharides folding, sugar code and lectin, Glycosaminoglycans, mucopolysaccharides, hyaluronic acid. Chondroitin sulfate, keratan sulfate, dermatan sulfate, Bacterial cell wall – proteoglycans and peptidoglycans
September 12	<b>Unit – II: Metabolism of Carbohydrates</b>	Reactions, energy balance and regulation of Glycolysis, Reactions, energy balance and regulation of Gluconeogenesis, Pyruvate dehydrogenase complex, Reactions, energy balance and regulation of TCA cycle, Pentose phosphate pathway, regulation and significance Pasteur and Crabtree effect, Anapleurotic reactions,
October 16	<b>Unit – III: Chemistry and Metabolism of Nucleic Acids:</b>	Glyoxylate cycle, Glucuronic acid cycle, Glycogen metabolism. Purines, pyrimidines, nucleosides, nucleotides, unusual bases Structure of DNA – Watson Crick Model, A- and Z- forms Supercoiling of DNA – negative and positive, linking number Structure of mRNA, tRNA, rRNA, siRNA / miRNA Properties of NA – denaturation and renaturation , T <sub>m</sub> (factors affecting T <sub>m</sub> ) and C <sub>ot</sub> curves, Heteroduplex mapping – D loops and R loops Biosynthesis of purines and pyrimidines Degradation of purines and pyrimidines

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<p>November 15 +2</p>	<p><b>Unit – IV: Chemistry and Metabolism of Vitamins</b></p>	<p>Regulation: <i>de novo</i>, salvation, nucleotide analogs  Purines, pyrimidines, nucleosides, nucleotides, unusual bases.  Discovery of vitamins, classification, RDA  Vitamin A – source, biological role, deficiency    Vitamin B1 – Thiamine – source, biological role, deficiency  Vitamin B2 – Riboflavin – source, biological role, deficiency  Vitamin B3 – Niacin – and B5 – Pantothenic acid – sources, biological  role, deficiency  Vitamin B6 – Pyridoxamine – and B7 – Biotin – source, biological role,  deficiency  Vitamin B9 – Folic acid – and B12 – Cobalamine – source, biological  role, deficiency  Vitamin C – Ascorbic acid – source. Biological role, deficiency  Vitamin D – Calciferol – source, biological role, biological role,  deficiency  Vitamin E, Vitamin K – source, biological role, deficiency</p>

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## Academic Organiser 2017-18

**M.Sc- Sem-I**

**Bio chemistry: Paper-III-BI 103T: Bioanalytical Techniques**

**Name of the Lecturer: M. Usha**

Month & No. of teaching days	Unit	Name of the Topic
August 13	Unit – I: Spectroscopy	Beer Lambert's Law, Molar extinction coefficient, Absorption maximum, UV-Vis: Spectroscopy, Colorimetry – principle, instrumentation, application, Fluorescence Spectroscopy – principle, instrumentation, application, Atomic Absorption Spectrometry – principle, instrumentation, application, NMR – principle, instrumentation application, ESR – principle, instrumentation application, CD – principle, instrumentation, application, ORD – principle, instrumentation, application
September 7	Unit – II: Chromatography	Mass spectroscopy – principle, instrumentation, application, X-ray crystallography  Partitioning and counter current distribution, PC – principle, instrumentation, application, TLC – principle, instrumentation, application. GC – principle, instrumentation, application
October 15 + 3 Extra	Unit – III: Centrifugation and Electrophoresis	Ion-exchange – principle, instrumentation, application, Gel filtration (Gel exclusion chromatography) – principle, application, Affinity chromatography – principle instrumentation, application; immune precipitation, HPLC and RP-HPLC – principle, instrumentation, application. FPLC, LC – principle, instrumentation, application  Peptide mapping and N-terminal sequencing of proteins  Centrifugation, RCF and types of rotors, Ultracentrifugation – principle, instrumentation, application, CsCl density gradient and sucrose gradient centrifugation – principle, application, Electrophoresis – moving boundary and zonal electrophoresis, Native and SDS-PAGE, IEF and 2D PAGE Agarose Gels, PFGE, Zymography
November 20 + 2 Extra	Unit – IV: Tracer Techniques	PAGE for DNA sequencing DNase-I hypersensitivity mapping, DNA-Foot-printing and Chromatin IP methods. Denaturing gels for RNA, Southern and Northern Blots  Stable and radioactive isotopes, Radioactivity theory, half-life and emission spectra of half-life of Biologically useful isotopes - $^2\text{H}$ , $^3\text{H}$ , $^{14}\text{C}$ , $^{18}\text{O}$ , $^{32}\text{P}$ , $^{35}\text{S}$ , $^{125}\text{I}$ Isotopes used for labeling proteins ( $^3\text{H}$ , $^{14}\text{C}$ , $^{35}\text{S}$ , $^{125}\text{I}$ ) and nucleic acids ( $^3\text{H}$ , $^{32}\text{P}$ ), Detection of radioactivity by Scintillation counting, Autoradiography, Fluorography, Phosphor-imaging, applications, GM counter, gamma counter, Radiation hazards and safe disposal of radioactivity waste; luxometry and chemiluminescence as alternative to radioactivity. Isotope dilution method – pulse chase, Historic examples- $^{14}\text{C}$ and $^{18}\text{O}$ to study photosynthesis. Historic examples- $^{32}\text{P}$ and $^{35}\text{S}$ to study viral replication (Hershey-Chase experiment). Historic examples- $^{14}\text{N}$ and $^{15}\text{N}$ in DNA replication (Meselson and Stahl experiment)

