M.Sc. BIOCHEMISTRY
SEMESTER - I

COURSE TITLE: CELL BIOLOGY

Course code: PSBCTC101
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2018, Dec 2019 & Dec 2020

Objectives: Cell is the basic unit of life. Therefore knowledge concerning it is important for the pursuit of other branches in life sciences. The course has been designed to provide insight to students into the structures of cell and constituents, and to some extent their functioning, which will serve as the edifice for subsequent learning.

UNIT – I: CELL STRUCTURE AND DIVERSITY

i. Universal Properties of Cell; cell theory, diversity of the cell size and shape, different classes of cells,
ii. Preliminary methods used in cell biology, Microscopic techniques for study of cells; Sub-cellular fractionation.
iii. Membrane structure and function; Transport of nutrients, ions and macromolecules across membranes, exocytosis, and endocytosis, Membrane pumps; Na^+, K^+, Ca^{2+} pumps.
iv. Cell wall and ECM, Cell motility; cilia, flagella of eukaryotes and prokaryotes.

UNIT - II: CELL ORGANELLES

i. Cellular organelles; Structure and function of endoplasmic reticulum, golgi bodies, lysosomes, endosome, Mechanism of vesicular transport.
ii. Mitochondria, chloroplast and peroxisomes.
iii. Nucleus; nuclear envelope, NPC, nucleolus, nuclear matrix.
iv. Chromosomes and chromatin, centromeres, telomeres, nucleosome, Hetero and euchromatin, types of chromosomes and alterations.

UNIT - III: CELL SIGNALING AND CELL COMMUNICATION

i. Cell signaling- signaling molecules, cell surface receptor; G- protein linked cell-surface receptors, protein-kinase linked cell surface receptors, signal transduction pathways; Ras/MAPK' Pathways, second messengers.
ii. Cell signaling in micro-organisms; bacterial chemotaxis, quorum sensing.
iii. General principle of cell communication, cell-cell interaction, structural and functional significance of plasmodesmata.
iv. Cellular junction and adhesion; role of different adhesion molecules, gap junction.

UNIT – IV: CELL CYCLE, GROWTH, DIVISION AND REGULATION

i. Biology of cancer; Cancer Genes (Oncogenes and Tumor Suppressor Genes), retinoblastoma and E2F proteins.
ii. Introduction to growth control and cell cycle; Mitotic Spindle, Microtubules, checkpoints.
iii. Regulators of cell cycle progression; role of cyclin and cyclin dependent kinases.
iv. apoptosis and cell death; program cell death, extrinsic and intrinsic pathways

UNIT –V: **DEVELOPMENT BIOLOGY**

i Cellular basis of differentiation and development- mitosis, gametogenesis and fertilization.
ii Development of *Drosophila*- early drosophila development, pattern formation, maternal and gap genes, pair rule and segmentation genes, nervous system and eye development, Homeotic genes and their role in development.
iii Development of *C. elegans*-Introduction, life cycle, organogenesis (vulva formation).
iv Morphogenesis and organogenesis in *Arabidopsis thaliana* as model plant- shoot and root development, leaf and floral development.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walsh, P. (2006) Molecular Biology of the Cell. Garland Science, USA. . 4th edition.
2. Alberts, B., Bray, J.L., Roberts, K. and Watson, J.D. (2008). Molecular Biology of the Cell. Garland Publishing House, New York. 2nd ed.
3. Du Praw, E.J. (1968). Cell and Molecular Biology. Allyn & Bacon, Boston, USA.
4. Dyson, R.D. (1975). Essentials of Cell Biology. Allyn & Bacon, Boston, USA.
5. Swanson, C.P. and Webster, P. (2006). The Cell. Prentice – Hall, Englewood Cliffs, USA.
6. De Robertis, E. D. P. and De Robertis, E.M.F. (2001) Cell and Molecular Biology. Lippincott Williams and Wilkins, Philadelphia, USA. .8th ed.
7. Karp, G (2007) Cell and Molecular Biology : Concepts and Experiments. John Wiley Inc. New York. 5th ed.
8. Szallasi, Z., Stelling, J., and Periwal,V.(2007). System Modelling in Cellular Biology, Prentice Hall, India.

M.Sc BIOCHEMISTRY
SEMESTER-I

COURSE TITLE: BIOPHYSICAL AND BIOORGANIC CHEMISTRY

Course code: PSBCTC102
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2018, 2019 & Dec 2020

Objectives: This course is intended to educate the students about rapid identification of and familiarization with the structural features of natural products commonly encountered in Biological materials. Studies on metabolic pathways are necessary to understand how bio molecules interact with each other in a living system. Also in this course students will get familiarised with the basic techniques used by the biologist in the routine experimentation. Since biotechnology is emerging as the most potent technology for commercial synthesis of pharmaceuticals and allied products, basic knowledge of Bio-molecules and the methodologies involved in their structural analysis will stand in good stead.

UNIT-I: CHEMICAL FOUNDATIONS OF BIOLOGY AND STEREOCHEMISTRY:

i. Chemical bonding including de-localization, and Hydrogen bonding. pH, pKa, pKb, Handderson-Haselbach equations. Muta-rotation.

ii. Z & E Nomenclature, Chirality in biphenyls, allenes & spiranes, stereo - and optical-isomerism with reference to monosaccharaides and amino acids.

iii. Brief Introduction with reference to Chemical reactivity of Heterocyclic scaffolds present in Biological systems: Pyrrole, imidazole, thiazole, pyridine, pyrimidine, benzimidazole, quinoline and flavone

iv. Classes of organic compounds and functional groups - atomic and molecular dimensions; space filling and Molecular models

UNIT-II: UV & IR SPECTROSCOPY

i. UV SPECTROSCOPY: General principles of UV spectroscopy, electronic energy levels and electronic transitions, Absorption laws, Chromophores, auxochromes, bathochromic shift, hypsochromic shift, hyperchromic effect, hypochromic effect, solvent shifts in

alkenes and ketones, Woodward-Fieser rules for calculating absorption maxima of unsaturated carbonyl compounds (with special reference to steroids).

ii. IR SPECTROSCOPY: General principles of IR spectroscopy, fingerprint regions, stretching and bending vibrations, Fermi resonance, IR absorption bands of common functional groups (hydroxyl, carbonyl, amides, amines), factors affecting the carbonyl absorptions in common organic compounds.

iii. Principle and applications of CD & ORD

iv. Applications of the above mentioned techniques in structure elucidation

UNIT-III: MASS SPECTROSCOPY & NMR

i. Principles of Mass spectrometry, RDA fragmentation and Mc Lafferty rearrangement.

ii. Nuclear Magnetic Spectroscopy-^{1}H NMR: Basic principles, chemical shift parameters; multiplicity factors controlling J values (coupling constant).

iii. ^{13}C-NMR: Basic principle, Comparison of ^{1}H and ^{13}C nuclei for NMR studies.

iv. Applications and NMR (^{1}H and ^{13}C) in structural elucidation of simple molecules like ethyl alcohol, ethyl acetate, benzene, phenols and their methyl ethers, glucose & its acetate.

UNIT-IV: ANALYTICAL TECHNIQUES:

i. Chromatography Techniques; TLC, Paper Chromatography, Chromatographic methods for macromolecule separation- Gel permeation, Ion exchange, Hydrophobic, Reverse- Phase and Affinity Chromatography, HPLC & FPLC.

ii. Electrophoretic Techniques; Theory and application of Polyacrylamide and Agrose gel electrophoresis, Capillary electrophoresis, 2D electrophoresis, Disc gel electrophoresis, gradient electrophoresis, Pulse Field gel electrophoresis

iii. Centrifugation; Basic principle, and theory (RCF, sedimentation coefficient), Types of Centrifuges- Microcentrifuge, High speed and Ultra centrifuge, preparative centrifugation, differential & density gradient, sedimentation equilibrium methods, molecular weight determination using centrifugation.

iv. Applications of above techniques.

