PERIYAR E.V.R.COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 6200 23									
GENERAL COURSE PATTERN FOR PG – BIOCHEMISTRY 2018 – 2019 ONWARDS									
S.No.	PART	COURSE	COURSE TITLE	Exam Hrs.	Hrs.	Credits	Internal Exam	External Exam	Total
I SEMESTER									
1		Core I	**Bimolecular Chemistry**		6	5	25	75	100
2		Core II	**Analytical Biochemistry**		6	5	25	75	100
3		Core III	**Microbiology**		6	4	25	75	100
4		Core IV	**Cell Biology**		6	4	25	75	100
5		Core V P	**Major Practical – I**		6	4	40	60	100
			TOTAL		**30**	**22**	**140**	**360**	**500**
II SEMESTER									
6		Core VI	**Metabolism and Regulation**		6	5	25	75	100
7		Core VII	**Enzymology and Bioenergetics**		6	5	25	75	100
8		Core VIII	**Molecular Biology**		6	5	25	75	100
9		Core IX	**Physiology**		6	4	25	75	100
10		Core X P	**Major Practical - II**		6	4	40	60	100
			TOTAL		**30**	**23**	**140**	**360**	**500**
III SEMESTER									
11		Core XI	**Clinical Biochemistry**		6	5	25	75	100
12		Core XII	**Immunology**		6	5	25	75	100
13		Core XIII P	**Major Practical III**		6	5	40	60	100
14		CBE I	**Advanced Endocrinology**		6	4	25	75	100
15		CBE II	**Biostatistics and Bioinformatics**		6	4	25	75	100
			TOTAL		**30**	**23**	**125**	**375**	**500**
IV SEMESTER									
16		Core XIV	**Genetic Engineering**		6	5	25	75	100
17		Core XV P	**Major Practical -IV**		6	5	40	60	100
18		CBEIII	**Molecular Diagnostics**		6	4	25	75	100
19		CBE IV	**Pharmacognosy**		6	4	25	75	100
20		Project	**Project Work**		6	4	25	75	100
					30	**22**	**125**	**375**	**500**
					120	**90**	**500**	**1500**	**2000**

பெரியார் ஈ.வெ.ரா. கல்லூரி (தன்னாட்சி), திருச்சிராப்பள்ளி - 620023

PERIYAR E.V.R. COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 620023

DEPARTMENT OF BIOCHEMISTRY

M. Sc BIOCHEMISTRY SYLLABUS

(For the students admitted from 2018-2019 onwards)

BIOMOLECULAR CHEMISTRY

Objective: To understand the basis of macromolecules and their structure.

Unit -I

Carbohydrates: Structure and biological functions of Mono, di and Polysaccharides. Types of polysaccharides: Homo polysaccharides -chitin, fructans, mannans, xylans, and galactans. Structure and biological importance of Hetero polysaccharides- sugar derivatives glycosaminoglycans, proteoglycans. Glycoprotein – Blood group and bacterial cell wall polysaccharides, O- linked and N- linked oligosaccharides, marine polysaccharides and Lectins.

Unit -II

Amino acids: structures, classification and properties. Essential and non essential amino acids- aromatic amino acids - Amphibolic activity of amino acids- Amino acid sequencing - Protein - classification, characteristics features - primary, secondary, super secondary and tertiary structures, functions - Methods for determining protein conformations, symmetry and functional properties, domains – motif and protein folding, Stability of Proteins - denaturation &renaturation, ramachandran plot

Unit -III

Lipids: classification, sources and biological functions. Types of fatty acids - triacylglycerols - Membrane lipids - phospholipids, sphingolipids & eicosanoids. Structure, properties and functions of Cholesterol - Lipoproteins- types and functions – leukotriens – prostaglandins- bile acids, sex hormones and thromboxanes

Unit -IV

Nucleic acids: nitrogenous bases, nucleosides & nucleotides, Structure, types and biological functions of RNAs and DNA, forces stabilizing nucleic acid structures – Watson and Crick model- A, B and Z DNA- repetitive DNA - Super coiling – cot curve- Base stacking – denaturation and renaturation – Properties – Tm value –Linking number – micro RNA

Unit- V

Minerals, Vitamins and antioxidants: Water soluble vitamins – fat soluble vitamins- Sources, function and deficiencies- Minerals in Biological systems and its importance –Iron, calcium, Phosphorous, Iodine, Copper, Zinc - Antioxidants enzymic and nonenzymic antioxidants

Books

1. Zubay, G L., 1998. Biochemistry, WCB Publishers, USA.

2. Robert K. Murray et al., 2000. Harper's Biochemistry, Appleton and Lange Stainford Publishers, Connecticut.

3.Harper's Biochemistry 25th edition McGraw Hill

4. Principles of Biochemistry. Lehninger Nelson Cox Macmillan worth, Publishers, 2000.

5. Biochemistry. Davidson and Sittmann, NMS 4th ed. Lippincott Williams and Wilkins, 1999

References

1. Stryer, I., 1988. Biochemistry (2nd Edition), W.H. Freeman & Co., New York.

2. Lehninger, A. L. et al., 1993. Principles of Biochemistry, Worth Publishers. Inc. USA.

ANALYTICAL BIOCHEMISTRY

Objective

To understand the working principles, construction and applications of the instruments used in the studies related to various disciplines of biological sciences.

Unit- I

Electrochemical techniques: Principles, electrochemical cells and reaction, pH and buffers; measurement of pH (glass electrode) and titration curves. Ion selective and gas sensing electrodes, oxygen electrode, and their applications. Chromatographic techniques: general principles; adsorption and partition chromatography. Techniques and applications of - paper, column, thin layer, normal phase and reverse phase - ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC and HPLC, HPTLC.