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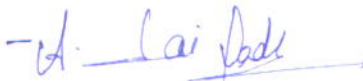
## Academic Organiser (2017-18)

### M.Sc- Sem-I

#### Bio chemistry: Paper---IV BI 104T: Bioenergetics and Photosynthesis

Name Of the Lecturer: M.Usha

Month & No. of teaching days	Unit	Name of the Topic
August 15	Unit.-I Bioenergetics	Elements of importance in biochemistry, (H, C, N, O, P, S), types and energy of bonds and interactions (ionic, covalent, coordinate, H-bonds, Van der Waal's, hydrophobic interactions) Law of thermodynamics, Gibbs free energy, Relevance of entropy and enthalpy in biological system and reactions, Biological oxidation, free energy changes, redox potential & phosphate potential. High energy bonds and high energy compounds, Electron transport chain, components & importance, Mechanisms of oxidative phosphorylation. Uncouples & inhibitors of energy transfer, Substrate level & oxidative phosphorylation Bioluminescence
September 16	Unit-II Biomembranes  Unit - III: Membrane Transport	Composition of plasma membrane and organelle membranes of plant and animal cells, Membrane dynamics. Forces stabilizing the membranes. Membrane asymmetry- Membrane Lipids and proteins. Fluid mosaic model of membrane. Integral membrane proteins and their secondary structures- $\alpha$ helices and $\beta$ barrels. Methods of detecting transmembrane proteins, hydrophathy plots. Lipid anchored membrane proteins-acyl, prenyl and GPI anchors, Artificial membranes: Liposome, micelles and vesicles, Reconstitution of functional membrane systems from purified components RBC membrane  Transport across cell membranes. Fick's law.
October 11+4 Extra	Unit - III: Membrane Transport  Unit- IV: Photosynthesis	Types of transport- simple diffusion, passive & facilitated diffusion. Active transport-primary & secondary active transport systems. Formation of ion gradients across membrane (proton gradients in organelles) Aquaporins and ionophores. Gated channels (voltage & chemical). Group translocation. Transport ATPases, $\text{Na}^+/\text{K}^+$ ATPases. ABC transporters; MDR1, CFTR Channels and pores. Bulk transport-endocytosis & exocytosis, Bacterial transport systems; Lactose permease, Phosphotransferase.  Photosynthesis-structure of organelles involved in photosynthesis in plants & bacteria.
November 9+5 Extra	Unit - IV: Photosynthesis	Light & dark reactions, Hill reaction. Light receptors-chlorophyll; light harvesting complexes, bacteriorhodopsin Photosystem I & II and their location. Mechanism of quantum capture & energy transfer between photosystems; Proton gradients & electron transfer in chloroplasts. Cyclic and non-cyclic Photophosphorylation. C3 pathway of carbon metabolism, C4 pathway & CAM metabolism. Regulation of photosynthesis, Photorespiration

  
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**Academic Organizer (2017-18)**  
**M.Sc Biochemistry**  
**Semester-II**

**Paper-I: BI 201T: Enzymology**

**Lecturer: Dr. A.Sai padma**

Month/ No of Teaching Days	Unit	Name of the topic
December 2	<b>Unit – I: Basic Enzymology</b>	Properties of enzymes, protein conformation & catalyses Thermodynamics of catalysis, Energy of activation, Relation of $\Delta G$ and $K_{eq}$
January 15	<b>Unit –II: Enzyme Kinetics</b>	Coupled reactions (endergonic and exergonic) in biochemical pathways Nomenclature and classification of enzymes Metal, co-factor, and co-enzyme requirements Methods to isolate and purify enzymes Assays, Activity Units and Specific activity High-Throughput enzyme assays Chemicals to identify active site residues: Arg, Cys, Lys, His Site-directed mutagenesis to identify active site residues: Triose Phosphate Isomerase  Single substrate assumptions, Michaelis-Menten kinetics (derive equation transformations) Steady state, Briggs -Haldane equation.
February 14+2	<b>Unit – III: Catalytic Mechanisms:</b>	Lineweaver Burk, EadieHofstee, Hanes plots. Bisubstrate reactions: sequential mechanism, compulsory order and random order mechanism, Non – sequential mechanisms, ping – pong mechanisms. Distinction between ordered and random addition of substrates and products release. Factors affecting catalysis (pH, temperature, pressure, enzyme and substrate concentration) Enzyme inhibition: Types of reversible inhibitions – competitive, non-competitive, un – competitive and mixed inhibition. Irreversible inhibition-covalent modification (suicide inhibition). Substrate inhibition, feedback inhibition and allosteric inhibition.  Chemical nature of enzyme catalysis: General acid – base, Covalent and metal catalysis, Transition state, proximity and orientation.

