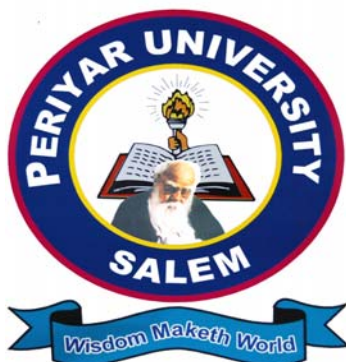


**PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM – 636 011**



**DEGREE OF MASTER OF SCIENCE
CHOICE BASED CREDIT SYSTEM
SYLLABUS FOR M.SC. BIO CHEMISTRY
FOR THE STUDENTS ADMITTED FROM THE
ACADEMIC YEAR 2012 – 2013 ONWARDS**

SEMESTER I**TOTAL CREDITS - 27**

PART	COURSE CODE	COURSE	HOURS	CREDIT	MARKS		
					CIA	EA	TOTAL
CORE I	08PBC01	BIOMOLECULES	5	5	25	75	100
CORE II	08PBC02	CELL AND MOLECULAR BIOLOGY	5	5	25	75	100
CORE III	08PBC03	ADVANCED ENZYMOLOGY	5	5	25	75	100
ELECTIVE	08PBCZ01	BIOPHYSICAL CHEMISTRY AND BIOCHEMICAL TECHNIQUES	5	4	25	75	100
PRACTICAL	08PBCP01	LAB COURSE-I	6	4	40	60	100
PRACTICAL	08PBCP02	LAB COURSE-II	6	4	40	60	100

TOTAL MARKS – 600

SEMESTER II

PART	COURSE CODE	COURSE	HOURS	CREDIT	MARKS		
					CIA	EA	TOTAL
CORE IV	08PBC04	INTERMEDIARY METABOLISM	5	5	25	75	100
CORE V	08PBC05	GENETIC ENGINEERING AND FERMENTATION TECHNOLOGY	5	5	25	75	100
ELECTIVE	08PBCZ02	PLANT BIOCHEMISTRY	5	5	25	75	100
EDC			4	4	25	75	100
VALUE EDU	08PHR01	HUMAN RIGHTS	2	2	25	75	100
PRACTICAL	08PBCP03	LAB COURSE-III	3	3	20	30	50
PRACTICAL	08PBCP04	LAB COURSE-IV	3	3	20	30	50

TOTAL CREDITS - 27**TOTAL MARKS – 600**

SEMESTER III

PART	COURSE CODE	COURSE	HOURS	CREDIT	MARKS		
					CIA	EA	TOTAL
CORE VI	08PBC06	ADVANCED CLINICAL BIOCHEMISTRY	5	5	25	75	100
CORE VII	08PBC09	DRUG BIOCHEMISTRY AND TOXICOLOGY	5	5	25	75	100
CORE VIII	08PBC08	CONCEPTS OF IMMUNOLOGY	5	5	25	75	100
ELECTIVE	08PBCZ03	BIOSTATISTIC AND RESEARCH METHODOLOGY	4	4	25	75	100
PRACTICAL	08PBCP05	LAB COURSE-V AND INTERNSHIP (for 15 Days)	6	4	40	60	100
PRACTICAL	08PBCP06	LAB COURSE-VI	6	4	40	60	100

TOTAL CREDITS - 27**TOTAL MARKS – 600**

SEMESTER IV

PART	COURSE CODE	COURSE	HOURS	CREDIT	MARKS		
					CIA	EA	TOTAL
CORE VI	08PBC07	HUMAN PHYSIOLOGY AND ENDOCRINOLOGY	5	4	25	75	100
CORE VII	08PBCZ04	BIOINFORMATICS&NANO TECHNOLOGY	5	4	25	75	100
CORE VIII	08PBCPR1	PROJECT	-	5			100

TOTAL CREDITS – 13

TOTAL MARKS – 300

SEMESTER	CREDIT	MARKS
I Semester	27	600
II Semester	27	600
III Semester	27	600
VI Semester	13	300
Total	94	2100

TOTAL MARKS FOR M.Sc BIOCHEMISTRY – 2100

TOTAL CREDITS FOR M.Sc BIOCHEMISTRY – 94

SCHEME OF EXAMINATION

S.NO	TITLE OF THE SUBJECT	DURATION OF EXAM	CREDITS	MARKS
1.	BIOMOLECULES	3	5	100
2.	CELL AND MOLECULAR BIOLOGY	3	5	100
3.	ADVANCED ENZYMOLOGY	3	5	100
4.	BIOPHYSICAL CHEMISTRY AND BIOCHEMICAL TECHNIQUES	3	4	100
5.	LAB COURSE- I	6	4	100
6.	LAB COURSE-II	6	4	100
7.	INTERMEDIATE METABOLISM	3	5	100
8.	GENETIC ENGINEERING AND FERMENTATION TECHNOLOGY	3	5	100
9.	PLANT BIOCHEMISTRY	3	5	100
10.	EDC	3	4	100
11.	HUMAN RIGHTS	3	2	100
12.	LAB COURSE-III	5	3	50
13.	LAB COURSE-IV	5	3	50
14.	ADVANCED CLINICAL BIOCHEMISTRY	5	5	100
15.	DRUG BIOCHEMISTRY AND TOXICOLOGY	5	5	100
16.	CONCEPTS OF IMMUNOLOGY	5	5	100
17.	BIOSTATISTIC AND RESEARCH METHODOLOGY	4	4	100
18.	LAB COURSE-V AND INTERNSHIP (for 15 Days)	6	4	100

19.	LAB COURSE-VI	6	4	100
20.	HUMAN PHYSIOLOGY AND ENDOCRINOLOGY	5	4	100
21.	BIOINFORMATICS&NANO TECHNOLOGY	5	4	100
22.	PROJECT	-	5	100

