M.Sc. BIOCHEMISTRY
SEMESTER I

Syllabus for the examinations to be held in the year Dec. 2022, Dec.2023 & Dec.2024

COURSE TITLE: CELL BIOLOGY

Course code: PSBCTC101	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course 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, Membrane pumps; Na^+, K^+, Ca^{2+} pumps.
iv. Cytoskeltal systems, motor proteins, motility, cilia and flagella

UNIT - II: CELL ORGANELLES

i. Cellular organelles; Mitochondria, chloroplast, endomembrane system; endoplasmic reticulum, golgi bodies, lysosomes and peroxisomes
ii. Membrane Trafficking; transport vesicles, endocytosis and exocytosis
iii. Nucleus; nuclear envelope, Nuclear pore complex, export and import of proteins
iv. Chromosomes and chromatin, centromeres, telomeres, 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, signal transduction pathways; Ras/MAPK' Pathways, second messengers
ii. Cell signaling in micro-organisms; bacterial chemotaxis and quorum sensing, signaling in plants
iii. Cellular communication: General principle of cell communication, extra cellular matrix, cell adhesions molecules

M.Sc. BIOCEMISTRY
SEMESTER I

Syllabus for the examinations to be held in the year Dec. 2022, Dec.2023 & Dec.2024

COURSE TITLE: CELL BIOLOGY

Course code: PSBCTC101	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

iv. Cell-cell interaction; Cell junctions: tight junction, desmosome, hemidesmosome and gap junctions, plant cell wall

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

i. Cell cycle; Phases of cell cycle. Interphase and M phase (mitosis and meiosis), checkpoints in cell cycle.
ii. Regulators of cell cycle progression; role of cyclin and cyclin dependent kinases.
iii. Apoptosis, program cell death, extrinsic and intrinsic pathways.
iv. Cell transformation and cancer, oncogenes and proto-oncogenes, tumor suppressor genes, metastasis.

UNIT - V: **DEVELOPMENT BIOLOGY**

i. Basic concept of development- gametogenesis, fertilization and early development
ii. Development of *Drosophila*- early drosophila development, pattern formation, maternal and gap genes, pair rule and segmentation genes, Homeotic genes and their role in development.
iii. Development of *C. elegans*-Introduction, life cycle, organogenesis
iv. Morphogenesis and organogenesis in *Arabidopsis thaliana* as model plant- shoot, root, leaf and flower 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

M.Sc. BIOCHEMISTRY
SEMESTER I

Syllabus for the examinations to be held in the year Dec. 2022, Dec.2023 & Dec.2024

COURSE TITLE: CELL BIOLOGY

Course code: PSBCTC101 **Contact hours: 48**
Duration of Examinations **Credits: 4**
Minor Test1: 1.5 hour **Max. Marks: 100**
Minor Test2: 1.5 hour **Minor Test1: 20**
Major Test: 3.0 hours **Minor Test2: 20**
Major Test: 60
Total: 100

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. 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

Syllabi for the examinations to be held in the years Dec. 2022, Dec. 2023 & Dec. 2024

COURSE TITLE: BIOPHYSICAL AND BIOORGANIC CHEMISTRY

Course code: PSBCTC102
Contact hours: 48

Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course 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 familiarized 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

M.Sc BIOCHEMISTRY
SEMESTER I

Syllabi for the examinations to be held in the years Dec. 2022, Dec. 2023 & Dec. 2024

COURSE TITLE: BIOPHYSICAL AND BIOORGANIC CHEMISTRY
Course code: PSBCTC102
Contact hours: 48

Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

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.

M.Sc BIOCHEMISTRY
SEMESTER I
Syllabi for the examinations to be held in the years Dec. 2022, Dec. 2023 & Dec. 2024

COURSE TITLE: BIOPHYSICAL AND BIOORGANIC CHEMISTRY
Course code: PSBCTC102
Contact hours: 48

Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

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 will cover upto 20% of syllabus. Minor test II will cover 21%- 40% of syllabus. Major test will cover 41% -100% of syllabus. Major test will have 7 questions. One question will be very short answer type of multiple parts compulsory spread over entire syllabus of 15 marks. The remaining 6 questions will be from remaining 41%-100% part of the syllabus of 15 marks each and the candidate will have to attempt any three of them. The major test will 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. 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 (2014). Spectrometric identification of organic compounds, 8th Edition. John Wiley and sons, USA.
4. Finar, I.L (2007). Organic Chemistry, Vol.II. Pearson Education, Singapore.
5. Voet D, Voet JG and Pratt CW (2016). Fundamentals of Biochemistry, 5th Edition. John Wiley & Sons. New York.