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		Mechanism of co-enzymes: pyridoxal phosphate and flavin nucleotides
March 15+3	<b>Unit-IV: Enzyme Regulation</b>	<p>Catalytic mechanism of RNase  Catalytic mechanism of Chymotrypsin, Trypsin  Catalytic mechanism of Lysozyme  Catalytic mechanism of Carboxypeptidase, Subtilisin  Slow transition and Hysteretic behavior in enzymes.  Enzyme inhibitors as drugs: RT and Protease inhibitors as anti-HIV drugs</p> <p>Convergent and divergent evolution of enzymes  Reversible and irreversible activation of enzymes (phosphorylation, pro-enzyme)  Enzymes activation by ligand binding and dimerization (protein tyrosine receptors)</p>
April 6+3		<p>Allosteric enzymes; binding of ligands to proteins, co-operativity,  Hill plot for Myoglobin and Hemoglobin, sigmoidal kinetics;  MWC and KNF models. Significance of sigmoidal behavior.  Study of ATCase as a typical allosteric enzyme.  Regulation of Glutamine Synthetase  Multiple forms of enzymes-Lactate dehydrogenase.</p>

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**Academic Organiser (2017-18)****M.Sc- Sem-II****Bio chemistry: Paper-II: BI 202T: Molecular Biology****Name Of the Lecturer: M.Usha**

Month & No. of teaching days	Unit	Name of the Topic
January 15	Unit – I: DNA Replication	Models of replication – random, conservative, semiconservative. Prokaryotic and eukaryotic DNA polymerases, helicases, ligases, topoisomerases. Initiation – primosome, ori-sequences, accessory proteins. Elongation – replisome, leading and lagging strands, Okazaki fragments. Termination, Inhibitors of replication. Replication of circular chromosomes by theta model-E. coli, $\phi$ X 174. Replication of circular chromosomes by rolling circle (lambda phage) and strand displacement models (mt-DNA). Replication of linear chromosomes, telomeres, telomerase. Amplification – Polytene and double minute chromosomes. <i>In vitro</i> replication - PCR
February 16+5 Extra	Unit – II: DNA Repair  Unit – III: Transcription	Types of damage – oxidation, deamination, alkylation, adducts, breaks. Direct repair – MGMT, photo-reactivation, AlkB. Base Excision Repair (Short and Long Patch). Nucleotide Excision Repair. Mismatch Repair. Repair of DSBs by NHEJ and Homologous recombination. Holiday junctions and repair of collapsed forks. SOS and bypass repair. Diseases due to defects in DNA repair. Roles of ATM, BRCA in DNA repair  Principles of transcription. prokaryotic RNA polymerases. Bacterial transcription - Initiation – promoter sequences. Elongation and termination of transcription– rho dependent and independent. Basal, Constitutive and regulatory levels of transcription.
March 14+2 Extra	Unit – III: Transcription  Unit – IV: Translation	Eukaryotic DNA dependent RNA polymerase -I (ribosomal repeats). Polymerase –II, Promoters and enhancers. Polymerase-III, 5s and tRNA. Post-transcriptional modifications - capping, Poly A addition Splicing and RNA editing; Inhibitors of transcription.  Nature of genetic code, Wobble hypothesis. Ribosomes, structure, functional domain and subunit assembly. Components and mechanism of translation. Initiation, elongation and termination of translation in Prokaryotes.
April 8	Unit – IV: Translation	Inhibitors of protein synthesis. Translational controls. Non-ribosomal protein synthesis- antibiotic peptide. <i>In vitro</i> translational systems-Wheat germ, rabbit reticulocyte lysate and Xenopus Oocyte. Post translational modifications of proteins. Role in targeting (isoprenylation)