UNIT-V: STEROIDS, VITAMINS, ANTIBIOTICS AND ALKALOIDS

i. STEROIDS: Biosynthesis of Cholesterol, structure of Cholesterol, Ergosterol (without synthesis), Steroidal Sex Hormones: Classification, structure of Estrone, Progesterone, Testosterone, Physiological importance of steroidal hormones. Non-Steroidal hormones,

ii. VITAMINS: Structure elucidation of Vitamin A, B1, B2, B6, B12,, Vitamin K, Vitamin P. Functions of Vitamins, Vitamin deficiency related diseases.

iii. ANTIBIOTICS: Natural products as drugs; Antibiotics, Broad spectrum antibiotics, Penicillin and other modified forms. General structure of Cephalosporin along with modified forms and streptomycin.

iv. ALKALOIDS: General structure and functions of alkaloids like Caffeine, Nicotine, Reserpine, Quinine, Morphine, Piperine and Atropine.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Segel, I.H. (1976) Biochemical Calculations. John Wiley and Sons.
2. Burger, A. (Latest Edition) Medicinal Chemistry, Part I, II and III.
3. Silverstein, R.M (2004). Spectrometric identification of organic compounds. John Wiley and sons, USA.
4. Finar, I.L (2007). Organic Chemistry, Vol.II. Pearson Education, Singapore.
5. Voet, D. And Voet, J.G.(2007). Biochemistry. John Wiley and Sons.
6. Kemp, W. (1991, Third Edition) Organic Spectroscopy.
7. Nasipuri , D. (2011, Third Edition) Stereochemistry of Organic Compounds, Principles and Applications
8. Freifelder, D. Physical Biochemistry. W.H. Freeman and Company, New York
9. Upadhyay,Upadhyay and Nath (2003) “Biophysical chemistry: Principles and Techniques”,Himalaya Publishing House,Mumbai.
10. Wilson K & Walker J. (Eds.). 2000. Principles and Techniques of Practical Biochemistry. 5th Ed. Cambridge Univ. Press.

M. Sc. BIOCHEMISTRY
SEMESTER - I

COURSE TITLE: MOLECULAR BIOLOGY

Course code: PSBCTC104
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: In today's scientific world no biological study is complete till it is studied at the molecular level. This course will guide students about the basic background (physical and chemical) of molecular biology. The primary objective is to make students achieve a simple, comprehensive and interested view of basic composition of nucleic acids, their structure and their mode of replication. The study deals with conversion of genetic information coded in DNA to cellular macromolecules. The contents cover important aspects like, synthesis, modification and regulation of important cellular macromolecules, namely RNA and Protein.

UNIT-I: DNA STRUCTURE, FUNCTION AND REPLICTION

i. DNA as a genetic material, DNA Structure and function: Physical and chemical structure of DNA, Alternate forms of DNA A,B,Z; Alternate DNA structure H-, G- DNA loops; D-loop, R- loop, cruciforms, hairpin loops,;
ii. DNA structures; Primary, secondary, tertiary and quartenary DNA structure; Function of alternate forms and structure of DNA.
iii. Denaturation analysis of DNA; denaturation curve and assessement of GC % and Tm, Hyper – and hypochromic effect of DNA.
iv. Replication of DNA, Replication of core genome and replication of extrachromosomal DNA, Elements and factors required for replication of core genome in eukaryotes, prokaryotes and viruses taking *E.coli, S. cerevisae* and phi X174 as models.

UNIT-II: RNA STRUCTURE FUNCTION AND REPLICATION

i. RNA Structure; Physical and chemical structure, and Function. Secondary structures of RNA RNA as genetic material; RNA genomes; Denaturation analysis of RNA
ii. Linear and circular RNA genomes. Single stranded as well as double stranded genomes. Replication of RNA genomes + sense, -ve sense, ambi-sense and ds RNA genomes.
iii. RNA as a structural molecule transfer and ribosomal RNA, RNA as a information molecule messenger RNA, RNA as an biocatalyst, Ribozymes, RNA as a regulatory molecule; RNAi and Antisense RNA;

iv. Introduction to various types of small nuclear, small nucleolar, small cytoplasmic Mi and Si RNA molecules and their role in cell.

UNIT-III: GENE EXPRESSION - TRANSCRIPTION

i. Mechanism of transcription in prokaryotes: Elements and factors involved in prokaryotes; Promoter sequences and regulatory factors.
ii. Operon concept; Inducible and repressible operons in prokaryotes. Attenuation, antitermination, auto- regulation of gene expression. Negative and positive control of gene expression
iii. Mechanism of transcription in Eukaryotes: Gene activation in eukaryotes, Basal transcription apparatus, Eukaryotic promoter sequences, enhancers and silencers and general and specific factors.
iv. Initiation, elongation and termination of transcription in Eukaryotes. Comparison of basic transcription and regulation of transcription in Prokaryotes and eukaryotes

UNIT-IV: GENE EXPRESSION - TRANSLATION

i. Genetic Code; Universality and degeneracy of code and exceptions to code, Wobble hypothesis, Codon usage bias.
ii. Mechanism of translation in prokaryotes: Elements and factors required for translation, Co-transcriptional- translation,
iii. Initiation, elongation and termination of translation in prokaryotes. Non- ribosomal peptide synthesis.
iv. Mechanism of translation in Eukaryotes: Elements and factors required for translation, Initiation, elongation and termination of in eukaryotes.

UNIT V: REGULATION OF REPLICATION, TRANSCRIPTION, TRANSLATION

i. Regulation of DNA replication, Origin of replication and regulatory factor, Relation between origin, regulatory factors and copy number
ii. Regulation of transcription in eukaryotes; Post transcriptional regulation: mRNA processing capping and polyadenylation.
iii. mRNA splicing and editing, nucleo-cytoplasmic mRNA transport, mRNA stability, degradation and half life period .
iv. Regulation of translation, co- and post translational modification of peptides, role of molecular chaperons.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Watson G.D (2008). Molecular biology of the gene. Cold spring habor Ltd Press.
2. Burton E (2008). Molecular Biology: gene to protein. Jones & Bartlett.
3. Clark & Pazdernik (2009).Biotechnology: applying the genetic revolution. Academic Press.
4. Hartwell(2004). Genetics from genes to genomes. Macgrawhill.
5. Russell (2006). Genetic: molecular Approaches. Pearson Press.
6. Lewin (2011). GenesX. Jones & Bartlett.

M.Sc BIOCHEMISTRY

SEMESTER-I

COURSE TITLE: BIOMOLECULES

Course code: **PSBCTC107** **Contact hours: 48**
Duration of Examination: **Credits**: 4
Minor Test 1: 1 Hour **Minor I**: 20 marks
Minor Test 2: 1 Hour **Minor II**: 20 marks
Major Test: 60 marks
Total: 100

Syllabus for the examinations to be held in the year Dec. 2018, Dec.2019, Dec.2020

UNIT- 1: CHEMISTRY OF CARBOHYDRATES

(i) Introduction: Biological fitness of organic compounds, dimensions and shape of biomolecules, supramolecular assemblies and cell organelles.

(ii) Carbohydrates: Classification; Monosaccharides, Isomerism, D and L forms, Stereoisomerism, epimers, anomers, pyrans and furans.

(iii) Sugar acids, sugar alcohols, aminosugars and their derivatives. Diassacharides: Homo and hetero-diasaccharides.

(iv) Polysaccharides: Storage forms- Glycogen, Starch, Inulin. Structural forms- Cellulose, Chitin. Heteropolysaccharides/ glycosamineglycans: Hyaluronic acid, Heparin, Chondroitin sulfate, Dermatan sulfates and their biological functions. Important biomolecules possessing sugar moieties.

UNIT-2: CHEMISTRY OF LIPIDS

(i) Classification of Lipids: Fatty acids, saturated/unsaturated, odd and even-carbon, essential fatty acids.

(ii) Fats/Triacylglycerols; waxes, Phosphoglycerides- Lecithins, Cephalins, Phosphatidyl serine, Phosphatidyl inositol and their derivatives, Phospho-sphingolipids/sphingomyelins.

(iii) Glycolipids, Gangliosides, Plasmalogens, Cardiolipins, cholesterol and prostaglandins.

(iv) Functions of lipids, Lipid bilayer, micelles and liposomes. Functions of lipids and lipoproteins.

Unit-3: CHEMISTRY OF PROTEINS

(i) Amino acids and their classification, pKa values and pI, peptide bond formation.