Unit -II

Centrifugation: Principles, differential and analytical centrifugation, density gradient centrifugation; Analysis of sub cellular fractions, ultracentrifuge and its application. Tracer technique: Nature of Radioactivity: Patterns of decay, half life and its application, Geiger Muller Counter- principle and applications. Scintillation counter – Principle, types and applications. Use of isotopes in biological studies.

Unit- III

Electrophoresis: Principles, electrophoretic mobility, factors influencing electrophoretic mobility – Agarose gel electrophoresis – SDS PAGE - paper, disc, slab gel electrophoresis. Isoelectric focusing, 2D PAGE, capillary electrophoresis. Pulse field Electrophoresis, Isotachophoresis - Native gel – Gradient gel electrophoresis

Unit- IV

Spectroscopy: –Beer Lambert's Law – absorption spectrum, principle, instrumentation and applications of UV / VIS spectroscopy, IR, ESR, AAS & flame photometer, NMR, GC-MS, LC-MS, MALDI-TOF

Unit- V

Molecular techniques: PCR– basic principle, RT-PCR, quantitative PCR and in situ PCR. Comet assay. Mutagenecity testing– Ames test. DNA finger printing, DNA foot printing.Membrane blotting and hybridization of nucleic acids- southern, western, northern blot and fluorescent insitu hybridization- RFLP, RAPD, AFLP

Books

1. Keith Wilson & John Walker 2005. Principles and Techniques of Practical Biochemistry, Cambridge University Press, India.
2. Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath, 2014. Biophysical Chemistry (Principles and Techniques) 4th Edition, Himalaya Publishing House, India.
3. Braun, R.P. 1987: Introduction to Instrumental Analysis, Tata McGraw Hill, India
4. West, E.S. and Todd, W.R., 1985, Textbook of Biochemistry, MacMillan, Germany.
5. Kothari, C.R. Research Methodology, Methods and Techniques 2nd Edn, New Age International Publishers. New Delhi.

MICROBIOLOGY

Objectives

i) To understand the applications of different microbes.
ii) To study the applications of microbiology in various industries.

Unit -I

General Microbiology: Introduction and scope of microbiology. Brief study of structure and organization of major groups of microorganisms - archaebacteria, cyanobacteria, eubacteria, fungi, algae, protozoa and viruses. Culture of microorganisms - batch, continuous and pure cultures. Control of microorganisms - physical, chemical and chemotherapeutic agents. Preservation of microorganisms.

Unit -II

Microbial growth and metabolism: Microbial growth– definition. growth curve, measurement of growth and growth yields, synchronous growth, factors affecting growth. Microbial metabolism–Photosynthesis in microbes.Role of chlorophylls, carotenoids and phycobilins, Calvin cycle. Hydrogen– iron– nitrite oxidising bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis, fermentations– diversity, Nitrogen metabolism, nitrogen fixation, hydrocarbon transformation.

Unit -III

Environmental Microbiology: Microbiology of soil - soil microflora, role of soil microbes in biogeochemical cycles (C,N,S) - Marine and fresh water microbiology. Contamination of domestic and marine waters. Water purification and sewage treatment. Microbes in waste water treatments. Microbiology of air - Role of microbes in biogas production,

Unit -IV

Clinical Microbiology: Epidemic, endemic, pandemic and sporadic diseases. Pathogenicity, virulence and infection. Epidemiology of infectious diseases. Bacterial diseases of human (typhoid, cholera, syphilis, gonorrhoea and pertusis). Fungal diseases of human (superficial, cutaneous, subcutaneous and systemic mycoses). Viral diseases of human (AIDS, hepatitis, polio, rabies and measles). Mycoplasmal, Chlamydial, Rickettial and protozoan diseases of human. Mycotoxins.

Unit -V

Applied Microbiology: Microbial production of organic acids – citric acid and acetic acid Role of microbes in the production of antibiotics and vaccines. Microorganisms as biofertilizers – Bioremediation of contaminated oil - Microbes as foods –Microbial degradation of xenobiotic compounds - Microbial immobilization. Microbes in biological warfare.

Books

1. Pelczar et al. (1998): Microbiology. Tata McGraw-Hill, New Delhi.
2. Prescott et al. (1996): Microbiology, WMC Brown Publishers, USA.
3. Martin Alexander (1969): Introduction to soil microbiology. Wiley International, NY.
4. Gladwin and Trattler, 2013, Clinical Microbiology Made Ridiculously Simple (6th Edition), Medmaster, UK.

CELL BIOLOGY

Objectives i) To study the structural and functional organization of cells

ii) To understand the homeostatic mechanism of each organ system

Unit -I

Cell: Organelles: structure and functions of nucleus, mitochondria , golgi bodies, endoplasmic reticulum, ribosomes, lysosomes, plastids, Major classes of cell gap junctions – Major families of cell adhesion molecules and its roles – the cadherins (classical and desmosomal) – extra cellular matrix- integrins, connexins.

Unit -II

Biomembranes: structure of model membrane – lipid bilayer, fluid mosaic membrane model and membrane protein- Membrane assembly – importins and exportins. Membrane transport. Diffusion (passive and facilitated), osmosis, active transport (symport, antiport, Na+ K+ ATP ase), ion gradients, ion selective channels, group translocations, porins, endocytosis and exocytosis - Cell Wall

Unit –III

Cell division and cell cycle: mitosis, meiosis and their regulation, steps in cell cycle, regulation and control of cell cycle – Cancer Cell- Oncogenes – tumor suppressor genes - Programmed cell death – Brief outline of apoptosis. Differences between apoptosis and necrosis. – cell communication – cell to cell fusion in both normal and abnormal cells

Unit –IV

Genetics: Mendelian traits – Dominance – Segregation – Independent assortment - Linkage and crossing over - Tetrad analysis - Sex determination in plants - Sex limited and sex linked intentence - cytoplasmic inheritance - Male sterility, mechanisms, cytoplasmic, genetic and cytoplasmic and genetic male sterilities and applications

Unit- V

Developmetal Biology: Basic concepts of development : Potency, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development. Gametogenesis, fertilization and early development.