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M.Sc- Sem-II

Bio chemistry: Paper-II: BI 203T Biochemical Genetics and Model Organisms

Name Of the Lecturer: M.Usha

Month & No. of teaching days	Unit	Name of the Topic
December 6+2 Extra	Unit – I: Mendelian Genetics	Mendel's Laws, Importance of meiosis in heredity, Non-Mendelian Inheritance – Maternal effect, Maternal influence, Cytoplasmic inheritance. Gene interactions - Epistasis, Expressivity, Penetrance. Sex linked, sex limited, and sex influenced genes;
January 17+4 Extra	Unit – I: Mendelian Genetics  Unit – II: Linkage and Mapping	Polygenic inheritance and polyploidy. Mutations (spontaneous / induced, somatic / germinal, forward / reverse, transition / transversions). Mutations (Silent, missense, nonsense, and frame shift mutations, conditional, leaky). Detection, selection & isolation of microbial mutants, Estimation of mutation rates. Reversion and suppression of mutations. Mutagens – physical, chemical. Transposon mutagenesis, site-directed mutagenesis  Discovery of linkage, Morgan's experiments. Cytological proof of crossing over. 2- and 3- point crosses. Recombination, Interference. Tetrad analysis Mapping human genes by pedigree analysis; Fundamentals of population genetics (HW Law). Pedigrees of AR, AD, XR, and XD inherited trait. Mobile genetic elements – Zea Ac, Ds and Spm elements
February 16	Unit – II: Linkage and Mapping  Unit – III: Bacterial Genetics	<i>Drosophila copia</i> , Yeast Ty elements. Using recombination to make knockout cells / organisms  Discovery of conjugation. Mapping bacterial genes by conjugation. Discovery of transformation. Mapping bacterial genes by transformation. Discovery of transduction. Mapping bacterial genes by transduction. Discovery of transposition. Structure of transposons, replicative and conservative transposition, use as mutagens. Mapping phage genes – Fine structure of rII locus: Complementation analysis. Fine structure of rII locus: Deletion mapping

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March 15	Unit – IV: Model Organisms	<p><i>Dictyostelium</i> to study cell – cell communication and differentiation. <i>Saccharomyces</i> to study homologous recombination in mating type switch; site of formation of buds. <i>Neurospora</i> to study one gene – one enzyme hypothesis. <i>Drosophila</i> to study embryonic development (homeotic mutations). <i>C. elegans</i> to study development and nervous system. <i>Danio</i> to study vertebrate development, GLO fish. <i>Xenopus</i> to study embryogenesis. <i>Mus</i> inbred and knockout strains, NOD and nude mice. <i>Zea mays</i> to demonstrate cytological proof of crossing over. <i>Arabidopsis</i> to study flower development</p>
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**Academic Organizer 2017-18**

**M.Sc SEMESTER II**

**Biochemistry: Paper-IV: BIostatistics AND CLINICAL BIOCHEMISTRY**

**Name of the lecturer: Dr.S.Padma**

MONTH	Paper /Unit	TOPICS COVERED
DECEMBER 3	<b>I Biostatistics-I</b>	fundamentals (sample, population, variable); Types of variables, Measurement and measurement scales Measures of central tendency (mean, median, mode) Measurement of dispersion (range, variance, standard distribution) Study of bivariate data: correlation and regression
JANUARY 15+2	<b>I</b>          <b>II: Introduction to Clinical Biochemistry</b>	Graphical methods to depict data (histograms, bar-plots, pie charts, line graphs) Probability and probability distribution( Normal, Binomial, Poisson) Student's t – test Chi – square test; Contingency tests CRD: Completely Randomized Design; 1-way ANOVA, RCBD: Randomized Complete Block Design; 2-way ANOVA  Precision, reliability, reproducibility and other factors in quality control, Normal values in health and diseases. Radio isotopes in diagnosis. Specimen collection. Automation
FEBRUARY 13+4	<b>II</b>          <b>III Pathophysiology</b>	QA in clinical laboratories Examination of Urine, Blood, Sputum & CSF Storage of specimens, Clinical laboratory informatics, Renal function tests, osmolarity and free water clearances, acute and chronic renal failure, Liver function tests Gastric function tests and pancreatic function tests. Free radical metabolism, ROS in disease Plasma proteins in health and disease, Paraproteinemias, proteinuria, Hyperlipoproteinemias and lipidemias. clinical application of plasma enzyme assays , Jaundice, Nutritional assesment therapy, cholesterol, sodium and blood pressure, Eating disorders, physiological interrelationship Between cardiovascular, respiratory and renal systems.

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<p>MARCH 15+1</p>	<p><b>IV: Molecular diagnostics of genetic defects</b></p>	<p>Pregnancy test, prenatal diagnosis &amp; genetic counseling, Diagnosis of anemia, thalassemia Diagnosis of genetic diseases by molecular biology techniques (cystic fibrosis, Hemachromatosis, thalassemiias, sickle cell diseases) DNA probes; restriction fragment length polymorphism (RFLP); polymerase chain reaction (PCR); Amplification of mRNA</p>
<p>APRIL 7</p>	<p><b>IV: Molecular diagnostics of genetic defects</b></p>	<p>AIDS, Clinical diagnosis. Oncogenic enzymology: acid phosphatase, alkaline phosphatase, lactate dehydrogenase. Body fluid constituents of use in oncology, Newborn screening: PKU, tyrosinemia, aminoacidurias, organic acidurias, porphyrias. Acetylcholinesterase and other tests on amniotic fluid; chromosomal abnormalities by cytogenetics.</p>

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**Academic Organizer (2017-18)**  
**M.Sc Biochemistry II Year, Semester-III**