(ii) Essential amino acids, amino acids as building blocks of proteins, chemical synthesis of polypeptides.

(iii) Φ and ψ bonds and angles, primary, secondary, tertiary and quaternary- structure of proteins.

(iv) α and β pleated sheets; classification and functions of proteins, conjugated proteins- glycoproteins and lipoproteins.

UNIT-4: CHEMISTRY OF NUCLEIC ACIDS

(i) Nucleic Acids: Definition, importance and functions, structure of purines and pyrimidine bases.

(ii) Structure of nucleosides and nucleotides, biologically important nuleotides,

(iii) Structure of different types of nucleic acids, hydrolysis of nucleic acids.

(iv) Other nucleotide derivatives- active sulphates, S-adenosylmethionine (SAM), Purine and Pyrimidine analogues

UNIT-5: PORPHYRINS AND VITAMINS

(i) Porphyrins: Nucleus and classification of porphyrins, important metallo porphyrins occurring in nature, chemical nature and physiological significance of bile pigments.

(ii) Vitamins: Structure and functions of Fat soluble vitamins, A,D,E,K.

(iii) Structure and role of Water soluble vitamins, Thiamine, Riboflavin, Niacin, Pyridoxine.

(iv) Structure and role of cyano-cobalamine, Folic acid, Biotin and Vitamin C.

Books Recommended

1. Nelson DL and Cox MM (2013) Lehninger Principles of Biochemistry, 6th Edition, Macmillan Worth Publishers, New Delhi.

2. Voet D and Voet JG Biochemistry, 4th Edition, John Wiley & Sons, New York.

3. Zubey G (1998) Biochemistry, 4th Edition, WMC Brown Publishers, USA

4. Berg JM, Tymoczko, JL and Stryer L (2015) Biochemistry, 7th Edition, WH Freeman & Co., New York

5. Cohn EE, Stumph PK, Bruening G and Doi RH (1987) Outlines of Biochemistry, 5th Edition, John Wiley & Sons, New York

M. Sc BIOCHEMISTRY
Biomolecules
Semester-I

LIST OF PRACTICALS

1. To find the lambda max of given two solutions : bromophenol blue & methyl orange
2. To demonstrate the Beer-Lambert law
3. Estimation of protein in a given sample using Biuret method
4. Quantitative estimation of protein in a given sample by Lowry's method
5. Quantitative estimation of protein in a given sample by Bradford's method
6. To find the absorption maxima of aromatic amino acids
7. To find the concentration of unknown protein solution by using lambda max of aromatic amino acids
8. Estimation of reducing sugars using DNS
9. To perform qualitative test for proteins or amino acids
10. To calculate the acid values of fats and oils(butter)
11. Quantitative estimation of carbohydrate by Anthrone method

M.Sc. BIOCHEMISTRY
SEMESTER-II

COURSE TITLE: GENETIC ENGINEERING

Course code: PSBCTC201
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: The aim of the course is to extend the student's understanding of new concepts and expertise in molecular biology and fundamentals of recombinant DNA technology.

UNIT-I: FUNDAMENTALS OF GENETIC ENGINEERING

i. Scope of genetic engineering; Genetic Engineering guidelines. *E.coli* as model organism.
ii. Concept of cloning; Gene centric cloning and genome centric cloning, concept of isolation and identification of gene
iii. Molecular tools and their uses; enzymes used in genetic engineering: restriction endonucleases, Ligases, Kinases, Phosphatases, Polymerases, terminal transferases
iv. Gene cloning vectors: plasmids, bacteriophages, cosmids and artificial chromosomes.

UNIT-II: TECHNIQUES IN GENETIC ENGINEERING

i. Isolation, purification, quantitation and electrophoresis of genomic and extra genomic DNA.
ii. Isolation, purification, quantitation and electrophoresis of nuclear, organelles and cytoplasmic RNA.
iii. Size standards for DNA and RNA. Enrichment of RNA molecules for studying gene expression
iv. Southern, Northern and Western blotting; Preparation of labeled DNA probes- radioactive and non- radioactive labeling,

UNIT-III: GENE CLONING

i. Construction of genomic. Preparation of vector and insert for cloning and construction of recombinant DNA molecule. Transformation of *E.coli* with recombinant DNA.
ii. Construction of cDNA library, Cloning differentially active genes. Subtractive hybridization

iii. Screening and analysis of genomic and cDNA library by function and sequence based methods
iv. Expression strategies for heterologous genes; vector engineering and codon optimization, host engineering. Expression in eukaryotic and prokaryotic systems.

UNIT-IV: ALTERNATE WAYS OF GENE CLONING AND MODIFICATION

i. Polymerase chain reaction, nucleic acid amplification, primer design and programming. Modifications of basic PCR
ii. Site directed mutagenesis and protein engineering: methods, strategies and applications.
iii. Cloning interacting genes; two and three hybrid system, RNase protection assay and reporter assay,
iv. Phage display, Gene tagging, Transposon tagging. *In vitro* transcription and translation, methods and application

UNIT-V: ADVANCED TECHNIQUES IN GENETIC ENGINEERING

i. DNA sequencing: Sanger's Chain termination methods, next generation sequencing methods
ii. Nucleic acid micro arrays: method and applications. RNA antisense, ribozyme and interference; methods and applications.
iii. Gene Knock out technology; method and applications: Chromosome engineering; method and application.
iv. Genetic engineering in molecular diagnostics, production of genetically engineered drugs and vaccines, industrial products of genetically modified organisms.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. William, W. et al. (1997). Methods in Gene Technology. Bios Scientific Publications.
2. Glick, B.R. and Pasternack, J. J. (2007). Molecular Biotechnology: Principles and applications of recombinant DNA. ASM Press.
3. Miesfeld, R.J. (1999). Applied Molecular Genetics . John Wiley and sons Inc. Publications.
4. Ream, W. and Field, K. G. (2003). Molecular Biology Techniques. An intensive Laboratory Course. Academic Press.

5. Sambrook, J. et al.(2005). Molecular cloning: A Laboratory Manual. Cold Spring Harbour Laboratory Press, New York.
6. Primrose, S. (2007). Gene Manipulation: an embracing techniques. Blackwell Science pub.6th ed.
7. Brown, T. A. (2004). The Basic Principles of Gene cloning and DNA analysis. Blackwell science pub. IV ed.

M.Sc. BIOCHEMISTRY
SEMESTER-II

COURSE TITLE: ENZYMOLOGY

Course code: PSBCTC202
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: The course is structured to provide the students insight into protein/ enzyme structure, enzyme kinetics and mechanism & control of enzyme action, enzyme folding, enzyme purification and enzymes characterization. It also aims at acquainting students with clinical and industrial applications of enzymes.

UNIT-I: INTRODUCTION TO ENZYMES

i. General characteristics of enzymes, nature of enzymatic and non-enzymatic catalysis, Enzyme specificity, biocatalysts vs chemical catalysts

ii. Criteria for Nomenclature and IUB classification of enzymes, significance of nomenclature and classification of enzymes; significance of numbering system,

iii. Holoenzyme, apoenzyme cofactor, coenzyme, prosthetic group

iv. Basis of enzyme assays, Units of enzyme activity- IU, katal, turn over number and specific activity;

v. Structure of enzyme proteins, N and C terminal amino acid determination, sequencing of polypeptides, protein folding, amino acid side chains and their influence on preferred folding; other catalytic bio-molecules.

UNIT-II: MECHANISM OF ENZYME ACTION

i. Enzyme catalysis; effect of enzyme on the rate and equilibrium of a reaction

ii. Specificity of enzyme action: type of specificity, lock and key, induced fit hypothesis

iii. Chemical mechanisms involved in biocatalysis, proximity and orientation effect, acid/base catalysis covalent catalysis, strain and distortion theory

iv. active (catalytic) site, elucidation of amino acids involved in active site, identification of functional groups at active sites

v. Mechanism of action of chymotrypsin, carboxypeptidase, ribonuclease and lysozyme

UNIT-III: KINETICS OF ENZYME CATALYSED REACTIONS

i. Principles of bioenergetics, basis of kinetics of enzyme catalysed reactions

ii. Steady state vs equilibrium assumption, Henri and Michaelis-Menten equations, Michaelis-Menten equation for uni-substrate enzyme catalysed reactions and its significance,

iii. Kinetic parameters V_{max}, K_m , Lineweaver-Burk plots, Eadie-Hofstee and Hanes plots,

iv. Factors affecting enzyme activity: enzyme/substrate concentration, pH and temperature dependence of enzymes,

v. Enzyme inhibitions: Reversible and irreversible inhibition, types of enzyme inhibitions, and determination of K_i.