TOTAL CREDITS: 94

TOTAL MARKS: 200

Marks Distribution Pattern

Theory

External Assessment – **75** **Marks**

Internal Assessment – **25** **Marks**

Question Paper Pattern

MAXIMUM MARKS -75 MARKS

Section A 5×5 =25

Answer all questions

(Internal choice)

Section B 5×10=50

Answer all questions

(Internal choice)

Classification of Internal Marks

Seminar – **5** **Marks**

Test – **10** **Marks**

Assignment – **5** **Marks**

Attendance – **5** **Marks**

25 **Marks**

Passing minimum (Internal Assessment) – **12** **Marks**

Passing minimum (External Assessment) – 38 Marks

Total passing minimum – 5 Marks

PRACTICALS

External Assessment – 60 Marks

Internal Assessment – 40 Marks

Passing minimum (Internal Assessment) – 20 Marks

Passing minimum (External Assessment) – 30 Marks

Total passing minimum – 50 Marks

No classification for internal assessment.

**Question paper pattern (Theory)
Duration of examination; Three Hours**

Maximum: 75 marks

Section A (5×5 =25)

Answer all the questions

Two question from each unit with internal choice

Section B (5×10 =50)

Answer all the questions

Two question from each unit with internal choice

Note to questions paper setters

All units in the syllabus should be given equal weightage; key and scheme of valuation should be provided

Question Paper Pattern for Practicals

Question paper pattern – I

Time	:	6 hours
Maximum marks	:	60 marks
Experiment I	:	25 marks
Experiment I	:	20 marks
Record	:	10 marks
Viva	:	5 marks

Question Paper - II

Time	:	5 hours
Maximum marks	:	30 marks
Experiment I	:	15 marks
Record	:	10 marks
Viva	:	5 marks

BIOMOLECULES

UNIT I - INTRODUCTION TO BIOMOLECULES

Molecular design of life prelude. Biochemical unity, biological diversity, Biochemical evolution, exploring evolution.

Carbohydrates- classification, structure, function, physical and chemical properties of monosaccharides, oligosaccharides and polysaccharides (homopolysaccharides and heteropolysaccharides). Structure and functions of Bacterial cell wall polysaccharides, glycoproteins, and polyols.

UNIT II - PROTEINS AND AMINOACIDS

Classification, structure (including super secondary structures), function, physical and chemical properties of amino acids and proteins. Amino acid sequencing, Ramachandran plot, Structure and functions of Hb, actin, myosin keratin, collagen, and elastin. Aminoacid sequencing, Ramachandran plot.

UNIT III - LIPIDS

Classification, structure, function, physical and chemical properties of lipids. Lipids and cell membrane, Membrane models, Diversity of biological membranes, membrane dynamics, and membranes of cell organelles .Membrane transport. Channels and pumps.

UNIT IV - NUCLEIC ACIDS

Structure of nitrogenous bases, nucleotide, nucleosides, properties of nucleic acids, Cot curve value, types and structure of DNA and RNA

(mRNA, tRNA, 8 rRNA, sn RNA, hnRNA) DNA model, DNA. Histone proteins, chromatin and non histone proteins. Miscellaneous alternative confirmation of DNA- slipped mispaired DNA, parallel stranded DNA and anisomorphic

UNIT V - VITAMINS AND MINERALS

Classification, structure and function of fat soluble and water soluble vitamins (including antioxidant properties). Minerals of biological system (Fe, Ca, Na, K, I, Mg, Mn, Zn, P).

REFERENCE BOOKS

1. Lehninger Principles of Biochemistry 5th edition by Nelson, David L. and Cox, W.H. Freeman and Co., NY (2008).
2. Fundamentals of Biochemistry 3rd edition by Donald Voet, Judith G. Voet and Charlotte W Pratt, John Wiley & Sons, NJ (2008).
3. Outlines of Biochemistry 5th edition by Eric E. Conn, P.K. Stumpf, G. Brueins and Ray H. Doi, John Wiley and sons, Singapore (2005).
4. Biochemistry 4th edition by Lubert Stryer, WH freeman and co, Sanfrancisco (1995).
5. Text book of Biochemistry 4th edition by Thomas M devlin, A John Wiley, Inc publication, New york (1997).
6. Biochemistry 4th edition by Zubay G L, W M C Brown publishers (1988).
7. Principles of Biochemistry by Garrette & Grisham, Saunders College publishing (1994).

8. Biochemistry 3rd edition by U.Sathayanarayana, Books and allied (p) ltd., India (2006).

CELL AND MOLECULAR BIOLOGY

UNIT I - INTRODUCTION TO CELL BIOLOGY

Pre-biotic molecular evolution and origin of life, review of variety of ecology of living world, evolution of life, types of cell, plant and animal cells, cell organelles- structure and functions, cytoskeleton, types of tissues.

UNIT II – CELL-CELL INTERACTION

cell matrix adhesion, ECM, hyaluronans, proteoglycans, laminin, integrins, fibronectins. Cell-cell adhesion, specialized junctions, desmosomes, gap junctions, tight junctions, adhesion molecules-cadherins and connexins

CELL CYCLE AND CELL DIVISION- Over view of cell cycle and its control in mammalian cells, check points in cell cycle. Apoptosis- pathways regulators and effectors in apoptosis.

UNIT III – GENETIC CODE

Salient features of genetic code, wobble hypothesis, decipheration of genetic code. Contribution of Nirenberg, Matthaei and Khorana. Natural variation in the genetic code .

DNA Replication – Messelson and Stahl's semi conservative replication model, Enzymes of replication (Polymerases, Topoisomerases, Ligases, Helicases, Primases and SSB Proteins.) DNA Replication in prokaryotes and eukaryotes, Rolling circle model, replication of mitochondrial DNA

UNIT IV– PROKARYOTES AND EUKARYOTES TRANSCRIPTION

Structure and function of RNA polymerases. Initiation, elongation and termination of transcription, post transcriptional modification, Inhibition of transcription, Ribozymes, RNA Replicase and reverse transcriptase.