Books

1. Arthur C. Guyton, 2005, Text Book of Medical Physiology, WB Saunders's, USA.
2. C. C Chatterjee, 1985, Human Physiology Vol I & Vol II. 11th Edn, Kalyani Mukerjee Publications, Kolkata, India.
3. Reference 1. West, E.S. and Todd, W.R., 1985, Textbook of Biochemistry, MacMillan, Germany. 2. Zubay, 1998, Biochemistry 4th Edition, WMC Brown Publishers, USA.
4. Lodish et.al. Molecular Cell Biology 5th ed. 2003, WH Freeman.
5. Murray et al. Harper's Biochemistry 26th ed. Mcgraw Hill 2003
6. Smith et al. Principles of Biochemistry. Mammalian Biochemistry. McGraw, Hill 7th ed.
7. De Robertis and De Robertis. Cell and Molecular Biology. Lea and Febiger 8th ed.
8. Alberts et al. Molecular Biology of the Cell 4th ed. Garland Sci. 2002.

MAJOR PRACTICAL– I

Biochemical and Microbial Techniques

1. Estimation of Carbohydrate by DNS method
2. Estimation of proteins by Lowry method
3. Estimation of DNA by diphenylamine method
4. Estimation of RNA by orcinol method
5. Estimation of Iodine value of oil.
6. Estimation of Acid value of oil.
7. Staining technique - Grams staining
8. Determination of bacterial growth curve
9. Media preparation and Culture techniques - pour plate, spread plate and streak plate method.
10. Biochemical Characterization of Bacteria

    Indole test, Methyl red test, Triple sugar Iron Agar test, Voges Proskauer test, Citrate Utilisation test, Catalase test

    Demonstration

11. Separation of amino acids by circular, ascending and descending paperchromatography.
12. Separation of plant pigments by column chromatography.
13. Separation of lipids by TLC.

PHYSIOLOGY

Objectives: i) To study the functional mechanism of body organ systems.
ii) To understand the homeostatic mechanism of each organ system.

Unit I

General and cellular physiology: Cell as the living unit of the body. The internal environment - homeostasis. Control systems, functional systems in the cells, blood – Formed elements, composition, development and function - body fluids- plasma, CSF, synovial fluid, amniotic fluid - Hemoglobin - structure and function. Coagulation of blood, mechanism of clotting - clotting factors, clot retraction, fibrinolysis.

Unit II

Gastro-intestinal system: General principles of GI function – mastication and swallowing, esophageal motility, salivary secretion, gastric mucosal barrier, pancreatic and biliary secretion, gastrointestinal motility, digestion and absorption, functions of colon, pathophysiology of peptic ulcer. Absorption of carbohydrates, fats and proteins, vitamins, water and electrolytes.

Unit III

Cardio-vascular and respiratory physiology: Properties of cardiac muscle, cardiac cycle, heart as a pump, cardiac output, specialized tissues of the heart, coronary circulation, generation & conduction of cardiac impulse, control of excitation and conduction, electrocardiogram-arrhythmias. Principles of hemodynamics, neurohumoral regulation of cardiovascular function, cardiac failure, circulatory shock. **Respiration** - functional anatomy of respiratory system, mechanism of respiration, pulmonary circulation, principles of gaseous exchange - oxygen and carbon-dioxide transport, regulation of respiration, hypoxia, oxygen therapy and toxicity, artificial respiration.

Unit IV

Nerve and muscle physiology: Classification and properties of nerve fibers, nerve conduction, functional anatomy of skeletal muscle, neuro-muscular transmission and blockers, excitation-contraction coupling, mechanisms of muscle contraction, smooth muscles. General design of nervous system. **Special senses** - vision, hearing, smell, taste and their perceptions. Autonomic nervous system, limbic system and hypothalamus. EEG, sleep, emotions and behavior. Learning and memory.

Unit V

Renal physiology: Structure and function of kidney - Structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Tubular secretion. Homeostatic regulation of water and electrolytes, acid-base balance. Body fluid compartments. Urine formation. Regulation of extracellular sodium & osmolarity, renal mechanisms for the control of blood volume, blood pressure, micturition, diuretics, renal failure.

Reference Books

1. Arthur C. Guyton, 2005, Text Book of Medical Physiology, WB Saunders's, USA.
2. C. C Chatterjee, 1985, Human Physiology Vol I & Vol II. 11th Edn, Kalyani Mukerjee Publications, Kolkata, India.
3. West, E.S. and Todd, W.R., 1985, Textbook of Biochemistry, MacMillan, Germany.
4. Zubay, 1998, Biochemistry 4th Edition, WMC Brown Publishers, USA.

ENZYMOLOGY AND BIOENERGETICS

Objectives

i) To impart thorough knowledge about enzymes and enzyme kinetics.
ii) To understand the various concepts of bioenergetics.

Unit -I

Nomenclature and classification of enzymes: according to IUB-EC-1964. Intracellular localization of enzymes, homogenization techniques, isolation and fractionation of enzymes - classical methods of purification and crystallization - separation based on molecular size, electric charge, solubility difference and selective adsorption, criteria of purity, units of enzyme activity.

Unit -II

Principles of catalysis: - collision & transition state theories, specificity of enzymes. Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid - base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis. Coenzymes - structure and functions, Mechanism of enzyme action: lysozyme, chymotrypsin and carboxypeptidas.