UNIT-IV: REGULATORY ENZYMES

i. Enzymes in regulation of metabolic pathways, Covalent and noncovalent modification of enzymes

iii. Allosteric enzymes, sigmoidal kinetics and its physiological significance

iv. general mechanisms of enzyme regulation: Feedback inhibition, Feedback repression, induction, Partial Proteolysis

v. Covalent modification of enzymes-reversible covalent modification

vi. Phosphorylation, adenylylation, uridylation, ADP-ribosylation, methylation, disulphide reduction as means of regulation

UNIT-V: ENZYME TECHNOLOGY

i. Strategies for bulk enzyme production, sources of enzyme isolation

ii. Enzyme purification, criteria and aim for purification, techniques /steps involved

iii. Chromatography, ion exchange, adsorption, hydrophobic, and gel filteration; salting out

iv. Ascertaining purity level of enzyme, specific activity; criteria of enzyme purity, characterization of an enzyme, determination of the molecular weight (Mr)

v. Industrial applications of enzymes- in diagnosis, therapy, brewery, dairy, food processing, detergent, textile; enzyme immobilization and its industrial importance; protein engineering, enzyme inhibitors and drug design.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Segal, L.H. (1975). Enzyme Kinetics. Wiley Interscience, USA.
2. Walsh, C. (1979). Enzymatic reaction mechanism. Freeman and company, USA.
3. Gerhartz, W. (1990). Enzyme in Industry,Production and application VCH.
4. Shultz, A.R. (1994). Enzyme Kinetics. Cambridge Press.
5. Fresht (1995) 2nd Ed. Enzyme structure and mechanism. Freeman and company.
6. Trevor, P. (2002) 4th Ed. Understanding Enzymes. Prentice Hall/Ellis, Harwood, England.
7. Dixon, M. and Webb,E.C. (1997). Enzymes, 3rd Ed. Academic Press, New York.
8. Nicholas, C. Price and Lewis Stevens (2007). Fundamentals of Enzymology. 6th edition.
9. Biotol, P. (2008). Principles of Enzymology for technological Applications. Elsevier Pub

M.Sc. BIOCHEMISTRY
SEMESTER – II

COURSE TITLE: GENETICS

Course code: PSBCTC203
Duration of Examinations
Minor Test1: 1 hour
Major Test2: 2.5 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test1: 10
Major Test: 40
Total: 50

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: In recent years, genetics and related sciences have grown explosively, generating large body of new information regarding the fine structure of gene and gene expression in pro- and eukaryotes. Besides, the molecular approach is being adopted in altering genotype and tailoring plants and animals to answer human needs. This course will introduce student to the basic concepts of genetics and prepare him to appreciate the boom of biotechnology and participate in the on going revolution.

UNIT-I: GENETICS-I

i. Mendelian genetics, Crossing over and Linkage, molecular mechanism of crossing over, Holliday model of recombination
ii. Bacterial genetic system; transformation, transduction, conjugation and F mediated sexduction, Site specific recombination.
iii. Concept of molecular markers, genetic mapping, Physical mapping, Chromosome walking
iv. Reverse genetics: Tilling, Gene silencing, RNA inference

UNIT-II: GENETICS-II

i. Mutation: Physical and Chemical mutagens, induction of mutations; molecular basis of mutations; detection of mutations
ii. Transposons; molecular characteristics of transposable elements in bacteria, Mechanism of transposition, Transposable elements in eukaryotes and prokaryotes
iii. Introduction to human genetics, Role of genetics in medicine, Patterns of single gene inheritance -autosomal recessive; Autosomal dominant
iv. Human pedigrees; X linked inheritance, Sex influenced and sex limited expression.

UNIT- III: GENETICS-III

i. Multiple alleles, Non disjunction; Dosage compensation.
ii. Sex determination; Role of Y chromosome; Genetic recombination; Maternal inheritance.

iii. Molecular cytogenetics: Fluorescence in situ hybridization (FISH); Genomic in situ hybridization (GISH), Comparative Genomic Hybridization (CGH).

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NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Lewin, B., (2008) Gene IX, John and Batleh, 9th Ed.
2. Gardner, E.J., Simmons, M.J. and Snustad, D. P. (1991). Principles of genetics. John Wiley and sons, New York.
3. Kurt, W. Hide, N. Kirsten, W. and Wieland, M. (1994). DNA Fingerprinting in plants and fungi. CRC Press, Boca Raton.
4. Hughes, M.A. (1996). Plants and Molecular genetics. Addison Wesley Longman Ltd., U.K.
5. Stainsfield, W.D.(1991).Theory and Problems of Genetics. McGraw Hill, USA.
6. Watson, J.D., Hopkins, H.N., Roberts, W.J., Sleitz, J.A. and Weiner, M.A. (2007). Molecular biology of gene. The Benjamin/ Cumming Publishing Company, Inc. USA.
7. Cronk, N., Bateman, P., and Hawkins, A. (2008). Developmental Genetics and Plant Evolution. Taylor & Francis Pub.
8. Ruthwell, N. V. (2008),. Understanding Genetics : A molecular approach. Wiley-liss Pub.

M.Sc. BIOCHEMISTRY
SEMESTER – II

COURSE TITLE: MOLECULAR VIROLOGY

Course code: PSBCTC204
Duration of Examinations
Minor Test1: 1 hour
Major Test2: 2.0 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test1: 10
Major Test: 40
Total: 50

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: This course has been designed to develop broad understanding of molecular virological strategies, mechanisms and their relationship to current paradigms in virus pathogenesis. Also, it will provide theoretical knowledge of virus groups which are pathogens, including analyses of emerging infections, through an in depth study of selected viruses. Study of antiviral activities along with their application and relevance in current research, diagnoses and treatment will remain the main learning objectives of this course.

UNIT-I: INTRODUCTION TO MOLECULAR VIROLOGY

i. Mechanisms of viral entry and Spread of Infection/ viral pathogenesis;
ii. Host Resistance to Viral Infections;
iii. Cellular receptors and virus entry. Definition, structure and methods of discovery of viral receptors (polio, herpes, HIV).
iv. Cellular interactions-clathrin coated pits, lipid rafts
v. Virus uncoating mechanisms, virus-cytoskeletal interactions, chaperons.

UNIT-II: DNA AND RNA VIRUSES

i. Types of Viruses, Animal viruses, Oncogenic viruses (tumor viruses),
ii. DNA containing oncogenic viruses, human adenovirus,
iii. RNA containing oncogenic viruses, retroviruses (Onco RNA viruses), AIDS virus.
iv. Viral diseases: Description and pathology of diseases caused by myxo and paramyxo viruses (influenza and measle virus); viruses affecting nervous system (poliomyelitis virus), enterovirus (Coxsackie), viral hepatitis.

UNIT-III: VIRUS CONTROL

i. *Viral Vaccine:* Conventional vaccines- killed and attenuated, modern vaccines-recombinant proteins, subunits, DNA vaccines, vaccine delivery and adjuvants.
ii. *Antivirals:* Interferons, designing and screening for antivirals, mechanisms of action,
iii. Antiretrovirals—mechanism of action and drug resistance.
iv. *Modern approaches of virus control:* Anti-sense RNA, siRNA, ribozymes

NOTE FOR PAPER SETTING AND COURSE EVALUATION:

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

RECOMMENDED BOOKS:

1. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka (2003) Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. Publisher: American Society Microbiology.

2. Alan J. Cann (2000) DNA Virus Replication. Publisher: Oxford University Press.

3. Alan J. Cann (2005) Principles of Molecular Virology. Publisher: Elsevier Science & Technology Books.

4. Stephen K. Tyring. (2004) Field Virology Vol.1 and 2. Antiviral Agents, Vaccines, and Immunotherapies. Publisher: Marcel Dekker.