**Paper-I: BI 301T: Gene Regulation and Genetic Engineering**  
**Lecturer: Dr. A.Sai padma**

Month/ No of Teaching Days	Unit	Name of the topic
June 10+2	<b>Unit – I: Gene Regulation in Prokaryotes and Viruses</b>	Operon concept for gene regulation Positive (+ve)&Negative (-ve) control, Lac operon Attenuation – Trp operon Dual promoters – gal operon: Dual function of repressor – ara operon Phase variation in <i>Salmonella</i> flagellar protein synthesis Sporulation gene expression in <i>Bacillus</i> Riboswitch
July 15 +3	<b>Unit – II: Gene Regulation in Eukaryotes</b>	Anti – termination in lambda phage Lytic / lysogenic switch in lambda phage Control of plasmid copy number  Chromatin structure in active and inactive regions – DNA methylation. Eu-chromatin, histone acetylation, H2AX foci, histone code Transcriptional control – cell specific expression – promoters, enhancers, Transcription factors. Post- transcriptional control – alternative splicing RNA editing. RNA transport and stability. Translational feedback. Gene silencing – inactivation of mammalian X chromosome. Regulation by siRNA Gal operon of yeast. MAT locus and mating type switch in yeast, Antigenic variation in <i>Trypanosoma</i> .
August 14 +3	<b>Unit-III: Recombinant DNA Technology</b>	Enzymes in rDNA technology: Restriction endonucleases (discovery, properties).DNA and RNA polymerases Enzymes in rDNA technology: Nucleases, Kinases. Phosphatases, and Ligases Prokaryotic vectors (plasmids, cosmids, phage, phagemid, BAC) Eukaryotic vector-YAC and Expression vectors (insect, plant, mammalian cells)..Shuttle vectors, Targeting vectors Construction of cDNA and genomic DNA libraries Screening a library (+ve)&(-ve) selection strategies, Preparation of probes Southern blotting, Northern blotting, South-Western blotting. Creating KO cells, Cre – Lox systems.

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	<b>Unit – IV: Genetic Engineering:</b>	Yeast 2 hybrid Phage display
<b>September 10</b>		Reporter genes – GFP, b – gal, luciferase Expression in heterologous systems – bacteria Expression in heterologous system – yeast cells Expression in heterologous system – insect cells Expression in heterologous system – mammalian cells Molecular markers – RFLP, AFLP Random amplification of polymorphic DNA (RAPD), Short tandem repeat, Single-nucleotide polymorphism (SNP), Ribotyping
<b>October 3</b>		Molecular markers – RFLP, AFLP.

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**Academic Organizer (2017-18)**  
**M.Sc Biochemistry, Semester-III**  
**Paper II**  
**Immunology and Immunotechnology**

**Lecturer: D.Rajani**

Month and No of teaching days	Unit	Name of the topic
June 11	Unit I	<b>Components of the Immune System</b> History of immunology. Natural & acquired immunity, Specific & non-specific immune response. Cells & organs of immune system. Antigenic determinants, Epitopes, Haptens, Properties of strong antigens. Adjuvants – types, mode of action, and applications. Classification, structure, and biological properties of immunoglobulins. Isotypes, allotype, idiotypes. Theories of antibody formation, Generation of antibody diversity
July 16	Unit I Unit II	Genomic rearrangements of light and heavy – chain loci in B-cells Genomic rearrangements in T-cell receptor, structure of CD3, CD4, CD8. <b>Events in Immune Response</b> Humoral & cell-mediated immune response. Activation of T cells & B cells. Kinetics and regulation of primary and secondary immune response. MHC proteins structure & functions. Antigen processing & presentation. Transplantation immunology. Graft Versus Host Disease
August 15	Unit II Unit III	Complement fixation: pathways and biological consequences. Discovery and action of interferons. Cytokines in inflammation, obesity and cancer. Tumor immunology. <b>Immune Disorders</b> Hypersensitivity; Coombs classification. Type I-V hypersensitivity. Tests for diagnosis of hypersensitivity (Coombs), Tuberculin test. Auto immune diseases; classification Study of selected auto – immune disorders of types I – V. Immuno- deficiency disorders – primary and secondary deficiencies. Gene therapy for ADA deficiency and Immunology of AIDS
September 15	Unit III Unit IV	Immunosuppressive drugs and agents & their mechanism of action. Immune evasion by bacteria and viruses. <b>Immunotechnology</b> production of polyclonal antibodies; Animals models for production of antibodies. Methods of antibody purification: Salt precipitation, Affinity chromatography. Antigen-antibody binding (Equilibrium dialysis, Surface Plasmon Resonance); Affinity, Avidity Immunoprecipitation, Agglutination tests (Direct and indirect), Inhibition of Agglutination, Complement fixation test, Inhibition of complement fixation. ELISA, RIA Western Blots; use of antibody staining for FACS. Hybridoma technology – production of monoclonal antibodies; applications in research and immunotherapy; antibody engineering. Types of Vaccines.
October 3	Unit IV	Conventional vaccines - killed, attenuated, and subunit vaccines. Modern vaccines; peptide, DNA, recombinant / vector, and anti-idiotypic vaccines. Schedules of common vaccination, Benefits and adverse consequences of vaccination.