Unit -III

Kinetics of catalyzed reaction: Single substrate reactions, bisubstrate reactions, concept and derivation of Michaelis -Menten equation, Briggs Haldane relationship, Determination and significance of kinetic constants, limitations of Michaelis - Menten kinetics. Inhibition kinetics- competitive, non-competitive and uncompetitive. Allosteric inhibition, cooperative, cumulative, feedback inhibition.

Unit -IV

Methods of immobilization: - ionic bonding, adsorption, covalent bonding, microencapsulation and gel entrapment. Immobilized multienzyme systems. Biosensors - glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors. Abzymes and ribozymes. Enzymes of clinical importance and diagnostic significance. Enzyme engineering-Isozymes – Applications of enzymes in industries

Unit- V

Types of thermodynamic systems: Exergonic and andergonic reactions – entropy - Enthalpy and biochemical reactions, thermodynamic laws - Biological oxidation, oxidation-reduction reactions. High-energy phosphate compounds, role of ATP in biological system; energy transfer; acyl-phosphate group transfer. Types of energy transformation in living systems; energy in photosynthesis. ETC – components and mechanism – Oxidative Phosphorylation - Organization of electron carriers and enzymes in mitochondria, chloroplast and microsomes and their inhibitors

Text Books

1. Dixon, M. and Webb, J.F., 1979, Enzymes, Longman Publishing, London.

2. Price and Stevens, 1999, Fundamentals of Enzymology, Oxford University Press, UK.

3. Trevor Palmer, 1991, Understanding Enzymes, 3rd Edition, Ellis Harwood, UK.

Reference books

1. Bohinski, R.C., 1987, Modern concepts in Biochemistry, Alllyn and Bascon Inc., Boston.

2. Caret et al., 1993, Inorganic, Organic and Biological Chemistry, W. M. C. Brown, USA.

3. Lehninger, A. H. et al., 1993, Principles of Biochemistry, Worth Publ. Inc., USA.

4. Rawn, J.D., 1989, Biochemistry, Neil Patterson Publ., North Carolina, USA.

5. Stryer, I. 1988, Biochemistry (II Ed), W.H. Freeman & Co., New York, USA.

6. Voet, D. and Voet, J.G., 1990, Biochemistry, John Wiley & Sons Inc., New York, USA.

METABOLISM AND REGULATION

Objectives:

To understand the metabolic pathways and regulatory mechanisms.

Unit -I

Carbohydrate metabolism: Glycolysis and gluconeogenesis– pathway, key enzymes, hormonal and co-ordinate regulation. Pyruvate dehydrogenase complex and the regulation of this enzyme through reversible covalent modification. The citricacid cycle and regulation. The pentose phosphate pathway. Metabolism of glycogen and regulation.

Unit -II

Lipid metabolism: Lipogenesis-Control of acetyl CoA carboxylase-Role of hormones-Effect of diet on fatty acid biosynthesis. Biosynthesis, degradation and Regulation of triacylglycerol, phospholipids and cholesterol. Metabolism of triacylglycerol during stress. α, β,γ, Oxidation of fatty acids– Role of carnitine cycle in the regulation of β -oxidation. Ketogenesis and its control. Lipoprotein metabolism exogenous and endogenous pathways

Unit -III

Metabolism of amino acids: Overview of biosynthesis of nonessential amino acids. Catabolism of amino acid– transamination, deamination, ammonia formation, the urea cycle and regulation- Importance of glutamate dehydrogenase – synthesis of biologically important compounds from aminoacids

Unit -IV

Metabolism of purines and pyrimidines- de novo and salvage pathways for purine biosynthesis-Purine catabolic pathway. Metabolism of pyrimidines -biosynthesis and catabolism. Regulation of biosynthesis of nucleotides.

Unit -V

Metabolic integration and hormonal regulation: Key junctions in metabolism– glucose-6-phosphate, pyruvate and acetyl CoA. Metabolic profiles of brain, muscle, liver, kidney and adipose tissue. Metabolic interrelationships in various nutritional and hormonal states– obesity, exercise, pregnancy, lactation, IDDM, NIDDM and starvation. Basal metabolic rate-determination of BMR

Books

1. Biochemistry- Stryer, Freeman. 5th ed, 2002.
2. Harper's Biochemistry- Murray, 29th ed. Mc. GrawHill, 2011.
3. Principles of Biochemistry. 7th ed, Nelson Cox. Lehninger's McMillan Worth, 2013.
4. Biochemistry- Donald Voet, J.G. Voet, John Wiley, J O H N WI VP & Publisher Kaye Pace

Reference books

1. Biochemistry- 2nd ed- Kuchel and Ralston. Schaum's Outlines McGraw Hill, 1998.
2. Biochemistry NMS.4th ed- Davidson and Sittman. Lippincott.Willams and Wilkins, 1999.
3. Biochemistry 4th ed- Campbell and Farrell, Brooks/Cole Pub Co. 2002.
4. Metabolic Regulation-Keith N. Frayn, 2009.

BIOSTATISTICS AND BIOINFORMATICS

Objectives:

i) To understand the statistical concepts and their significance;
ii) To know the importance of research and to learn the art of data collection

Unit -I

Biostatistics: Definition, Data, sample, variable. Collection of data –Primary and secondary data,. Methods of data collection, Sampling – Methods of sampling, Advantages and disadvantages of sampling- Classification of data – Methods of classification, Frequency distribution, Types and illustration, Diagrammatic presentation of data- Line diagram, Bardiagram, Pie diagram, Pictogram. Graphical presentation of data- Line graph, histogram, Freqeuncy polygon, Frequency curve, Ogive curve.