5. Paul F. Torrence. (2005) Antiviral Drug Discovery for Emerging Diseases and Bioterrorism Threats. Publisher: Wiley, John & Sons, Incorporated.

6. Stanley A. Plotkin, Walter A. Orenstein (2008) Vaccines. Publisher: Elsevier Health Sciences.

M.Sc BIOCHEMISTRY
SEMESTER-II

COURSE TITLE: IMMUNOLOGY

Course code: PSBCTC205 | **Contact hours**: 48
Duration of Examinations: | **Credits**: 4
Minor Test1: 1 hour | **Max. Marks**: 100
Minor Test2: 1 hour | **Minor Test1**: 20
Major Test: 2.5 hours | **Minor Test2**: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: This course introduces students to molecular and cellular immunology, including antigen and antibody structure and function, major histo-compatibility complexes, B- and T- cell receptors, antibody formation and immunity and regulation of immune system. The course will also provide birds eye view of the applied aspects of the immunology.

UNIT - I: INTRODUCION TO THE IMMUNE SYSTEM

i. Introduction to immune system, Innate and acquired immunity, clonal nature of immune response; Organization and structure of lymphoid organs
iv. Cells of the immune system: Hematopoiesis and differentiation, B- lymphocytes, T lymphocytes, Macrophages, Dentritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells.
v. Nature and Biology of antigens and super antigens, Antibody structure and function, antibody mediated effector functions, antibody classes and biological activity
vi. Antigenic determinants on immunoglobulins, Immunoglobulin superfamily, BCR & TCR, generation of antibody diversity.

UNIT - II: HUMORAL AND CELL MEDIATED IMMUNITY

i. Regulation of immune response, Antigen processing and presentation, generation of humoral and cell mediated immune responses, Activation of B- and T- lymphocytes,
ii. Complement System: components of complement, complement activation, complement cascade, regulation of complement System
iii. Cytokines, cytokines receptors, cytokines antagonists, role of cytokines in T_H1/T_H2 subset development and their role in immune regulation, MHC: MHC molecules and genes, MHC restriction,
iv. Cell-mediated cytotoxicity: Mechanism of T cell and NK cell mediated lysis, Antibody dependent cell mediated cytotoxicity, macrophage mediated cytotoxicity.

UNIT - III: IMMUNOLOGICAL DISORDERS

i. Autoimmunity and auto immune disorders: organ specific and systemic autoimmune diseases, animal models for autoimmune diseases and the molecular mechanism, immunodeficiency disorder- AIDS
ii. Hypersensitivity: IgE mediated Hypersensitivity, Antibody mediated cytotoxic Hypersensitivity, Immune comlex- mediated Hypersensitivity, Delayed type Hypersensitivity
iii. Transplantation immunology: Immunological basis of graft rejection, clinical manifestation of graft rejection, general immunosuppressive therapy, specific immunosuppressive therapy, immune tolerance to allografts
iv. Immunological tolerance: central tolerance, peripheral tolerance, component of peripheral tolerance

UNIT IV: IMMUNODIAGNOSTIC PROCEDURES

i. Antigen- Antibody interactions and Techniques – ELISA and its variants, ELISPOT, Radio immunoassay, Immunofluorescence, Flow cytometry and Fluorescence, Immunoelectron microscopy
ii. Agglutination and haemagglutination assays
iii. Types of immundiffusion and immunoelectrophoretic procedures, isolectric focusing
iv. Affinity chromatographic methods and Immunoblotting.

UNIT - V: IMMUNOBIOTECHNOLOGY

i. Hybridoma Technology and Monoclonal antibodies detection and application of monoclonal antibodies;
ii. lymphokines: production and applications, Interleukine therapy
iii. Vaccines: History of vaccine development, introduction to the concept of vaccine, Active and passive immunization, Designing vaccines for active immunization: Conventional vaccines, subunit vaccines, conjugate vaccines, DNA vaccines, Recombinant vector vaccines
iv. Cell culture and maintenance of cell lines

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Goldsby, R. A., Kindt, T.J. and Osborne,B.A. (2002).Kuby Immunology. W.H. Freeman and company, New York.
2. Coleman, R.M., Lombard, M.F. and Sicard, R.E.(1992).Fundamental Immunology. Wm.C.Brown publishers,USA.

3. Roitt,I., Brostoff, J. and Male,D. (1999). Immunology. Hartcourt Brace and Company , Asia Pte.Ltd.
4. Benjamini,E.,Coico,R., and Sunshine, G. (2000). Immunology – a short course. John Wiley and Sons. Inc., New York.
5. Davies,H. (1997). Introductory Immunology. Chapman and Hall, New York
6. Bratke & Myrtek (2007). Immunology : The experimenter series.Elsener Pub.
7. Wood, Peter (2008). Understanding Immunology Elseiver Pub. 2nd edition.

M.Sc. BIOCHEMISTRY
SEMESTER-III

COURSE TITLE: PLANT BIOCHEMISTRY

Course code: PSBCTC301
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: This course deals with special metabolic attributes associated with plants, such as photosynthesis, nitrogen fixation, biosynthesis of carotenoids, alkaloids and other molecules that have found use in medicine. Role of plant hormones and their role in *in vitro* regeneration through tissue culture are also taught in this course

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UNIT –I: PLANT CELL STRUCTURE & TISSUE CULTURE

i. Structure and function of plant cell, including: cell wall, plasmodesmata, meristematic cells, vacuoles, Plant complex tissues, root quiescent zone, chloroplast, etc. Isolation of sub-cellular organelles
ii. Transport of water and ions; Translocation of inorganic and organic substances, evapo-transpiration.
iii. Secretory structures in plants, Defence systems in plants: Structural, Chemical, Physiological – reactive oxygen species and their generation, enzymic and non-enzymic components of antioxidative defence mechanism
iv. Tissue culture (somatic cell culture, somaclonal variation, protoplast isolation, fusion and culture); micropropagation and Transgenic plants.

UNIT-II: PHOTOSYNTHESIS

i. Proton gradient and electron transfer in chloroplasts of plants and purple bacteria; differences with mitochondria. Bacterio-rhodopsin and rhodopsin as ion pump.
ii. Light receptors- chlorophyll, light harvesting complexes, ferredoxin, plastocyanin, plastoquinone, carotenoids. Photosystem I & II, their location, mechanism of quantum capture and transfer between photosystems.
iii. The Hill reaction, photo-phosphorylation and reduction of CO_2, C_3, C_4 and CAM metabolism-light and dark reactions.
iv. Light activation of enzymes, photorespiration and regulation of photosynthesis.

UNIT-III : NITROGEN FIXATION AND SECONDARY METABOLITES

i. Biological nitrogen fixation, Development and structure of root nodules, Role of nod factors in nodule development.

ii. Structure of plant nitrogenase system, Symbiotic nitrogen fixation and its regulation. Formation and assimilation of ammonia
iii. sulfate reduction and their incorporation into amino acids.
v. Special features of secondary plant metabolism; terpenes (classification, biosynthesis), lignin, tannins, pigments, phytochrome, biosynthesis of nicotine, functions of alkaloids, cell wall components, surface waxes.

UNIT-IV: PLANT HORMONES

i. Structure and biochemical mode of action of auxins, gibberellins, cytokinins, abscisic acid and ethylene.
ii. Molecular effects of auxins in the regulation of cell extension and ethylene in fruit ripening,
iii. Role of hormones in regulation of seed dormancy, germination, growth, development and embryogenesis.
iv. Roles of other plant growth regulators: Brassinosteroids, Salicylic Acid, Jasmonates, Polyamines, Nitirc oxide (NO)

UNIT V: BIOCHEMISTRY OF PLANT GROWTH AND STRESS METABOLISM IN PLANTS

i. Biochemistry of seed development, fruit development and ripening including post-harvest ripening
ii. Structure and function of phytochrome, hormonal regulation of flowering, photoperiodism, and vernilization.
iii. Environmental stresses, salinity, water stress, heat, chilling, anaerobiosis, pathogenesis, heavy metals.
iv. Radiations and their impact on plant growth and metabolism, criteria of stress tolerance.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given**.**

BOOKS RECOMMENDED

1. Sarakle,M.P.(1997). Handbook of Photosynthesis. Marcel Dekker Inc. NY, Basel, Hong Kong.
2. Goodwin, T.W. and Mercer, E.I. Introduction to plant Biochemistry. Pergamom Press Oxford.
3. Dennis, D.T. Biochemistry of Energy Utilization in Plants. Blackie, Glasgow, London.