M.Sc BIOCHEMISTRY
SEMESTER I
Syllabi for the examinations to be held in the years Dec. 2022, Dec. 2023 & Dec. 2024

COURSE TITLE: BIOPHYSICAL AND BIOORGANIC CHEMISTRY
Course code: PSBCTC102
Contact hours: 48
Duration of Examinations **Credits: 4**
Minor Test1: 1.5 hour **Max. Marks: 100**
Minor Test2: 1.5 hour **Minor Test1: 20**
Major Test: 3.0 hours **Minor Test2: 20**
Major Test: 60
Total: 100

6. Kemp, W. (1991, Third Edition) Organic Spectroscopy.
7. Nasipuri , D. (2018, Third Edition) Stereochemistry of Organic Compounds, Principles and Applications
8. Friefelder, D. (1999). Physical Biochemistry - Application of Biochemistry and Molecular Biology, 2nd Edition, W.H.Freeman and Co.
9. Upadhyay, Upadhyay and Nath (2016) "Biophysical chemistry: Principles and Techniques", Himalaya Publishing House, Mumbai.
10. Wilson K & Walker J. (Edited by ndreas Hofmann and Samuel Clokie). 2018. Principles and Techniques of Practical Biochemistry. 8th Ed. Cambridge Univ. Press.

M. Sc. BIOCHEMISTRY
SEMESTER - I

COURSE TITLE: MOLECULAR BIOLOGY

Course code: PSBCTC109 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test1: 1.5 hour | **Max. Marks: 100**
Minor Test2: 1.5 hour | **Minor Test1: 20**
Major Test: 3 hours | **Minor Test2: 20**
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2022, Dec 2023 & Dec 2024

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 AND FUNCTION

i. Techniques to study nucleic acids; centrifugation, crystallography, electron -microscopy, spectroscopy and chromatography.
ii. 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 cruciform, hairpin loops
iii. DNA structures; Primary, secondary, tertiary and quaternary DNA structure; Function of alternate forms and structures of DNA, Topography and superhelicity of DNA.
iv. Denaturation analysis of DNA; denaturation curve and assessment of GC % and Tm, Hyper and hypochromic effect of DNA

UNIT-II: DNA REPLICATION AND INTRODUCTION TO RNA

i. Interaction of DNA with proteins ; role of these interactions on the function of DNA, e.g. Zn finger , leucine zipper, helix turn helix and helix-loop -helix proteins
ii. Replication of DNA, Replication of core genome and replication of extra chromosomal DNA, Elements and factors required for replication of core genome in eukaryotes, prokaryotes. Regulation of replication.
iii. Chromosomal replication with chromosomal replication in *E.coli* and *S. cerevisiae*, as reference.
iv. Extra chromosomal elements replication with phi X174, Plasmid and mitochondrial replication as reference

M. Sc. BIOCHEMISTRY
SEMESTER - I

COURSE TITLE: MOLECULAR BIOLOGY

Course code: PSBCTC109 **Contact hours: 48**
Duration of Examinations **Credits: 4**
Minor Test1: 1.5 hour **Max. Marks: 100**
Minor Test2: 1.5 hour **Minor Test1: 20**
Major Test: 3 hours **Minor Test2: 20**
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2022, Dec 2023 & Dec 2024

UNIT-III: GENE EXPRESSION I - TRANSCRIPTION

i. RNA structure and function. RNA as a structural, carrier, information and catalytic molecule. Detailed structure and function of transfer , messenger and ribosomal RNA,
ii. Mechanism of transcription in prokaryotes: Elements and factors involved in prokaryotes; Promoter sequences and regulatory factors,
iii. Operon concept; Inducible and repressible operons in prokaryotes. Attenuation, antitermination, auto-regulation of gene expression. Negative and positive control of gene expression.
iv. Mechanism of transcription in Eukaryotes: Gene activation in eukaryotes, Basal transcription apparatus, Eukaryotic promoter sequences, enhancers and silencers and general and specific factors. Initiation, elongation and termination of transcription in Eukaryotes

UNIT-IV: GENE EXPRESSION II- TRANSCRIPTION/TRANSLATION

i. Post transcriptional regulation: mRNA processing capping and polyadenylation.mRNA splicing and editing, nucleo-cytoplasmic mRNA transport, mRNA stability, degradation and half life period . Differential gene experssion
ii. Genetic Code; Universality and degeneracy of code and exceptions to code, Wobble hypothesis, Codon usage bias.
iii. Mechanism of translation in prokaryotes: Elements and factors required for translation, Co-transcriptional- translation, regulatin of prokaryotic translation.
iv. Initiation, elongation and termination of translation in prokaryotes. Non- ribosomal peptide synthesis.