TRANSLATION (In prokaryotes and eukaryotes)- t-RNA and its adaptor function, activation of amino acids. Aminoacyl t-RNA synthetase, Ribosomes and its composition. Formation of initiation complex, elongation, termination. Post translational modification.

UNIT V– REGULATION OF GENE EXPRESSION

Basic elements in control of gene expression, Structural and regulatory genes, mechanism of activation of gene expression, Operon model (Lactose, Arabinose and Tryptophan), Attenuation, Transcriptional control in Eukaryotes in Zinc finger motif, Leucine Zipper, Steroid receptor.

RECOMBINATION AND MUTATION:

Recombination-Holliday model, Rec BCD Enzyme, Rec A Protein, Messelson radding model, site specific recombination. Genetic Basis and onset of Cancer. Mutation – DNA Damage and repair.

REFERENCE BOOKS

1. Molecular cell biology 6th edition by Lodish H Baltimore and et al., W.H.Freeman and Co., NY (2008).
2. Molecular biology of cells 5th edition by Alberts, Bruce, Garland pub., (2008).
3. Cell biology by E S Saedava

4. Cell and Molecular Biology 8th edition by E D P de Robertis and E M F de Robertis, Lippincott W&W, (2001).
5. Principles of cell biology 2nd edition by Kelein Smith and M Kish, Harper and Row pub., (1995).
6. Molecular cloning: a laboratory manual by J.Sambtook. E.F.Fritsch, and T.Maniatis, Cold Spring Harbor Laboratory Press, New York, (2001).
7. Genes IX by Benjamin Lewin, jones and bartlet pub.,(2008)
8. Cell and Molecular biology 5th edition by Gerald Karp John Wiley and Sons Inc(2008)
9. Molecular biology 2nd edition by david Friefelder narosa Publishing house,new delhi(1987)
- 10.Molecular biology 3rd edition by Weaver R.F. Tata Mc graw-hillcompanies, inc. india (2005)
- 11.Essential molecular biology A practical approach 2nd edition by Brown TA, IRL press ,oxford (2007)
- 12.Cell and molecular biology by Ajoy Paul

ADVANCED ENZYMOLOGY

UNIT-I

IUB Classification and Nomenclature , Intracellular Location of Enzymes, Enzyme Units, Active site , Determination of 3D structure of active site, Enzyme Turn over, Significance of Enzyme Turn over.Iso Enzymes , Apo Enzymes , Abzymes, Ribozymes.Monomeric and oligomeric Enzymes.

UNIT-II

Enzyme Kinetics- Steady state theory , MM Equation, LB Plot, Eadie Hostsee Plot , Hanes Plot, Enzyme catalysis and Mechanism of Enzyme

catalysis, Serine proteases (Carboxypeptidases, Chymotrypsin) and Lysozyme. Mechanism of Bi Substrate reaction .Metalloenzymes and Metal Activated Enzymes.Co enzymes – Structure and functions.

UNIT-III

Enzyme Regulation: Mechanism, Feed forward stimulation, Feedback inhibition- Allosteric Enzymes, Sigmoidal Kinetics and their Significance, Hill's Equation, Scachard Plot and their application. Reversible and irreversible inhibition- types, Kinetics, Determination of Inhibitor constant and LB Plot.

UNIT-IV

Multi Enzyme complex-Structure and Mechanism of action and Regulation of Pyruvate dehydrogenase Enzyme Immobilisation- Methods and applications. Role of Enzymes in Colorimetric , Amperometric , Optical and piezo-electric biosensors.

UNIT-V

Application of Enzymes- Enzymes as analytical reagents, Enzymes in Medicine and Industry, Biotechnological applications of Enzymes

REFERENCE BOOKS

1. Enzymes by Dixon ,E.C webb , CJR thorne and K.F.Tipton , Longmans , London
2. Fundamentals of enzymology by Nicholas c.price , lewis stevans, oxford university press , 2nd ed(1998).

3. Enzymes 5th edition by Trevor palmer, affiliated East –West press (p) ltd.(2004)
4. Protein biochemistry and biotechnology, gary walsh and denis and headon ,john wiley and sons Ltd.USA (2002).
5. Enzyme Kinetics and Mechanism – Paul F. Cook.

BIOPHYSICAL CHEMISTRY AND BIOCHEMICAL TECHNIQUES

UNIT-I

Buffers – Definition and determination of pH , Henderson Hasselbalch Equation. Dialysis, Surface tension and Viscosity. Microscope and its Types. - Principle, Instrumentation and application of Microscope Sedimentation -Principle, Instrumentation and application of centrifuges. Types of Centrifugation, Types of Rotors.

UNIT-II

Chromatography- Fundamental concepts, Types, Principle, Instrumentation and application of Chromatography- Paper. TLC, Ion-Exchange, Molecular sieving, Affinity, Adsorption, GLC, HPLC and FPLC.

UNIT-III

Electrophoresis- Separation Methods and fundamental Concepts. Types , Principle, Instrumentation, Application of Paper, Gel, SDS, Native Gel , Isoelectric Focussing,.Pulse Field Electrophoresis, Capillary Electrophoresis.

UNIT-IV

Spectroscopy- Basic Principle , Instrumentation and Application of UV,Visible & IR Spectrophotometers, Mass Spectrophotometry, NMR, ESR, Flame photometry & Fluorimetry.

UNIT – V

Radioisotopes-GM Counter, Scintillation Counter. Quantitation & Detection of Radioactive isotopes (Gas ionization, Liquid scintillation & Autoradiography).Diagnostic & therapeutic uses of radioactive isotopes. Radiation Hazards & Safety measures. Biosensors- Principle, Types and applications. Applications of techniques- DNA isolation, RNA isolation and protein isolation.