4. Dey, P.M. and Harborne, J.B. Plant Biochemistry. Academic Press.
5. Hammond, J. (2005). Plant Biochemistry
6. Buchnan. Biochemistry and Molecular Biology of Plants.IK International Pvt. Ltd.
7. Hawes, C. Plant Cell Biology. Oxford University Press.
8. Hand Walter Heldt(2005): Plant Biochemistry Academic Press. 3rd Edition
9. Petor, J. Davies (2004): Plant Hormones. Kullwer, Academic Publishers 3rd Edition.

M.Sc. BIOCHEMISTRY
SEMESTER –III

COURSE TITLE: INTERMEDIARY METABOLISM

Course code: PSBCTC302
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: In this course the student is exposed to detailed metabolic events, their regulation and interrelationship, including bioenergetics. Metabolic disorders, however, are indicated but dealt in with more details in the course Clinical Biochemistry.

UNIT-1: METABOLISM OF CARBOHYDRATES

i. Digestion and absorption of carbohydrates, Glycolysis, glycogenesis, glycogenolysis, gluconeogenesis.
ii. Citric acid cycle, amphibolic role of citric acid cycle, effect of starvation and diabetes mellitus on carbohydrate metabolism.
iii. Pentose phosphate pathway, shuttle and other minor pathways, Electron transport chain, bioenergetics.
iv. Uncouplers of oxidative phosphorylation, inter-conversion of sugars and their conversion to respective alcohols and acids, regulation of carbohydrate metabolism.

UNIT-2: METABOLISM OF LIPIDS

i. Digestion and absorption of lipids, α, β and ω oxidation of fatty acids. Influence of starvation and diabetes mellitus on ketosis.
ii. Biogenesis of fatty acids, elongation of fatty acids, triacylglycerol, phosphoglycerides, sphingolipids, cholesterol, prostaglandins and other protanoids.
iii. Catabolism of triacylglycerols, phosphoglycerides, sphingolipids.
iv. Breif exposure to metabolic disorders of lipids, regulation of lipid metabolism.

UNIT-3: METABOLISM OF AMINO ACIDS

i. Digestion and absorption of proteins, General reaction of amino acid metabolism i.e transamination, deamination and decarboxylation.
ii. Catabolism of amino-acids and amphibolic role of citric acid cycle, urea cycle.
iii. Biogenesis of essential and non-essential amino acids and their regulation.
iv. Metabolism of amino acid precursors, brief exposure to metabolic disorders of amino acid metabolism

UNIT-4: NUCLEIC ACID METABOLISM

i. Biosynthesis of purine and pyrimidine nucleotides.
ii. Formation of nucleoside di and tri-phosphates and their de-oxy derivatives.
iii. Catabolism of nucleotides and salvage pathways.
iv. Importance of HGPRTase and regulation of nucleotide biosynthesis.

UNIT-5: INTEGRATION OF METABOLISM

i. Metabolic fates of glucose-6 phosphate, pyruvate and acetyl CoA.
ii. Metabolic profiles of brain, muscle, adipose tissue, liver and kidney.
iii. Hormonal regulation of metabolism.
iv. Regulation of major metabolic pathways and hormonal regulation of metabolism.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMENDED:

1. Abeles RH, Frey PA and Jeneks WP (1992) Biochemistry, Jones and Bartlett Publishers, Boston.
2. Berg JM, Tymoczko, JL and Stryer L (2002) Biochemistry, 5th Edition, WH Freeman & Co., New York.
3. Cohn EE, Stumph PK, Bruening G and Doi RH (1987) Outlines of Biochemistry, 5th Edition, John Wiley & Sons, New York.
4. Murray RK, Granner DK, Rodwell VW and Mayes PA (2000) Harper's Biochemistry, 25th Eidtion, Applaton and Lange Publications, California, USA.
5. Nelson DL and Cox MM (2001) Lehninger Principles of Biochemistry, 3rd Edition, MacMillon Worth Publishers, New Delhi.
6. Rawn JD (1990) Biochemistry, 2nd Edition, Harpers and Row Publications, New York.
7. Voet D and Voet JG (2001) Biochemistry, 3rd Edition, John Wiley & Sons, New York.
8. Zubey G (1998) Biochemistry, 4th Edition, WMC Brown Publishers, USA.

M.Sc. BIOTECHNOLOGY
SEMESTER - III

COURSE TITLE: BIOINFORMATICS

Course code: PSBCTC303
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credit: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: - The last decade has seen veritable explosion in of information generated by molecular biologists. To come in grips with the cascade of information knowledge of computers and their applications has become very important. Bioinformatics, loosely defined as interaction of molecular and computational biology, has to do this and to unravel more of nature's secrets. The present course has been designed to provide the students basic knowledge about genomics, proteomics and bioinformatics.

UNIT-I: BASIC STATISTICS

i. Measures of central tendency and measures of dispersion, probability and its types: permutation, combination, probability computations
ii. Theoretical distributions: Bionomial, Poisson and Normal. Hypothesis testing; two types of errors
iii. Tests of significance: t-test, chi-square test, one way and two way analysis of variance
iv. Simple correlation and regression.

UNIT-II: FUNDAMENTALS OF COMPUTERS

i. Introduction to digital computers; organization, binary number system, flow chart and programming techniques
ii. MS OFFICE software covering word processing, spreadsheets and presentation software
iii. Types of networks, data transmission methods, communication protocols.
vii. Internet- Evolution and its Uses, Intranet Protocols, Concepts of Internet, URL, Domain Names, E-mail concepts, FTP & its usages.

UNIT-III: INTRODUCTION TO BIOLOGICAL DATABASES

i. Internet and the biologist, Scope of Bioinformatics, Biological Databases; Primary, Secondary & Composite databases.
ii. Nucleotide Sequence Databases; GenBank, EMBL, DDBJ, NCBI Data Model.
iii. Protein Sequence Databases; SWISS-PROT protein sequence database, Translated EMBL (TrEMBL), UniProt, PROSITE,Pfam, OWL: A composite protein sequence database.
iv. Structural Databases; Protein Data Bank (PDB), Molecular Modelling Database (MMDB), Nucleic Acid Database (NDB), SCOP (Structural Classification of Protein), CATH (Class Architecture Topology Homology)

UNIT-IV: INFORMATION RETRIEVAL & SEARCHING OF BIOLOGICAL DATA

i. Retrieval Systems: SRS, ENTREZ, GQuery: Global cross database NCBI Search, DBGET Search, LinkDB: Database of link information
ii. Sequence Similarity Search: BLAST, FASTA, CLUSTALW.
iii. Sequence submission tools: BankIt, Sequin, Webin, SAKURA.
iv. Retrieval of Structural Data from PDB, MMDB, CDD, Protein Visualization Software: RASMOL, Cn3D, JMol., PyMol, Swiss-PDB (SPDBV)

UNIT-V: COMPUTATIONAL ANALYSIS OF BIOLOGICAL DATABASES

i. Analysis of DNA and protein sequences, ESTs, SAGE and Gene prediction
ii. Definition of Genome, Introduction to Human Genome Project, Genome Sequencing, Genome Maps & their uses.
iii. Sequence assembly, Genome analysis, Phylogenetic analysis.
iv. Currently existing biological databases (Summary) ACEDB: A database for genome information.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Baxevanis, A.D. and Francis Onellette, B.F. (2001). Bioinformatics. Wiley Interscience. John Wiley and Sons Inc. New York.
2. Attwood, T.K. and Parry-Smith, D.J. (1999). Introduction to Bioinformatics. Pearson Education Ltd., Singapore.
3. Mueller, J.P. and Sheldon, T. (1998). Internet information server 4. Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Curtin, D.P. et al. (1999). Information Technology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. Dhar, M.K. and Kaul, S. (1997). Statistics in Biology. Malhotra Brothers, Jammu.
6. Snedecor, G.W. and Cochran, W.G. (1989). Statistical methods. Iowa State University Press, Ames.
7. Steel, R.G.D. and Torrie, J.H. (1981). Principles and procedures of statistics: A Biometrical approach. McGraw-Hill Book Company, Singapore.
8. Ye, Q. S. (2008). Bioinformatics: A practical approach. Champman & Hall/ CRC.
9. Noah, H. (2008) Bioinformatics Genomics and postgenomics. Wiley.
10. Tramontano Anna (2008). Int. to Bioinformatics. Chapman & hall/ CRC.