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**Academic Organizer 2017-18**

**M.Sc SEMESTER III**

**Biochemistry: Paper-IV: BI 303T: Cell signaling, Differentiation and methods of cell study**

**Name of the lecturer: Dr.S.Padma**

MONTH/No of Teaching days	Unit	Name of the topic
JUNE 12	<b>UNIT I- Ultra structure of Cell</b>	Structural organization of prokaryotic cells, Structural organization of eukaryotic cells (Plant/animal cells) Ultra structure of mitochondria, chloroplast, nucleus. ER. Golgi etc Extracellular matrix-collagen, elastin, fibrillin, fibronectin, laminin & proteoglycans. Integrins.
JULY 16	I  <b>Unit – II: Methods of Cell Study</b>	Cell junctions, Cell adhesions, Cytoskeleton-microtubules, microfilaments and myosin, Totipotency, General strategies of cell cycle and its regulation, Early embryonic cell cycle & M-phase maturation factor Simple and compound microscope Phase contrast, dark field and polarization microscopy, Electron microscopy, SEM, TEM; freeze fracture, Fluorescence and Confocal microscopy; imaging live cells, FRET and FRAP, Atomic force microscopy, Flow-Cytometry and cell sorting (FACS), Plant tissue culture.
AUGUST 15	II  <b>Unit III: Cell Signaling</b>	Animal and insect tissue culture, Methods of cell disruption and fractionation, isolation of organelles. Cell communication and types of signaling molecules, Types of receptors and their structure, Monomeric and trimeric G-proteins and their role, Second messengers – cAMP, cGMP, Ca <sup>+2</sup> , calmodulin, inositol, NO, Introduction of signaling components in bacteria, Chemotaxis, Plant signaling system an over view.
SEPTEMBER 13	III  <b>Unit IV: Cell &amp; Differentiation</b>	Stress signaling in plants (biotic), Stress signaling in plants (abiotic), Plants hormones and their mechanism of action Overview of developmental regulation, Platelet derived growth factor (PDGF); Epidermal growth factor (EGF), Insulin like growth factor (IGF), Nerve growth factor, Vascular endothelial growth factor (VEGF), Tumor necrosis factor (TNF) & erythropoietin, Fibroblast & muscle cell differentiation.
OCTOBER 4	III/IV	Formation of body pattern in Drosophila, Apoptosis and apoptosome, Modes of action of TS genes – p110, p16, p21, Phosphatase and tensin homolog (pTEN), p53 and c-Myc

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**Academic Organiser (2017-18)**

**M.Sc- Sem-III**

**Bio chemistry: Paper-IV: BI304T: Endocrinology and Metabolic Disorders**

**Name Of the Lecturer: M.Usha**

Month & No. of teaching days	Unit	Name of the Topic
June 11+4 Extra	Unit – I: Hormones and Endocrine glands	History of endocrinology, Organization and classification of hormones and endocrine systems, Basic mechanism of action of peptide hormones and receptors, Basic mechanism of action of steroid , hormones and receptors, Chemistry, physiology, and disorders related to Hypothalamus-Pituitary axis, Chemistry, physiology, and disorders related to thyroid and parathyroid glands, Glycoprotein hormones (LSH, FSH, TH, hCG, POMC), Growth hormone family (GH, hCS, Prolactin), Adrenal hormones, Gonadal hormones
July 16	Unit – II: Endocrine regulation  Unit – III: Disorders of Amino Acid and Carbohydrate Metabolism	Regulatory pathways (positive, negative, feedback loops), Regulation of biosynthesis of steroid hormones by peptide hormones (LH, FSH, ACTH) Endocrine regulation of growth, Endocrine regulation of stress, Endocrinology of Ca homeostasis, Endocrinology of blood sugar, hunger, digestion, and obesity, Endocrine regulation of renal function, Endocrine regulation of cardiovascular system (angiotensin, BNP, ET1), Endocrinology of fertility (changes in menstruation, pregnancy, and menopause), Medical uses of steroid hormones (contraception, HRT, hydrocortisone, anabolic steroids), Erythropoietin, Adipocytokines, Orexins  Disorders of aromatic amino acid metabolism,
August 13		Disorders of proline and hydroxyproline metabolism, Disorders of lysine metabolism, Hemoglobinopathies; Thalassemia, Genetic defects in metabolism of amino acids ( maple syrup urine disease, homocystinuria, methyl malonic Acidemia), Genetic defects in metabolism of urea (Argininemia, ArignosuccinicAcidemia, Carbamoyl Phosphate Synthetase-I deficiency), Disorders of glycogen storage, Disorders of fructose and Galactose metabolism Pentosuria,
September 14	Unit – IV: Disorders of Lipids and Nucleic Acids Metabolism	Diabetes Disorders of acid Lipase deficiency, Farber's disease, Neeman-Picks disease, Goucher's disease, Krabbe disease, Sulphatide-lipdosis disease, Fabry disease, Downs and Turner's syndrome, Hyperuricemia and Gout,
October 2		Hereditary Xanthinuria and Lesch-Nyhan syndrome