REFERENCE BOOKS

1. Principles and techniques of practical biochemistry 7th edition by Keith Wilson and John Walker, Cambridge University Press (2010).
2. An introduction to Spectroscopy for Biochemist, Brown. SB Academic Press.
3. molecular Spectroscopy by John.M oxford university press (2005)
4. Introduction to Centrifugation by Ford T.C and Graham J.N., Bioscientific Publishers Ltd, Oxford.
5. Biophysical chemistry Principles and Techniques 3rd edition by Avinash Upadhyay and Nirmalendhe Nath, Himalaya Publishers (2002).

6. A Biologist Guide to Principles and Techniques of Biochemistry by Keith Wilson and Kenneth Goulding, Edward Arnold Publishers (1994).

LAB COURSE-I

PRACTICAL – 1

1. Isolation and Estimation of Glycogen by Colorimetric method.
2. Estimation of Thiamine and Riboflavin by Fluorimetry method.
3. Separation of Lecithin from Egg yolk by TLC.
4. Estimation of Sodium and Potassium by Flame Photometry.
5. Differential centrifugation of cell organelles and identification of Marker Enzymes.
6. Mitotic Preparation –Onion Root tip.
7. Estimation of Calcium from Milk by Titrimetry.
8. Separate the given Amino acids and Sugars by Paper Chromatography (Ascending, Descending and circular).
9. Separation of Serum LDH by SDS PAGE.

LAB COURSE –II

I. Enzyme Isolation and Assay of Enzymatic Activity.

- a. Extraction and Purification of Enzymes(Peroxidase)
- b. Molecular Weight Determination of Enzymes(Peroxidase) by Molecular Sieve
- c. Specific Activity (Peroxidase)

II. Immobilisation Enzyme

- a. Immobilisation of peroxidase/Acid phosphatase by matrix entrapment, ionic and cross linking

III. Enzyme Kinetics

- a. Assay of peroxidase and Effect of pH and temperature on enzyme activity.
- b. Assay of salivary Amylase, AST, ALT, ALP, ACP.

REFERENCE BOOKS

LAB COURSE –I & LAB COURSE – II

1. Practical clinical biochemistry, volume I and II- Harold varley, et al., CBS publishers, Fifth Edition,(1980).
2. Biochemical Methods. Sadasivam.S and Manickam, A. II Edition. New Age International private Ltd Publishers.
3. Laboratory techniques in biochemistry and molecular biology, Work and Work.
4. A Biologist's guide to principles and Techniques of Practical Biochemistry, K. Wilson and K.H. Goulding,ELBS Edtion,(1986).
5. Modern Experimental Biochemistry Boyer,R III Edition, Benjamin Cummings Publishers.
6. A Text book of practical biochemistry, by David Plummer.
7. Enzymes Structure and Mechanism, Aln Fessht (1997).

INTERMEDIARY METABOLISM

UNIT I

Introduction to metabolism of cells, Aerobic glycolysis & Fermentation-energetics of glycolysis & fermentation.Gluconeogenesis, substrate cycle & reciprocal regulation of glycolysis &

gluconeogenesis. Metabolism of glycogen & regulation. Maintenance of blood sugar by liver.

Citric acid cycle & its regulation-energetics. The amphibolic nature of the citric acid cycle, HMP shunt, Uronic acid pathway, Cori's cycle, The Glyoxalate pathway, Metabolism of fructose, Galactose & Mannose. Lactose synthesis & Glycoprotein synthesis. Synthesis of bacterial cell wall polysaccharides.

UNIT II

Oxidation saturated & unsaturated fattyacids. Oxidation of fatty acids with even & odd numbered carbon atoms. Alpha ,Beta & Omega oxidation. Ketogenesis, biosynthesis of saturated & unsaturated fattyacids. Regulation of fatty acid metabolism. Mitochondrial chain elongation.

Metabolism of triacyl glycerol, phospholipids& sphingolipids. Cholesterol biosynthesis & regulation .Degradation of cholesterol, cholesterol transport excretion, lipoprotein metabolism .The cyclic & linear pathways of arachidonic acids metabolism. Prostaglandins and thromboxenes metabolism.

UNIT III

High energy phosphates. Components of electron transport chain and the sequence of electron transport. Oxidative phosphorylation – the chemiosmotic theory. Mechanism of ATP synthesis. Uncoupling of oxidative phosphorylation. Inhibitors of respiratory chain and oxidative phosphorylation. Mitochondrial transport systems, ATP/ADP exchange, malate/glycerol phosphate shuttle

UNIT IV

Degradation of amino acids – transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle and its regulation. Catabolism of amino acids-carbon skeleton of amino acids to amphibolic intermediates, key role of glutamate dehydrogenase in nitrogen metabolism.

Integration of metabolism

Interrelationship of carbohydrates proteins and fat metabolism- role of acetyl CoA and TCA cycle. Interconversion of major food stuffs. Metabolic profile of the principal organs and their relationships.

Biosynthesis of non-essential amino acids. Conversion of amino acids to specialized products. Serotonin, Gamma amino butyric acid, dopamine, epinephrine, nor- epinephrine, melanin, creatinine, creatine.

UNIT V

Metabolism of nucleotides, de novo synthesis purine nucleotides, salvages pathway degradation of purine nucleotides, de novo synthesis pyrimidine nucleotides, salvages pathway, degradation of pyrimidine nucleotides , inhibitors, metabolism of porphyrin . Biosynthesis and degradation of porphyrin, heme, formation, transport and excretion of bile pigment.

REFERENCE BOOKS

1. Lehninger principles of Biochemistry 5th edition by Nelson, David L. and Cox, W.H.Freeman and Co., NY (2008).
2. Fundamentals of Biochemistry 3rd edition by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NJ(2008).
3. Outlines of Biochemistry 5th edition by Eric E.Conn, P.K. Stumpf, G.Brueins and Ray H.Doi, John Wiley and sons, Singapore (2005).