M. Sc BIOCHEMISTRY
SEMESTER-III

COURSE TITLE: MAMMALIAN HORMONES

Course code: PSBCTC307
Duration of examinations
Minor Test: 1 hour
Major Test: 2.0 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test: 10
Major Test: 40
Total: 50

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: This course deals with the mammalian hormones, both endocrine and exocrine in nature and covers the hormones that are either derived from amino acids or are short peptides and polypeptides and their regulation and mechanism of action, including that through signal transduction processes. Steroidal hormones or those derived from fatty acids, including those that act locally, are also to be covered.

UNIT-I: GENERAL CONCEPTS AND THE HORMONES OF THE PITUITARY AND HYPOTHALAMUS

(i) Definition and classification of hormones, receptors of hormones on cell surfaces, transport of hormones, mechanism of action of hormones.

(ii) Hormones of hypothalamus: growth hormone releasing hormones (GHRH & GHIRH), GnRH, Dopamine.

(iii) Thyroid stimulating release hormones (TSH-RH), Somatostatin, Corticotroin release hormone, Melanocyte stimulating release hormone (MSH-RIH).

(iv) Hormones of pituitary glands: Growth Hormone (GH), Prolactin, Thyroid stimulating hormones (TSH), Adrenocarticotropic hormones (ACTH), Gonadotropic Hormones (FSH & LH), Melanocyte stimulating hormone (MSH), Oxytocin, Vasopressin.

UNIT-II: HORMONES OF PANCREAS, THYROID, PARATHYROID and GIT

(i) Hormones of pancreas: Insulin and Glucagon and their role in carbohydrate metabolism.

(ii) Hormones of Thyroid and Parathyroid: T3 and T4, Thyrocalcitonin, Parathormone.

(iii) Erythropoietin, Angiotensin, Kallikrein, GABA, 5-OH Tryptamine.

(iv) Somastostatin, Somatomedin, Epigastrin, Gastrin, Cholecystokinin, Leptin, Plancental Hormones.

UNIT-III: STEROID HORMONES OF ADRENALS AND GONADS

(i) Role of Epinephrine, Nor-epinephrine, Glucocorticoids; cortisol, cortisone.

(ii) Mineralo-corticoids: aldosterone;

(iii) Estrogens, progesterone and androgens (testosterone)

(iv) Eicosanoids: Prostaglandins, Thromboxines and leukotrienes.

NOTE FOR PAPER SETTING

Minor test 1 should cover upto 20% of syllabus. Minor test 2 should cover 21%-40% of the syllabus. Major test should cover 41%-100% of syllabus. Major test will have 7 questions, each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test 2 will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Guyton and Hall: Textbook of medical Physiology, Gopsons Paper Ltd. 13th edition.
2. Smith, Rae, Backett: Clinical Biochemistry. Blackwell Science 9th edition.
3. Burtis Carl, A. Ashwood, R. Edward: Fundamentals of Clinical Chemistry, 6th edition.
4. Marschall, Clinical Biochemistry, 3rd edition.
5. Biochemistry. A case-oriented approach. Sixth edition: By R Montgomery, T W Conway, A A Spector and D Chappell.
6. Ganong, F. William, Review of Medical Physiology, 24th edition (LANGE Basic Science.
7. Das, Debajyoti, Biochemistry, 14th edition. Academic Publishers.

M.Sc. BIOCHEMISTRY
SEMESTER-IV

COURSE TITLE: NUTRITIONAL BIOCHEMISTRY

Course code: PSBCTC403
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2020, May 2021 & May 2022

Objectives: This course deals with human nutrition, the sources, daily requirements in health and disease and deficiency symptoms. Emphasis is also laid on nutritional formulations for patients with different ailments including genetic disorders.

UNIT-I: NUTRITIONAL REQUIREMENTS FOR ENERGY

i. Basic concepts and relationship between food, nutrition, health and disease. Recommended daily allowances.
ii. Determinants of energy value of foods, energy requirement and factors affecting requirements.
iii. BMR-definition, measurement, direct and indirect calorimetry, SDA.
iv. Factors influencing BMR and SDA.

UNIT –II: MEASUREMENT OF ENERGY AND NITROGEN BALANCE

i. Thermogenic effects of foods, Measurement of energy expenditure.
ii. Dietry requirements and sources of carbohydrates, dietary fibre and its role in nutrition and maintenance of blood sugar.
iii. Nitrogen balance and factors influencing it.
iv. Protein quality and complementary value of cereal proteins and the inherent limitations.

UNIT-III: LIPIDS, MINERALS, VITAMINS AND WATER AS DIETARY REQUIREMENTS

i. Major classes of dietary lipids and essential fatty acids and their influence on the composition of plasma lipoproteins and atherosclerosis.
ii. Water and electrolyte composition and their distribution and balance in human body. Acid-base regulation; respiratory acidosis and alkalosis.
iii. Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodide, zinc, copper, fluorine and other micro-nutrients and their deficiency symptoms.

iv. Hypervitaminosis.

UNIT-IV: TOXINS AND ASSESSMENT OF NUTRITIONAL STATUS

i. Naturally occurring toxins and their ill-effects on health.
ii. Assessment of nutritional status, malnutrition and over- and under-nutrition.
iii. Basic concepts of dietetics, diet therapy.
iv. Dietary modifications in specific conditions.

UNIT-V: CLINICAL NUTRITION/ DIET FORMULATIONS

i. Diet charts/formulations for infants, pre-school and school children, adolescents and adults, expectant and nursing mothers,
ii. Diabetics, Obesity, hyperlipidemic, hyperuricemic, uremic patients
iii. Cancer, Hypertension, Renal failure
iv. Allergic symptoms.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Fennema R. Owen: (2005). Food chemistry Marcel Dekker, Inc. New York 3rd ed.
2. Wong W.S. Dominic: (1996) Mechanism and Theory in Food Chemistry, 1996 CBS Publisher's & Distributors.
3. Wardlaw G.M and Smith A.M: (2006) Contemporary Nutrition, sixth edition, McGRAW- Hill Companies, Inc.
4. Srilakshmi B: (2011). Dietetics, sixth edition, New age international publishers.

M.Sc. BIOCHEMISTRY
SEMESTER-IV

COURSE TITLE: CLINICAL BIOCHEMSITRY

Course code: PSBCTC404 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test1: 1 hour | **Max. Marks: 100**
Minor Test2: 1 hour | **Minor Test1: 20**
Major Test: 2.5 hours | **Minor Test2: 20**
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2020, May 2021 & May 2022

Objectives: This course teaches the student the clinical applications of Biochemistry in diagnosis of diseases and metabolic disorders and the principles involved in the use of special instruments and methodologies in such investigations.

UNIT-I INTRODUCTION

i. Definition and scope of clinical biochemistry in diagnosis, use of clinical laboratory and interpretation of results.
ii. Body Fluids: Biochemistry of urine, blood and cerebrospinal fluid, normal and abnormal constituents and clinical entities in body fluids.
iii. Water, Electrolyte and Acid Base Balance: Distribution of water in body, water turnover and balance. Quality control in Clinical Biochemistry.
iv. Electrolyte composition of body fluids, regulation of electrolyte balance, production of acids and bases by the body, maintenance of body pH.

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UNIT-II DISORDERS OF METABOLISM-I

i. Diabetes mellitus, Diabetes insipidious, Glycosylated haemoglobin, Glucose Tolerance test (GTT), Galactosemia.
ii. Glycogen storage diseases and hypoglycaemia
iii. Lipid Storage diseases, Ketone bodies and ketoacidosis.
iv. Serum lipid profile, Hypertriacylglycerolemia and cholesterolemia, Role of HDL and Apo-Lipoproteinemia.