*U. Sai Reddy*  
12/6/17

**Academic Organizer 2017-18**

**M.Sc SEMESTER IV**

**Biochemistry: Paper IV: Physiology And Xenobiotics**

**Name of the lecturer: Dr.S.Padma**

MONTH/No of Teaching days	Unit	Name of the topic
November 13	<b>I: Neurophysiology</b>	Types of neuronal cells – Neuroglia, microglia, astrocytes, oligodendrocytes, Schwann, satellite and epididymal cells Nerves: regeneration of nerve fibers, generation of nerve impulse, all or none principle. Mechanism of synaptic transmission, transmission of nerve impulse. Types of neurotransmitters and their receptors, mode of signaling, Electrical synapse and giant neurons, Division of vertebrate nervous system: CNS, PNS, ANS, regions of the brain, Sensory organs – eye, ear, skin, tongue Vision: visual system, rhodopsin and classical GPCR mechanism, termination of visual signal, Cone cells, specialization in color vision, physiology of colour blindness, Similarity between vision, olfaction and gustation.
December 14+1	<b>I: Structure and Physiology of Muscle</b>	Structure of various types of muscle: striated, cardiac, smooth, fast twitch, slow twitch, Mechanism of muscle contraction, regulation of contraction, Role of actin and myosin in non-muscle cells., Cytochalasins and cytokinesis. Muscle gene expression, regulation at transcriptional and posttranscriptional level. Role of muscle proteins in cell locomotion, Neuro-muscular transmission, Electromyography, Sherrington starling Kymograph (recording drum), Disorders of muscle (dystrophy, myopathy, monocytosis, myotonia, paralysis, Myasthenia gravis), Detection and treatment of muscle disorders Disorders of muscle (dystrophy, myopathy, monocytosis, myotonia, paralysis, Myasthenia gravis), Detection and treatment of muscle disorders
January 15	<b>III: Human Reproductive Biology</b>	Female reproductive system: anatomy and endocrinology, Causes of female infertility (acquired and genetic), treatments, Male reproductive system: anatomy and endocrinology, Causes of male infertility (environmental and genetic), treatments, Puberty, reproductive aging (menopause and andropause), Gametogenesis and

*A. Sai Padma*  
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		fertilization (natural and assisted ( <i>in vitro</i> )), implantation and placenta, Milestones in first trimester of pregnancy ( <a href="http://www.ehd.org/virtual-human-embryo/">http://www.ehd.org/virtual-human-embryo/</a> ), Milestones in second trimester of pregnancy. Milestones in third trimester of pregnancy, child birth, Placenta as source of stem cells, cord banking
February 14+1	<b>IV: Liver and Xenobiotics</b>	Liver functions, pharmacopeia drug deposition and mechanisms of drug detoxification, Cytochrome P450 enzymes, molecular biology, catalytic cycle, isozymes, inhibitors. Dose response relationship, drug-receptors interactions, Pharmacodynamics; pharmacokinetics, Phase I reactions - modifications, Phase II reactions - conjugation Phase III reactions - modifications and elimination,
March 2	IV	Environmental factors influencing drug metabolism Effects and metabolism of model toxins: aflatoxins, bacterial exotoxins (types I, II, and III), Nutrient drug interactions - I and II

A. Lai Jade  
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**ACADEMIC ORGANISER -2017-18**

**M.Sc SEMESTER IV**

**Biochemistry: Paper-II: Bioinformatics**

**Name of the lecturer: Dr.S.Padma**

MONTH	Unit	TOPICS COVERED
November 12	<b>I Genomics</b>	Genomics and branches of genomics (Why study a genome?) HGP and Strategies for sequencing genomes (shotgun and hierarchical sequencing), 1st generation sequencing methods (Maxam and Gilbert Method; Sanger's method), 2 <sup>nd</sup> and 3 <sup>rd</sup> Generation DNA sequencing methods (Next Generation Sequencing), Genetic and Physical maps of the genome, EST, STS, DNA sequence databases, Use of databases; data mining, Comparing DNA sequences, pairwise local and global alignment, BLAST, FASTA, PAM and BLOSUM matrices, Multiple sequence alignments (Phylogenetic trees, Clustal-W, COBALT),
December 14	<b>II: Transcriptomics</b>	Epigenomics and metagenomics: Relation of transcriptome to genome and proteome (Why study a transcriptome?) Tools of transcriptomics: Northern blots, RNase protection assays, RT-PCR and Q-PCR, HT tools of transcriptomics: Microarrays for expression profiling, alternate sequencing, HT RNA sequencing: SAGE, MPSS, RNA-Seq, GIGA, Identifying expressed sequences by ChIP-seq, DNase-seq, ENCODE Project (Encyclopedia of DNA Elements), Design and analysis of siRNA / RNAi for expression analysis; siRNA libraries, Anti-sense oligos for regulating transcriptome, Regulation by miRNA, Extent and role of ncRNA, GWAS association with phenotypes, Transcriptome databases (ESTs, Transcriptome Shotgun Assembly, ArrayExpress)
January 17+1	<b>III: Proteomics</b>	Relation of proteome to genome and transcriptome (Why study a proteome?) HUPO goals and accomplishments, Methods for sequencing proteins: Edman degradation 2D gels and peptide maps MS – MALDI. LC-MS, Tandem MS (MS-MS) Micro-arrays for proteins, Proteins motifs, sequences, and structure databases; Peptide sequence and MS profiles databases, Comparing protein sequences, alignment, Predicting secondary structure- <i>ab initio</i> , Homology folding, threading,