Unit -II

Measures of central tendency: Definition of Average, Arithmetic mean- Direct method and short cut method for continuous series, Discrete series, Median – Definition, Calculation of median for individual series, Discrete series, Continuous series, Difference between mean median and mode- Definition, Calculation of mode for individual series, Continuous series, Discrete series.

Unit -III

Standard Deviation: Definition, Calculation of Standard deviation for individual series, Discrete series, Continuous series, Merits and demerits of S.D., Definition – Variance, Standard error, Coefficient of variation. Correlation analysis –Definition, Uses, Types of correlation-, Methods of studying correlation. Karl Pearson's correlation for individual series, continuous series and discrete series. Analysis of variance- one way ANOVA and Two way ANOVA.

Unit – IV

Bioinformatics: An overview, Definition & History; Bioinformatics databases & tools on the Internet- NCBI, EBI, PIR, Swiss-Prot, GenBank – Biological sequence analysis – pairwise sequence comparison – biological data bases – BLAST and FASTA- multiple sequence alignments – phylogenetic alignment

Unit – V

Protein and Gene structure prediction: – Chour -Fasmann rules , GOR methods, Protein 3D structure – homology modeling, threading, fold recognitions- Protein visualization tools – RasMol, HEX, Swiss PDB viewer- Functional genomics- Genome databases – human genome – gene cluster – DNA microarray – SWISS – 2DPAGE database, Drug discovery– molecular docking

Books

1. Biostatistics analysis, zar, J.H, Prentice Hall, New Jersey (1984).
2. Statistical methods for biologists, Palanichamy. S and Manoharan. M (1990).
3. Statistical methods by S.P Gupta. S.Chand&Co., (2011)
4. Biostatistics – A foundation for analysis in health science, Daniel(2006)
5. Research Methodology – Methods and Techniques by C.R. Kothari(2007)
6. Research methods for biological science by Gurumani. N, MJP pub., (2007)
7. Research methods in biological science – Dr. S.Palanichamy, M. Shanmugavelu
8. Bioinformatics-Sequence and Genome Analysis- David W.Mount, Cold Spring Harbor Laboratory Press (2004).
9. Introduction to Bioinformatics, Attwood, T.K. and D.J. Parry-Smith, Pearson Education Ltd., New Delhi (2004).
10. Bioinformatics – Westhead, D.R., Paris J.H. And R.M. Twyman, Instant Notes: Viva Books Private Ltd, New Delhi (2003).

MAJOR PRACTICAL – II

Enzymes Studies & Food and Tissue analysis

Enzyme studies

1. Enzyme studies with amylase and phosphatases- Effect of temperature, time, pH, enzyme concentration and substrate concentration on reaction, measurements of Vmax and Km and Inhibition
2. Assay of Catalase.

Food and tissue analysis

3. Estimation of moisture content
4. Estimation of ash content
5. Estimation of carbohydrate by anthrone method
6. Estimation of phosphorus
7. Estimation of total lipids
8. Estimation of vitamin C
9. Estimation of Proteins
10. Estimation of Iron

CLINICAL BIOCHEMISTRY

Objectives: **i)** To impart through knowledge about the biochemical basis of various diseases

ii) To study the various diagnostic and therapeutic methodologies available for diseases and disorders.

Unit – I

Disorders of Blood: –clotting factors and disturbances in blood clotting - Haemophilia A and Haemophilia B. Anticoagulants. Blood groups, Haemoglobin in anaemias, Sickle cell anemia, Thallasemia, abnormal haemoglobins identifications, Systematic analysis of haemorrhage disorders. Porphyrias and porphyrinurias. Blood banking. Hemolytic diseases of the new born. Adverse reactions of blood transfusions.

Unit - II

Disorders of Carbohydrates and Lipids: –hyper and hypoglycemia. Regulation of blood glucose concentration – Diabetes mellitus – Complications, secondary degenerative diseases. Laboratory diagnosis of early and latent diabetes. Glucose tolerance test. Hypoglycemic agents. Galactosemia, Fructosuria and lactose intolerance. Glycogen storage diseases - Hypo and hyper cholesteremia, Hypo and hyper lipoprotenemia, Hypocholestremic agents, Hypertension. Lipid storage diseases, fatty liver, obesity- atherosclerosis.

Unit - III

Protein deficiency diseases and disorders:– Marasmus – Kwashiorkardiesease, plasma proteins, their significance and variation in health and diseases. Agammaglobulinemia, Multiple myeloma, Proteinuria, Wilson's disease – Gout, leshnyhan syndrome. oratic aciduria, and xanthinuria, cystinuria, Hartnup disease, Maple syrup disease, alkaptonuria, albinism, Tyrosinosis and Phenylketonuria - urea cycle.

Unit – IV

Diseases of the Liver: Hepatitis - types, Jaundice and varieties. Cirrhosis, Alcoholic liver diseases. Cholestatic liver diseases. Hepatic Tumors and Biliary tract diseases - Clinical manifestation of liver diseases. Liver functions Tests. Disorders of Bilirubin metabolism. Enzyme released from diseased liver tissue. Pancreatic function Test; Gastric function Test. Biochemical parameters of CSF in health and disease.

Unit – V

Renal function tests: - biochemical changes in acute and chronic renal failure. Normal and abnormal urinary constituents. Renal stress and its analysis. Enzyme parameters in pathological conditions. Cardiac disorders - Major manifestations of heart disease - Ischaemicheart diseases, Angina pectoris, myocardial infections. Cardiac markers- Troponin I, C- reactive protein- LDH, Creatine kinase. Serological tests in infectious diseases.