UNIT-III DISORDERS OF METABOLISM-II

i. Inborn errors of amino acid metabolism- Alkaptonuria, Phenylketonuria, Albinism, Homocysteruria, Tyroninemia and other aminoaciduria.
ii. Disorders of lipids: lipid mal-absorption and steatorrhea, sphingolipidosis,
iii. Clinical interrelationships of lipids, lipoproteins and apolipoproteins
iv. Disorders of nucleic acid metabolism (Purine and Pyrimidine metabolism)
v. Disorders of iron, porphyrin and mineral metabolism, Metabolism under stress conditions.

UNIT IV HEMATOLOGY, ACID-BASE BALANCE AND DETOXIFICATION

i. Hematology: Hemolytic anemia, G6PDH deficiency, Hemoglobinopathies, Thalassemias, thrombosis, blood clotting-extrinsic and intrinsic pathways, Bleeding and Clotting time.
ii. Electrolyte profile, Blood gas analysis.
iii. Acid-base balance and its disorders; metabolic and respiratory acidosis and alkalosis.
iv. Mechanism of detoxification: oxidation, reduction, hydrolysis and conjugation, clinical aspects of detoxification.

UNIT –V CLINICAL ENZYMOLOGY

i. Principles of diagnostic enzymology, clinical significance of alkaline and acid phosphatase, SGOT, SGPT, LDH, CPK, Aspartate Aminotransferase, Alanine Aminotransferase, Creatine kinase.
ii. Hapatic and Renal Function tests.
iii. Cardiac and Gastric Function tests.
iv. Prostrate and Thyroid Function tests.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given

BOOKS RECOMMENDED:

1. Smith, A.F., Beckett, G.J., Walker, S.W. and Rae, P.W.H. (1998): Clinical Biochemistry. 6th Edition, Blackwell Science.

2. Gaw, A., Cowan, R.A., O'Reilly, D.S.J., Stewart, M.J., Shepherd, J. (1995) Clinical Biochemistry, Churchill Livingstone, Edinburgh London.

3. Montgomry Biochemistry: A case oriented approach

4. Marshall and Bangert. Clinical Chemistry. Churchill Livingstone.

5. Marshall: Clinical Biochemistry.

6. Gangong F. William: Review of Medical Physiology 20th Edition.

M.Sc BIOTECHNOLOGY
SEMESTER-III

COURSE TITLE: TECHNIQUES IN BIOTECHNOLOGY

Course code: PSBTTE307 **Contact hours**: 48
Duration of Examinations **Credits**: 4
Minor Test1: 1 hour **Max. Marks**: 100
Minor Test2: 1 hour **Minor Test1**: 20
Major Test: 2.5 hours **Minor Test2**: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objective: The course is designed to give students a sound and basic exposure to Biotechnology. This course offers a very robust and forward-looking programme in the theory and techniques of Biotechnology. The course gives exposure to the various basic techniques of biotechnology used in molecular biology, enzymology, plant and animal tissue culture and immunology.

UNIT I: BASIC TECHNIQUES IN MOLECULAR BIOLOGY

i. Nucleic acid structure and types, Isolation of nucleic acids from microbes, plants and animals, methods and principles.
ii. Eletrophoretic analysis of nucleic acids (DNA, RNA) by Agrose gel electrophoresis, Molecular weight determination.
iii. Spectrophotometric analysis of DNA, RNA, Estimation of concentration and purity, Introduction to PCR.
iv. Cloning, Genomic DNA and cDNA library construction, DNA fingerprinting, molecular markers

UNIT II: BASIC TECHNIQUES IN ENZYMOLOGY AND BIOPROCESSING

i. General characteristics of Enzymes, biocatalysts vs chemical catalysts, Basis of Nomenclature and classification of enzymes, Enzyme activity, enzyme action, Nature of active sites, Enzyme substrate complex, Types of enzymes.
ii. Approaches for enzyme assays, Units of enzyme activity, specific activity, kinetics of enzyme catalyzed reactions, enzymes in regulation of metabolism,
iii. Industrial application of enzymes. Fundamentals of bioprocess development, products based on bioprocessing, growth and product synthesis kinetics
iv. Upstream and downstream processing, process optimization, scale up paradox, effluent treatment.

UNIT III: BASIC TECHNIQUES IN GENOMICS AND BIOINFORMATICS

i. Restriction mapping, nucleic acid hybridization and Microarray
ii. DNA sequencing, Maxam and Gilbert's degradation method and Sanger's dideoxynucleotide synthetic method
iii. Introduction to Bioinformatics, biological databases: Primary and secondary databases, structural databases.
iv. Sequence analysis at Nucleotide and protein level, Database retrieval systems, SRS, ENTREZ, NCBI datamodel, Database searching: BLAST, FASTA

UNIT IV: BASIC TECHNIQUES IN PLANT AND ANIMAL BIOTECHNOLOGY

i. Plant tissue culture, culture media, Establishment of cultures, acclimatization to field conditions and their applications
ii. Gene transfer in plants, vector mediated and vectorless methods, applications with reference to BT cotton and Golden rice
iii. Primary and established cell lines, mono-layer and suspension culture, cryopreservation
iv. Stem cells and therapy, three dimension culture, useful products from transgenic animals.

UNIT V: BASIC TECHNIQUES IN IMMUNOLOGY

i. Hematopoiesis and cell of immune system, T-cell subsets and surface markers, Immunogloublins – classes, structures and functions
ii. Antigen-Antibody interaction, Affinity and avidity, Recognition of antigen by T-cells and role of MHC, Structure of T and B cell receptors.
iii. Immuno-diffusion and Immuno-electrophoresis, Immuno-blot, ELISA, RIA
iv. Introduction to Monoclonal antibodies, production and application.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Primrose, S.B. (1994). Molecular Biotechnology, 2nd edition, Blackwell Scientific Publishers Oxford.
2. Berger, S.L and Kimmel, A.R (1996). Methods in Enzymology, Guide to Molecular Cloning Techniques, vol. 152, Academic Press Inc., San Diego.

3. Bhojwani S.S. and Razdan M.K. (2005) Plant tissue culture: Theory and practice. Elsevier Science, New Delhi.
4. J. Reinert and Y. P. S. Bajaj Applied and Fundamental Aspects of Plant Cell, Tissue, and Organ Culture . Springer-Verlag, Berlin, New York
5. Karl-Hermann Neumann, Ashwani Kumar, Jafargholi Imani: Plant Cell and Tissue Culture - A Tool in Biotechnology: Basics and Application (Principles and Practice). Springer-Verlag, Berlin, New York
6. Keshavachandran and Peter, KV (2008): Plant Biotechnology: Methods in Tissue Culture and Gene Transfer. Orient Blackswan
7. Sambrook, J. Fritsch, E.F. and Maniatis, T. (2001). Molecular Cloning. A Laboratory Manual 2nd ed., Cold Spring Harbor Laboratory Press.
8. Kuby, J. (2007), Immunology. 6th Edition. W.H. Freeman and company, New York.
9. Satyanarayana, U. (2005). Biotechnology. Books and Allied (P) Ltd, (Kolkatta) India
10. Nicholas, P, Stevans, L. Fundamental of Enzymology (1999). Oxford University Press, New York.
11. Tripathi, G. (1999). Enzyme Biotechnology. Technoscience Publications, Jaipur, India.
12. Palmer T. The Chemical Nature of Enzyme Catalysis, Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. Horwood Publishing Limited, Coll House, Westergate, England, 2001.
13. Stanbury, P. F., Whitaker, A., Hall, S. J., Principles of Fermentation Technology, Butterworth-Heinemann, UK 1995.
14. Creuger W and Crueger A (1991) Biotechnology: Text Book of industrial microbiology and Biotechnology. Sinauer Associatesw Inc. Sundarland , MA.
15. Molecular cloning: A laboratory manual, 3 volumes by Green & sambrook. 4th edition, cold spring. Harbor laboratory press, 2012.
16. Gene cloning & DNA analysis : An introduction by T.A.Brown, 6th edition , wiley-Blackwell,2010.
17. Recombinant DNA principles & methodologies edited by James.J.Greeene & venigalla.B.Rao, CRC press, 2009.
18. Essentials of molecular biology by David Freifelder & George.M.Malacinski ; 2nd edition, panama publishing corporation.reprinted 1996.