4. Biochemistry 4th edition by Lubert Stryer, WH freeman and co, Sanfrancisco (1995).

5. Text book of Biochemistry 4th edition Thomas M devlin, A John Wiley, Inc publication, New york (1997).

6. Biochemistry 4th edition by Zubay G L, W M C Brown publishers (1988).

7. Principles of Biochemistry Garrette & Grisham, Saunders College publishing (1994).

GENETIC ENGINEERING AND FERMENTATION TECHNOLOGY

UNIT-I

Introduction to Gene Manipulation – Basic techniques of Genetic Engineering –Isolation and purification of Nucleic acids, Agarose gel electrophoresis, Southern Northern, Western Blotting, PCR and its types, RFLP,RAPD . Genetic transformation of prokaryotes: Transferring DNA into E.coli – Chemical induction and Electroporation. DNA delivery methods, Gene targeting and Gene tagging.

Restriction modification enzymes used in recombinant DNA technology.

Cloning vectors - Plasmid cloning vector PBR322, other plasmid vectors.

Cloning of foreign genes: Vectors for cloning large piece of DNA.

Bacteriophage vectors and other phage vectors,Cosmids, Phagemids; YAC

and BAC vectors. Viral vectors –SV40, Reterovirus,Adenovirus,

Vacciniavirus and Baculovirus as Vectors. Marker genes - Selectable

markers and Screenable markers, non-antibiotic markers.

UNIT-II

Gene expression in prokaryotes- Tissue specific promoter, wound inducible promoters, Strong and regulatable promoters; increasing protein production; Fusion proteins; Translation expression vectors. Mammalian cell expression vectors, Two-vector expression system, two-gene expression vector. Gene library- Construction cDNA library and genomic library, screening of gene libraries – screening by DNA hybridization, immunological assay and protein activity.

UNIT-III

Gene Therapy- Somatic cell Gene therapy, Germ cell gene therapy, Stem cell and its application in gene therapy. Gene therapy for inherited disease, cystic fibrosis, ADA, infectious disease, familial hypercholesterolemia, Antisense oligonucleotides, Si RNA, Micro RNA , Ribozymes ,Artificially designed aptamers.

UNIT-IV

Fermentor /bioreactor types and design of fermentor, Inoculum preparation, cell growth, substrate utilization, product formation .Mode of fermentation- fed-batch, batch and continuous culture; process and its control. Downstream processing –Recovery and purification of products

UNIT-V

Food fermentations- Bread, Malt Beverages, Vinegar, Fermented Vegetables, Fermented Dairy products, Microorganisms as Food- Single cells protein, Fats from Microorganisms, Production of Amino acids, Production of Enzymes. Production of bioinsectides and fungal polysaccharides.

GM foods, Food security and General ethical concern-Foods produced using modern biotechnology, Impacts of GM foods on human health and environment.

REFERENCE BOOKS

1. Molecular biotechnology 4th edition by Glick, B.R. and Pasternak, J.J. ASM Press, USA (2010)
2. DNA Molecular Biotechnology. Glick, B.R. and Pasternak, J.J. (2003).
3. Cloning 1 and 2. Glover, D.M. and Hames. B.D. IRL press (1995).
4. Molecular cloning. A laboratory Manual 3rd edition by Sambrook, J., Fritsch, E.F, Mariatis. Cold spring Harbor Laboratory, USA (2001).
5. Recombinant DNA 2nd edition by Watson, W.H. Freeman and Co., NY (1992)
6. Molecular biology of the cell 4th edition by Alberts, Johnson, Lewis, Raff, Roberts and Walter, Garland pub., NY (2002)
7. Molecular cell biology 6th edition by Lodish H Baltimore and et al., W.H. Freeman and Co., NY (2008).
8. Molecular biology of the Gene 5th edition by Watson, Baker, Bell. Dorling Kinderly (P)ltd, (2004)
9. Drlica, K. understanding DNA and gene cloning : A guide for the curious, John Wiley & sons, New york (1983).
10. Steven, P., biotechnology- A new Industrial Revolution, George Braziller Antebi, E. and Fishlock, D. Biotechnology, The MIT press, USA (1984)
11. Marx, J.L., A revolution in biotechnology, Cambridge Univ. press, UK (1989).

12. Principles of gene manipulation and genomics 7th edition. Blackwell pub., NY (2006).
13. Biotechnology 3rd edition. Smith, Cambridge Univ. press (1996).
14. Biotechnology. Rehm, (1986).
15. Biotechnology by U.Sathayanarayana, Books and allied (p) ltd., India (2008).
16. Introduction to biotechnology. Brown, London (1987).
17. Genetic engineering. Kingsman and kingsman, (1988).
18. Industrial biotechnology by A.H. patel.

PLANT BIOCHEMISTRY

UNIT I -Photosynthesis and transpiration:

Photosynthetic apparatus, Pigments, Biochemistry of Dark and light reaction, inhibitors and regulation and factors affecting photosynthesis. Bacterial photosynthesis ATP synthase- bacterial chloroplast and mitochondria. Water absorption and transpiration: Mechanism of water absorption, symplast and apoplast concept, transpiration – types, theories of transpiration, mechanism and factors affecting transpiration.

UNIT II

Biogeochemical Cycles ,Outlines of gaseous and sedimentary cycles ,role of macro and micronutrients in plants and hydroponics ,Nitrogen fixation and its types .Biochemistry of symbiotic and as symbiotic nitrogen fixation .Physiology of nodule formation ,genetics and genetic manipulation for nitrogen fixing genes. Nitrogen assimilation, Interrelationship between Photosynthesis and nitrogen metabolism.