Books

1. Henry.R.D : Clinical Chemistry- Principles and Techniques (Harfer and Row).
2. Cantrow and Trumper : Clinical Biochemistry.
3. King. E.J. &Wooden.I.A.P.: Clinical Biochemistry , Church Hill & Co.
4. Devlin (1997): Textbook of Biochemistry (with clinical correlation) (John Wiley and Sons Publishers)

IMMUNOLOGY

Objectives

i) To study in detail the components of immune system.

ii) To learn the biochemical basis of immune disorders .

Unit - I

Immune systems: Infection- types, factors influencing infection- pathogenecity. Sources and carriers of infectious agents. Cells of immune system. Lymophoid organs- primary and secondary; structure and functions. Natural defences of the body(Innate Immunity)- skin, mucous membrane, lysozyme and phagocytes - and acquired immunity- Reticuloendothelial system and its components.

Unit - II

Antigens: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Types of antigens- flagellae, somatic, capsular, soluble, heterophile, tumour and autoantigens. Antigen-antibody interactions- molecular mechanism of binding. Affinity, avidity, valancy, cross reactivity and multivalent binding. Complement system; components - Alternate and Classical pathways, initiators and MAC. Inflammation- acute and chronic; mechanism and significance.

Unit - III

Immunoglobulins: Basic structure, classes and distribution of antibodies. Antibody diversitygenetic and other factors. Theories of antibody formation. Acquired immunity- Humoral: Biosynthesis of antibodies; B and T lymphocyte cooperation. Primary and secondary immune response. Cell Immunity- components of T lymphocytes, T cell receptor diversity and CD molecules. Role of antigen presenting cells. Regulation of immune response. Cytokines, types and role in immunity. Mitogens and immunosuppresants. Immunological tolerance- at birth and in adults; induction and termination.

Unit - IV

Transplantation immunology: graft rejection and HLA antigens. Role of MHC and T cells. Prevention of graft rejection. **Hypersensitivity**- Immediate and delayed types; mechanism, of reaction. Vaccines and toxoids: types, production and uses. Active and passive immunization, immunization schedule. **Tumor immunology**: tumor antigens, immunosurveilance and NK cells. **Auto immunity**-mechanism of breakdown, pathogenesis and specific diseases.

Unit - V

Immunological Techniques: Polyclonal antibodies- principle and production of antisera. Monoclonal antibodies - Hybridoma technique, applications, merits and demerits. Recombinant antibodies. Principle and applications of RIA, ELISA, FISH. Precipitation reaction - Imunodiffusion, immunoelectrophoresis, precipitin ring test. Agglutination tests - Heamagglutination, Febrile and Latex agglutionation. Widal, VDRL, Pregnancy and Rheumatoid factor tests – Immunoblotting – ELISPOT- LIPSTIC

Books

1. Ivan Roitt, Jonathan Brostoff and David Male (1998): Immunology- 5th Edition. (Churchil Livingstone Publishers)
2. Janis Kuby (1998) : Immunology- 3rd and 4th Edition (W.H. Freeman)
3. Weir,D.N. (1997): Immunology (8th edn) (Churchil Livingstone)
4. Eli Benjamini and Sidney Leskowi : Immunology- A short course.

ADVANCED ENDOCRINOLOGY

Objective:

i)To obtain sound knowledge in Hormonal Biochemistry.

Unit- I

Hormones: classification, biosynthesis, circulation in blood, modification and degradation. Hormone receptors – structure and regulation. Mechanism of hormone action. **Hypothalamic and pituitary hormones**: Hypothalamic releasing factors. Anterior pituitary hormones: biological actions, regulation and disorders of growth hormones, ACTH, gonadotrophins and prolactin. Leptin. Posterior pituitary hormones – biological actions and regulation of vasopressin. Diabetes insipidus and SIADH secretion. Oxytocin. Hypopituitarism.

Unit -II

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

Unit -III

Adrenal And Pancreatic hormones: Adrenal cortical hormones- Synthesis, regulation, transport, metabolism and biological effects. Adrenal function tests. Cushing's syndrome, aldosteronism, congenial adrenal hyperplasia, adrenal cortical insufficiency. Adrenal medullary hormones – synthesis, secretion, metabolism, regulation and biological effects of catecholamines. Phaeochromocytoma - Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagons, somatostatin and insulin. Insulin receptor. Brief account of gastrointestinal hormones

Unit -IV

Gonadal hormones: Biosynthesis, regulation, transport, metabolism and biological actions of androgens. Hypogonadism and gynecomastia. Biosynthesis, regulation, transport, metabolism and biological effects of oestrogen and progesterone. The menstrual cycle. Pregnancy – diagnostic tests and biochemical changes. Foetal monitoring. Amenorrhea..

Unit -V

Signal transduction: Fundamental concepts and definitions of signals, ligands and receptors, endocrine, paracrine and autocrine signaling. Receptors and signaling pathways – cell surface receptors, ion channels, G protein coupled receptors, receptor kinases (tyr,ser/thr).Signal transduction through cytoplasmic and nuclear receptors. The Ras-raf MAP kinase cascade, second messengers – cyclic nucleotides, lipids and calcium ions. Crosstalk in signaling pathways.

Books:

1. Williams Textbook of Endocrinology – Wilson and Foster 13th ed. 2015.
2. Mechanisms of hormone action – Autind and Short, 1980.
3. Harper's Biochemistry – Murray et al. 26th ed. McGraw Hill, 2003.
4. Principles of Biochemistry – Mammalian Biochemistry, Smith et al. McGraw Hill, 1983.
5. Williams et al, Textbook of Endocrinology, 2015.

MOLECULAR DIAGNOSTICS

Objectives

i) To explore the molecular mechanisms of diseases.
ii) To study the various diagnostic tools available for these diseases.