*Dr. S. Padma*  
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		Post-translational modification (kinome, glycosylation)
February 16	<b>IV: Synthetic Biology</b>	Comparative genomics, evolution of human karyotype, Sequencing genomes of individuals; ethical concerns SNPs and human disease Genomics for rational drug design and drugdiscovery, Pharmacogenomics Nutrigenomics, Metabolomics, PCR techniques to create synthetic genes and genomes Minimal genome concept, Building an artificial phage; Building an artificial bacterium, Metagenomics for study of ecological samples.

*A. Sai Padak*  
9/11/12

**Academic Organizer**  
**(2017-18)**  
**M.Sc II YEAR Biochemistry (CBCS)**

**Semester IV: Paper III - Biotechnology**

Name of the lecturer: S.Vanitha

Month & no of teaching days	Unit	Name of the topic
November 12 (3 extra)	Unit IV  Protein engineering	Methods of immobilization of enzymes and cells, large scale production, site directed mutagenesis, high throughput screening tools, rational protein design and directed enzyme evolution, top 7 (Kuhlman <i>et.al</i> ), tags for protein purification, natural and recombinant fusion protein, altering kinetics, pH, specific activity, increasing stability, pegylated interferon, macro modifications. Methods of drug design & delivery.
December 13 (2 extra)	Unit III  Animal biotechnology	Development, maintenance and establishment of animal cell culture, cloning in mammalian and non- mammalian cells, production of viral vaccines, IFN, tPA, high value therapeutics, urokinase, monoclonal antibodies, chimeric antibodies, immunotoxins as therapeutics. Gene knockout , transgenic animals and application, human gene therapy, humanized animals as organ farm.
January 12 (3 extra)	Unit II  Plant biotechnology	Plant cell culture, callus, protoplast fusion, differentiation to plantlets, plant vectors- Ti plasmid, GM food and crops, terminator technology, anti- sense RNA, plantibodies, case studies of Bt cotton, Bt corn, Zeneca tomato paste, flavr savr tomato, virus resistant plants, roundup ready, golden rice.
February 13 (2 extra)	Unit I  Microbial biotechnology	Large scale cultivation of microbes, fermenter design, down stream processing, production of biomass, SCP, low molecular weight compounds, insecticides, enzymes for research, production of HFCS, cheese, polysaccharides (xanthan gum, gellan, pullulan etc), microbial mining, production of human insulin, interferon, human growth hormone, tPA, Superbug, microbial degradation of oil - bioremediation of oil spills.

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**Academic Organiser (2017-18)**

**M.Sc- Sem-IV**

**Bio chemistry: Paper-IV: BI404T: Microbiology (Elective)**

**Name Of the Lecturer: M.Usha**

Month & No. of teaching days	Unit	Name of the Topic
November 5	Unit – I: Fundamental Microbiology	Classification of bacteria, morphological types, distribution in nature. Isolation methods: Pure culture techniques & enriched cultures. Motility in bacteria.
December 7	Unit – I: Fundamental Microbiology	Staining methods (Gram's staining acid-fast & spore staining). Sterilization methods: Autoclaving, dry heat, filtration; chemical disinfectants, and irradiation by gamma rays. Growth Media: Supplemented media, Selective media & minimal salts media .Maintenance and preservation of microbial cultures .Bacterial Growth: Growth curve
January 7+2 Extra	Unit – I: Fundamental Microbiology  Unit – II: Viruses	doubling time. factors affecting growth (pH, temperature, factors affecting growth (pH, temperature, oxygen & agitation). Chemostat, continuous & synchronous cultures.  Discovery and general characteristics of viruses. Structure & composition of TMV, Cauliflower mosaic virus. One-step growth, single burst & eclipse experiments. General features of host-virus interactions- permissive and non-permissive hosts.
February 8+1 Extra	Unit – II: Viruses	Lytic versus lysogenic life cycles of $\lambda$ Phage. Assay methods (Plaque assay, Pock assay, heme agglutination assay, transformation assay). Purification methods (ultrafiltration, ultracentrifugation & affinity methods). Cultivation of viruses in animals & tissue culture. Life cycles of animal viruses (Poliovirus, Retroviruses (RSV/ HIV). Virusoids and viroids & prions.

*M. Usha*  
9/11/17