UNIT III

Biosynthesis ,transport ,distribution ,mechanism of action and physiological effects of Auxin ,Gibberellins ,cytokinins absisic acid ethylene .Phytochrome ,Biological clock ,Physiology and biochemistry of seed germination and dormancy. Types of dormancy and methods to overcome dormancy. Senescence.

UNIT IV

Biosynthesis and function of flavonoids,alkaloids ,terpenoids ,anthocyanins, steroids and lignin. Defense mechanism: structural and biochemical defense mechanism in plant. Principle of plant disease. Control of plant disease.

UNIT V

Gene Transfer techniques in plants – Direct, Vector mediated transfer. Ti Plasmid and Ri plasmid. Transgenic plants – Plant resistance to biotic and abiotic factors .Transgenic plants for improved nutrition, crop yield and as bioreactors. Tissue culture, types and application.

REFERENCE BOOKS

1. Plant biochemistry by Dey J.B. Harborne, Academic press (2000).
2. Plant biochemistry and molecular biology 2nd edition by Peter J.Lea Richard. C. Leegood, John Wiley & Sons, NY(1999).
3. Biochemistry and molecular biology of plants- Buchanan, Grussem Jones, AS of plant physiologist (2002)

4. Plant biochemistry 3rd edition by Hans Walter Heldt Elsevier Pvt Ltd (2005)
5. Methods in plant biochemistry and molecular biology by William. V. Dashek.
6. Introduction to plant biochemistry 2nd edition by T.W. Goodwin and E.I. Mercer. CBS pub., (1998)
7. Plant pathology – B.P Pandey S. Chand & Co., (2009).

LAB COURSE –III

1. Callus Induction and micro propagation
2. Isolation of protoplasts
3. Protoplast Culture
4. Anther culture
5. Somatic Embryogenesis
6. Collection of medicinal plants and qualitative analysis of secondary metabolites such as
 - a) Phenols
 - b) Flavonoids
 - c) Alkaloids
 - d) Glycosides
 - e) Steroids
7. Estimation of chlorophyll in leaves
8. Determination of aldehydes in lemon oil
9. Extraction and confirmation of
 - a. Pectin from orange peel
 - b. Caffeine from tea
 - c. Solanine from potato

LAB COURSE –IV

1. Isolation of Genomic DNA
2. Isolation of RNA

3. Restriction digestion of DNA
4. Isolation of plasmid DNA
5. Preparation of competent cell -Transformation
6. Agarose Gel electrophoresis
7. Southern Blotting –Demonstration
8. PCR – Demonstration

REFERENCE BOOKS

LAB COURSE –III & LAB COURSE –IV

1. Plant biochemistry – Practical – C.C. Giri & Archana Giri
2. Introductory practical biochemistry – S.K. Sawhney, Randhir Singh
3. Biochemical methods by sadasivam, A.Manickam
4. Pracical pharmacognosy by C.K.KoKate
5. Molecular cloning – A laboratory manual J. Sambroke, E.F. Fritsch & T.Maniatis
6. Recombinant DNA principles and methodologies James .J. Greene, Veningalla.B.Rao.
7. DNA cloning – a practical approach, D.M. Glover and B.D.Hames.

ADVANCED CLINICAL BIOCHEMISTRY

UNIT – I

Basic principles and practices of clinical laboratory collection of specimens – Blood, Urine, Amniotic fluid – patient management, Prognosis and Diagnosis. Laboratory safety – toxic chemicals and biohazards.

Automation in clinical laboratory – Precision, Quality assurance, clinical validation and accreditation.

UNIT – II

Disorders of carbohydrate metabolism (Hyperglycemia and Hypoglycemia): Diabetes Mellitus, Insulin receptors and C-peptides, Glycogen storage disease, Mucopolysaccharides, Lipids and lipoprotein abnormalities; Lipidosis, hypercholesterolemia, hypercholesterolemia and plasma lipoproteins – albuminuria Taysach's and Niemann picks diseases.

UNIT -III

Disorders of amino acids metabolism: Inborn errors of Branched chain amino acids, aromatic amino acids, aliphatic amino acids. Disorders of Nucleic acid metabolism: Purine and Pyrimidine metabolism – Gout, Lesch Nyhan syndrome and hereditary Ortoticaciduria.

UNIT – IV

Renal function test: Osmolarity and free water clearance, acute and chronic renal failure, renal hypertension, glomerulonephrities, nephritic syndrome, urinary calculi and dialysis. Liver function test: clinical significance of AST, ALT, ALP and Gamma glutamyl transpeptidase, jaundice. Pancreatic function test, Gastro intestinal function test, Cerebrospinal fluid – Characteristics of blood CSF barrier, composition of CSF. Detection of inborn errors in fetus and heterozygous carriers by enzyme assay in amniotic fluid.

UNIT – V

Disorders of mineral metabolism: Porphyrins, Hemoglobin- Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemia and anemia, Classification of anemia, blood clotting.

REFERENCE BOOKS

1. Fundamentals of clinical chemistry , N.W.Teitz, W.B. Saunders company, Second Edition (1994)
2. Teitz Fundamentals of clinical chemistry- A. Buritis, E.R. Ashwood (eds). Saunders WB CO.
3. Practical clinical biochemistry, volume I and II – Harold Varley et al., CBS Publishers, 4th Edition,(1988).
4. Text book of medical physiology 11th edition by A.C. Guyton & J.E.Hall, Harcourt Asia (2006).
5. Zubay, G.L. biochemistry, W.M.C. Brown publishers. New york, cambell, P.N and A.D. Smith, biochemistry illustrated 4th edition, Churchill Livingstone (1998).
6. Clinical biochemistry in diagnosis and treatment.Philip. D. Mayne, ELBS publication 6th edition (1994).
7. Clinical biochemistry – Metabolic and clinical aspects, William J.Marashall and Stephen K bangert, Pearson professional Ltd (1995).
8. Fundamentals of biochemistry 8th edition by Deb.A.C., books and allied (P) Ltd, (2002).
9. Biochemistry 3rd edition by U.Sathayanarayana, Books and allied (p) ltd., India (2006).
10. Biochemistry, Jeremy M.Berg, John L.Tymoczko, Lubert Stryre, 5th edition.