Unit- I

Molecular mechanisms of diseases: Detection of genetic defects, detection of infectious agents, tumor diagnosis markers and grading. Molecular genetics of B- cell neoplasia. Liver specific expression of cloned human genes, technology of carrier erythrocytes: a tool for diagnosis and therapy. Diagnosis of single gene disorders - spinal muscular atrophy, DMD and BMD, Fragile X syndrome.

Unit -II

Molecular methods: Restriction Fragment Length Polymorphism (RFLP) - DNA probes detection of mutations and deletions in gene - thalassemia, haemophilia, sickle cell anemia, retinoblastoma. DNA finger printing. Genetic disease probes. Chromosomal DNA probes for prenatal diagnosis of X-linked retinitis pigmentosa, prenatal sex determination.

Unit -III

Hereditary persistence of fetal hemoglobin: model for abnormal development regulation. Apolipoprotein genes, DNA polymorphism and hyperlipidemia, cDNA of human protein C for diagnosis of protein C deficiency. Prenatal diagnosis and carrier detection of phenylketonuria by gene, fluorescent in situ hybridization (FISH). -DNA probes - fluorescent labeling, chromosome painting and spectral karyotyping, peptide mapping.

Unit -IV

Approaches in hybridoma technology: hybridoma variants affecting isotype, antigen binding and idiotype: isolation of class and subclass switch variants by selection. MHC locus, HLA polymorphisms, HLA nomenclature, molecular analysis of the MHC, serological analysis DNA-based typing, combining typing results, HLA test discrepancies - MHC& its disease association.

Unit -V

Applications: Polymerase Chain Reaction - Its applications in diagnosis of infectious diseases - HIV, hepatitis B and tuberculosis. Identification of gene mutations and deletions - p53mutations. Use in solving paternity disputes and crime detection. Enzyme linked immunosorbent assay (ELISA) - Diagnosis of infectious diseases and cancer antigens, HIV detection.

Books

1. Lela Buckingham, Maribeth L. Flaws, 2007, Molecular Diagnostics - Fundamentals, Methods, & Clinical Applications, F.A. Davis & Company, Philadelphia.
2. Gath, D.D, 1994. PCR-based diagnostics in infectious diseases. Blackwell Scientific.
3. UK.Fazal Ahmed, 1984, Advances in Gene technology: human genetic disorders, ICSU, Paris.
4. Stanely, A et al., 1994, Vaccines, W. B. Saunders & Co., USA.

MAJOR PRACTICAL – III

Clinical Biochemistry

I. Haematological studies

1. Collection and storage of blood
2. Estimation of haemoglobin content.
3. Total RBC count.
4. Total WBC count.
5. Differential WBC count (DC).
6. Determination of clotting time
7. Determination of ESR.
8. Grouping of blood and Rh typing.

II. Biochemical analysis of blood

1. Estimation of blood glucose
2. Estimation of serum proteins
3. Estimation of A:G ratio in serum
4. Estimation of blood urea
5. Estimation of serum uric acid
6.Estimation of serum creatinine.
7. Estimation of serum cholesterol.
8. Estimation of serum phospholipids.

III. Urology

1. Collection and preservation of urine.
2. Identification of abnormal constituents

IV. Immunological techniques

1. Widal test – rapid slide test for typhoid
2. VDRL test – test for syphilis
3. Latex agglutination test for rheumatoid factor and Pregnancy

MOLECULAR BIOLOGY

Objectives:

1. To understand the basic structure and functioning of the genetic materials - DNA.
2. To emphasize the molecular mechanism of DNA replication, repair, transcription, protein synthesis and gene regulation in various organisms.

Unit -I

Molecular structure of genes and chromosomes: Chromosomal organization of genes, Structure of chromatin and chromosomes, heterochromatin, euchromatin-Mobile elements (Transposons) - bacterial transposons, viral transposons, viral retro transposons, structural organization of eukaryotic chromosomes, histone proteins, Telomeres and telomerase.

Unit -II

DNA Replication and DNA repair: Replication of DNA: DNA in prokaryotes and eukaryotes. Enzymes involved in replication, events on the replication fork and termination, mechanism of replication. Inhibitors of DNA replication - Mutation - point mutation and frame shift mutation, Suppressor mutations, nonsense and missense mutation - DNA damage and DNA repair.

Unit -III

Transcription and Processing: Basic principles of transcription- initiation, elongation and termination in prokaryotes. Inhibitors of transcription - Regulation of transcription in prokaryotes- Eukaryotic RNA polymerases - structure and functions of RNA pol I, II and III. Post transcriptional processing of mRNA, rRNA and t-RNA - Alternative splicing.

Unit -IV

Genetic code and Translation: The genetic code- general features - Components of protein synthesis, Mechanism of protein synthesis in bacteria and eukaryotes- amino acid activation, initiation, elongation and termination. Inhibition of protein synthesis - Post translational modifications of proteins

Unit -V

Gene expression and regulation-Levels of gene expression. Principles of gene regulation, Upregulation, downregulation, induction, gene regulation by DNA methylation. Lac, Tryp and Ara operon – role of chromatin in gene expression – gene silencing- gene knockout mechanism- Eukaryotic gene regulation – Gene amplification

Books

1. Lewin. Genes VII. Oxford University Press 2000.

2. Twyman. Advanced Molecular Biology Viva Publ. 2nd ed 1998.

3. Alberts. Molecular Biology of the Cell. 4th ed. Garland Sci. 2002.

4. Lodish et al. Molecular Cell Biology. 4th ed. Freeman 2000

5. Pitot HC. Fundamentals of Oncology. Marcel Dekker, 2002.

6. Stansfield et al. Molecular Cell Biology. Schaum's Outlines. McGraw Hill, 1996.

MAJOR PRACTICAL IV

Molecular Biology

1.Agarose gel electrophoresis of Nucleic acids (DNA & RNA)

2. Isolation of chromosomal DNA from blood samples by PhenolChloroform method.

3. Preparation of genomic DNA from Plant tissue by CTAB method

4. Preparation of genomic DNA from bacteria

5. Isolation of Plasmid DNA

6. Separation of Proteins by SDS- PAGE

6. Enzyme Linked Immuno Sorbent Assay

7. Plant Tissue culture techniques (Callus induction)

8. Denaturation of DNA and UV absorption studies.

9. Restriction digestion.

10. PCR

PHARMACOGNOSY

Objectives

i) To identify and characterize plant medicines.

ii) To study their phytochemistry.