DRUG BIOCHEMISTRY AND TOXICOLOGY

UNIT- I– Basic principles of medicinal chemistry

History and development of medicinal plants, sources and classification of drugs. Routes of drugs administration, dosage forms. Drug distribution, pKa values, hydrogen bonding, protein binding, chelation, steric effect, surface activity. Mechanism of action of drugs, combined effect of drugs. Factors modifying drug action, tolerance and dependence. Pharmacogenetics.

UNIT- II – Principles of basic and clinical pharmacokinetics

Drug metabolism – general pathways of drug metabolism (different types of reaction in phase I and phase II with examples), metabolism and excretion of drugs. Adverse drug reactions and treatment of poisoning. Drug interactions, factors affecting drug metabolism including stereo chemical aspects, significance of drug metabolism in medicinal chemistry.

UNIT- III – Systemic pharmacology

Autonomic nervous system, central nervous system, autocoids, chemotherapy of parasite infections, chemotherapy of microbial diseases, immunomodulators. Gene therapy. Therapeutic gases. Free radical biology and antioxidants, pharmacology of biophosphonates.

UNIT- IV – General and systemic toxicology

General toxicology: Basic principles of diagnosis. Mechanism of toxic effect, toxicokinetics – chemical carcinogens and teratogens, treatment of intoxication. Response of respiratory system, reproductive system, liver ,

kidney to toxic agents. Toxic effects of metals, solvents, environmental pollutants. Antidotes in the management of poisoning. Applied analytical toxicology and toxicovigilance.

UNIT- V – Plant Therapeutics

Basic constituents of plants (chemical classification). Isolation of active constituents from plant material. Percolation and maceration. Qualitative constituent characterization techniques. Utilization of HPTLC for the constituent analysis. Estimation of marker compounds on biological fluid after crude plant material. Introduction and medicinal terminology – IT enabled services, need of medical transcription, equipments used. Medical terminology – word root, combining form, suffixes prefixes, formation and defining medical words.

REFERENCE BOOKS

1. The pharmacology volume I and II – Goodman and Gillman
2. Basic pharmacology – Foxter Cox
3. Principles of medicinal chemistry 4th edition by Willam.O.Foye, B.I. Waverks, LW&W., (1995)
4. Burgers medicinal chemistry and drug discovery- principles and practice- Manfred. E.Wolf
5. Oxford text book of clinical pharmacology and drug therapy, D.G Grahme Smithand J.K.Aronson
6. Pharmacology and pharmatherapeutics- R.S. Satoskr, S.D.Bhandhakarand
7. Essential of pharmacotherapeutics, Barav.F.S.K
8. Introduction to medicinal chemistry, Batrick.G.L

9. Lippincotts illustrated review pahamacology, Mary. J.Mcek, Richarts, Pamela.C.

CONCEPTS OF IMMUNOLOGY

Unit I

Basic concepts of immunology- types of immunity, components of immune system, haematoposis. Immune reactive cells- B cells and T cells, mast cell, phagocytic cell, structure and function of primary and secondary lymphoid organs. Antigens, chemical nature, types, epitope, cross reactivity, adjuvant, super antigen, and mechanism of immunity to infection.

Unit II

Antibodies- Structure, theories of antibody formation, classes, immunoglobulin super family, generation of antibody diversity, class switching, primary and secondary immune response, kinetics, antigen recognition, antigen processing and antigen presentation, activation of B cells and T cells, immunological memory, lymphocytes and cytokines. Biology of the complement system, MHC complex class I, II and III molecules, transplantation immunology- allograft, typing – HLA typing and MLR. GVH reaction, organ transplantation, and immune suppressive therapy.

Unit III

Hyper sensitivity- types 1 to 5, mechanism, assay and treatment. Immunotolerance, autoimmune disorders. Immunization –active and passive immunization, vaccines toxoids, recombinant vaccines.

Hybridoma technology – monoclonal antibodies production and application in biomedical research, catalytic antibodies, plantibody.

Unit IV

Immunology disorders- B cell deficiencies, T cell deficiencies, secondary immuno deficiency diseases – AIDS- HIV lifecycle, pathogenesis, immunological abnormalities, diagnosis and treatment, AIDS vaccine.

Tumor immunology – immune surveillance – tumor viruses – tumor associated transplantation antigens – tumor specific antigens. Cell surface changes – tumor associated oncofoetal antigens, immune response to tumors- approaches to cancer immunotherapy – immuno diagnosis.

Unit V

Isolation and characterization of immune cells. Macrophage culture and assay of macrophage activation. Mitogen and antigen induced lymph-proliferation assay. Purification and quantification of antibody RID, EID, Nephelometry. Antigen-Antibody reactions in vivo and invitro.

REFERENCE BOOK

1. Immunology 4th edition by Ivan Roitt,J.V Rostoff and David Mole (1998).
2. Essential immunology 9th edition by Ivan Roitt,J.V Rostoff Blackwell science Led (1997).
3. Immunology by Janis kuby W.H freeman and Co. Ltd USA (1992).
4. Basic and clinical immunology 6th edition by Stites D.P stobo .J.D fundan berg.

5. Immunology an introduction I.R. tizard
6. Clinical and practical immunology by talwar volume I and II.

BIOSTATISTIC AND RESEARCH METHODOLOGY

UNIT I

Biostatistics –meaning, basic principles, importance in biological practice, variables –scales measurements, collection of data –questionnaire, classification –tabulation, diagrammatic and graphical representation of the biological data.