Unit – I

Traditional and alternative systems of medicine, Classification of crude drugs, Scheme for Pharmacognostic studies of a crude drug. Collection and processing of crude drugs.

Unit – II

Medicinal Plant Biotechnology- Medicinal Herbs and Transgenic Plants. Plant Tissue Culture as a source of biomedicinals-Introduction to biogenesis of Phytopharmaceuticals-Indian trade in medicinal and aromatic plants – antidiabetic herbal plants – hepatoprotective medicinal plants – anticancer medicinal plants- hypolipedimic plants

Unit – III

Analytical pharmacognosy-Drug adulteration, Methods of drug evaluation-biological testing of herbal drugs. Phytochemical investigation: LD_{50}, acute, subacute and chronic toxicity evaluation - Phytopharmaceuticals-Retrospect and Prospects - Ayurvedic Pharmacy.

Unit – IV

Pharmaceutical plant products: Carbohydrates and derived products. Drugs containing glycosides, Drugs containing tannins, Lipids, Terpenoids, Enzymes, antioxidants and protein drugs. Alkaloidal drugs – Extraction – Purification – formulation

Unit – V

Nutraceuticals and cosmeceuticals: Fibres, sutures and surgical dressing-Natural pesticides, Antibiotics and allergenic Extracts-immunomodulators-Adaptogens and Rasayana – natural pigments – natural food supplements

Books

1. Peter B. Kaufmann, et al. (1999): Natural Products from Plants, C.R.C. Press.

2. Munson, P. (1995) : Principles of Pharmacology.

3. Indian Materia Medica.

4. Bernfeld: Biogenesis of Natural Compounds, 2nd ed.

5. Willis:A text book of Pharmacognosy.

6. Trees and Evans:Pharmacognosy,.

GENETIC ENGINEERING

Objective: i) To understand and learn the emergence of genetic engineering

ii) To study the importances and applications of biotechnology

Unit I

Introduction to genetic engineering and rDNA technology: gene cloning, specialized tools and techniques of gene cloning – Restriction endonucleases – mechanism of action – ligases, S1 nuclease, methods of ligation- Vectors in cloning: Cloning and Expression vectors- Plasmids pBR, pUC, phages (M3, λ), yeast vectors, cosmids, phagemids, PAC, BAC, YAC, MAC, HAC vectors, Plant and Animal viruses as vector, binary and shuttle vectors, expression vectors for prokaryotes and eukaryotes, expression cassettes - Construction of genomic and cDNA libraries, selection and screening of recombinants

Unit II

Methods of gene transfer: direct and indirect DNA transfer - Microinjection, electroporation, particle bombardment gun (biolistic), ultrasonication, liposome mediated and direct transfer- Agarobacterium mediated gene transfer- Restriction analysis of DNA, molecular markers- VNTR, SSR, STS, SCAR, SNP- Microarrays

Unit III

Plant Biotechnology: Plant Tissue culture – micropropagation – organogenesis – somatic embryogenesis – molecular tagging of genes – Herbicide resistance, insect and pest resistance- disease resistance – virus resistance – secondary metabolites synthesis – *nif* gene and *nod* genes in nitrogen fixation *Bt* genes**,** non *Bt* genes like protease inhibitors – Transgenic plants

Unit IV

Animal Biotechnolgy: Animal cell culture **–** cell lines – organ and embryo culture – cryopreservation – embryo transfer – animal cloning – transgenic mice , cattle, goat and fish- tissue typing – correction of genetic disorders -human genome project – gene therapy – Recombinant insulin, somatotropin, vaccines, role of genetic engineering in diagnosis and cure of diseases – human protein replacement – DNA probes

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Unit V

Microbial biotechnology: Fermentation- fermentors and bioreactors- downstream processing- Bioremediation – types bioremediation of contaminated soil and waste land - microbial mining – biosensors – Production of organic acids, antibiotics and vitamins - Bioethical issues: Patenting of biotechnological inventions -IPR, Patenting, Ethical, legal issues and hazards of genetic engineering – Patenting of multicellular organisms

Books:

1. Principles of Gene Manipulation and Genomics, Seventh edition, S.B. Primrose and R.M. Twyman, 2006 Blackwell Publishing, USA.

2. Molecular Biotechnology- Principles and applications of Recombinant DNA, Bernard R. Glick, Jack J. Pasternak, and Cheryl L. Patten. — 4th ed., ASM Press, Washington, DC , USA

3. Gene cloning and DNA analysis : an introduction / T.A. Brown.—6th ed- Brown, T.A. (Terence A.) , Wiley-Blackwell. 2010.

4. Elements of Biotechnology, P.K. Gupta, Rastogi Publications, 2nd edition 3rd reprint, 2015-2016.

5. A text book of Biotechnology, R.C.Dubey, S.Chand Publications, 2014

6. An Introduction to Genetic Engineering, Third Edition, Desmond S. T. Nicholl, Cambridge University Press, USA

7. Genetic Engineering – Basics, New Applications and Responsibilities, Edited by Hugo A. Barrera-Saldaña, Published by InTech, Croatia, 2011.