UNIT II

Sample, population –sampling methods, survey statistical inference, point of interval estimation, hypothesis --simple hypothesis testing normal, t-test, chi-square test, ANOVA and interpretation, important non parametric methods.

UNIT III

Measures of central tendency ,variation ,standard deviation –standard error of mean, correlation, regression ,: Simple linear regression , multiple linear regression ,logistic regression. Introduction to multivariate analysis .Statistical packages (SPSS, STATA etc).Prediction and its importance, probability, sensitivity, specificity, efficiency of screening test, normal distribution properties and its importance.

UNIT IV

Research methodology: Biological research meaning – importance, constraints – steps in research process –selection and statement of problem formulation of hypothesis, review of literature, pilot study, reliability and validity of a tool. IPR – Bioethics

UNIT V

Principles and method of research designs –experimental and non – experimental designsectional, prospective and retrospective studies. Time scheduling – lab and field facilities – Research duration –choice of research topic –methodology procedure, Preparing, writing and documentation of research report .Role of computers in biological research and practice.

REFERENCE 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 41st edition 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 scienceby Gurumani.N , MJP pub., (2007)
7. Research methods in biological science – Dr.S. Palanichamy, M. Shanmugavelu
8. Biochemical calculation and biostatistics – Dr E. Padmini.

HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

UNIT-I

Definition of hormones, classification of hormones and mechanism of action of peptide hormones. Concepts of receptors - G protein coupled receptors - adenylate cyclases. Mechanism of action of steroid hormones, structure of steroid receptors - functional domain - DNA binding sites. Nuclear transport mechanism transcriptional and post transcriptional mechanism

UNIT-II

Structure, synthesis, secretion, mechanism of action and Pathophysiology of hormones of hypothalamo, hypophyseal complex, thyroid and parathyroid.

UNIT-III

Structure, synthesis, secretion, mechanism of action and pathophysiology of hormones of Pancreas, adrenal, gastro intestinal and gonads.

UNIT-IV

Respiratory system components and their functions-transport of oxygen and CO₂. circulatory system- composition and functions of plasma,

blood coagulation, transfer of blood gases. Digestive system-composition and functions; digestion and absorption of carbohydrates, lipids, proteins etc.

UNIT-V

Nervous system-organization, nerve impulses and neurotransmission, action potential. Structure and functions of reproductive system. Physiology of pregnancy and lactation. Excretory system- structure of nephron, formation of urine, tubular re-absorption and secretion

REFERENCE BOOKS

1. Endocrinology, Mac E. Hadley, Publishers- prentice hall international Inc, 4th edition
2. Text book of medical physiology 10th edition by Guyton, (2001)
3. Principles of biochemistry, Emil I. Smith
4. Endocrinology –Williams
5. Molecular medical biochemistry- J.P.Luzio.R.J.Thompson
6. Cell signaling 2nd edition by John T.Hancuck.oxford university (2006).

BIOINFORMATICS & NANOTECHNOLOGY

UNIT I – Elementary computer science

General awareness of computer hardware; CPU and other peripheral devices (Input/Output and auxiliary storage devices) Basic knowledge of computer system software and programming language-Machine language, assembly language and higher level language. General aspects of popular

commercial software packages like MS word, MS Excel, EX power point, other scientific application packages.

UNIT II– Genomics

Comparative genomics, Evolution of genomes, Genomic identification, Biomedical genome research, human genomic variation, genome resources- NCBI map viewer, ORF finder, locuslink. Analysis tools for sequence data banks. Pair wise alignment, Smith waterman, Multiple alignment-CLUSTAL, PRAS. Sequence databanks- protein, nucleotides.

UNIT III–Proteomics

Gel based protein analysis methods- 2 DE, MALDI-MS, Non gel bases protein analysis: HPLC, MS, LC-MS. Protein interaction network. Blast and Fasta type and their algorithms. Protein classification, secondary and tertiary structure prediction, GOR method, chou-Fasman method, HMMs, neural net works, blocks and profile analysis. Phylogenetic analysis, Maximum parsimony, maximum likelihood, UPGMA methods.

UNIT IV – Metabolomics

Basics, Data bases-small molecules, KEGG, CSD, MMCD, Mass spectrophotometry, metabolic engineering, metabolomic analysis. Metabolite extraction. Bio informatics insights for designing biomaterials. NMR and GC-MS- Sugars, acyl carnitines, amino acides, glycerol phospholipids and sphingolipids. Analysis of plasma for metabolomics.

UNIT V– Nano technology

Bio and Non bio nanomaterials. Optical signals- Fluorescence, bio luminescence, sensors, photon counters. Electrical and electro chemical sensing – DC and impedance, passive electrodes based on interfacing, nano electrodes. Nano materials for bio applications. Characterization and applications in medicine.

REFERENCE BOOKS

1. Genomic and proteomics-Functional and computational Aspects – sandar sunai Bioinformatics-concepts,Skill and Application-S,C Rastogi ,Namita mendritta,Parag rastogi (2000).
2. Protein Biochemistry and Proteomics –Hubert Rehn, Academic press (2006).
3. Bioinformatics –Principles and Application by Harshawaedhan .P.Bal
4. Pratical Bioinformatics by Janusz M.Bujnicki Springer Berlin (2008)
5. Nanotechnology –Basic science and Emerging Technologies-Rohit Majumdar
6. Nanotechnology –Fundamentals and Application –Mansi KarKare
7. Nanoscience and technology-K.P.Mathar.
8. Bioinformatics sequence and genome analysis 2nd edition by Mount Davit.
9. Introduction to proteomics: Tools for new BiologybyLiebler,Humana W.CBS pub., (2002)
10. Proteomics:From protin sequence to function S.pennington (2002)
11. Bioinformatics computing –Bryan Bergeron(2003)
12. Metabolomics analytic solution-Donna.L.Wilson
13. Metabolomics –Royston Goodacre