M. Sc. BIOCHEMISTRY
SEMESTER - I

COURSE TITLE: MOLECULAR BIOLOGY

Course code: PSBCTC109 **Contact hours: 48**
Duration of Examinations **Credits: 4**
Minor Test1: 1.5 hour **Max. Marks: 100**
Minor Test2: 1.5 hour **Minor Test1: 20**
Major Test: 3 hours **Minor Test2: 20**
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2022, Dec 2023 & Dec 2024

UNIT V: GENE EXPRESSION III- TRANSLATION AND DNA DAMAGE AND REPAIR.

i. Mechanism of translation in Eukaryotes: Elements and factors required for translation, Initiation, elongation and termination of translation in eukaryotes.
ii. Regulation of eukaryotic translation, Non ribosomal translation and its importance
iii. DNA Damage ; radiation damage, alkylation damage, mutagen and carcinogen damage, oxidative damage and instability in water
iv. DNA repair ; direct reversal of damage, base excision repair, nucleotide excision repair, mismatch repair and SOS repair

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 J.D (2017). Molecular biology of the gene. Pearson Education.
2. Burton E (2011). Molecular Biology: genes to proteins. Jones & Bartlett Publishers, Inc.
3. Clark & Pazdernik (2009).Biotechnology: applying the genetic revolution. AcademicPress.
4. Hartwell L (2010). Genetics from genes to genomes. Macgraw-hill Education.
5. Russell (2016). iGenetics: A molecular approach. Pearson Education.
6. Krebs J.E , Goldstein E.S, Kilpatrick S.T (2017). Lewin's GenesXII. Jones & Bartlett.

M.Sc BIOCHEMISTRY
SEMESTER-I

Syllabus for the examinations to be held in the year Dec. 2022, Dec.2023 & Dec.2024

COURSE TITLE: BIOMOLECULES

Course code: PSBCTC107	**Contact hours: 48**
Duration of Examination	**Credits: 4**
Minor Test 1: 1.5 Hours	**Minor I: 20 marks**
Minor Test 2: 1.5 Hours	**Minor II: 20 marks**
Major Test: 3.0 Hours	**Major Test: 60 marks**
	Total: 100

Course Objectives: This course focuses on the chemistry behind the biological roles of proteins, carbohydrates, nucleic acids and lipids and the link between structure and function of these molecules at a chemical level within a biological context. The course will give an overall knowledge and apply it to key chemical process relevant to life.

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. Dissacharides: Homo and hetero-disaccharides.

(iv) Polysaccharides: Storage forms- Glycogen, Starch, Inulin. Structural forms- Cellulose, Chitin. Heteropolysaccharides/ Glycosamine Glycans: 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.

M.Sc BIOCHEMISTRY
SEMESTER-I

Syllabus for the examinations to be held in the year Dec. 2022, Dec.2023 & Dec.2024

COURSE TITLE: BIOMOLECULES

Course code: PSBCTC107	**Contact hours: 48**
Duration of Examination	**Credits: 4**
Minor Test 1: 1.5 Hours	**Minor I: 20 marks**
Minor Test 2: 1.5 Hours	**Minor II: 20 marks**
Major Test: 3.0 Hours	**Major Test: 60 marks**
	Total: 100

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.

M.Sc BIOCHEMISTRY
SEMESTER-I

Syllabus for the examinations to be held in the year Dec. 2022, Dec.2023 & Dec.2024

COURSE TITLE: BIOMOLECULES

Course code: PSBCTC107	**Contact hours: 48**
Duration of Examination:	**Credits: 4**
Minor Test 1: 1.5 Hours	**Minor I: 20 marks**
Minor Test 2: 1.5 Hours	**Minor II: 20 marks**
Major Test: 3.0 Hours	**Major Test: 60 marks**
	Total: 100

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. 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
SEMESTER-II

Syllabi for the examinations to be held in the years May. 2023, 2024 and 2025

COURSE TITLE: GENETIC ENGINEERING

Course code: PSBCTC210	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course objective: 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: TOOLS AND TECHNIQUES USED IN GENETIC ENGINEERING

i. Isolation, purification, quantification and electrophoresis of nuclear, and cytoplasmic DNA and RNA.
ii. Isolation, purification, quantification and electrophoresis of environmental DNA and RNA
iii. Size standards for DNA and RNA. 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: GENE/S CLONING TECHNIQUES

i. Construction of genomic library. 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, RNA enrichment techniques. Cloning differentially active genes. Subtractive hybridization,
iii. Polymerase chain reaction, nucleic acid amplification, primer design and programming. modifications of basic PCR
iv. Southern, Northern and Western blotting; Preparation of labeled DNA probes- radioactive and non- radioactive labeling,

UNIT-III: GENE EXPRESSION/EXPRESSION TECHNIQUES

i. Gene centric cloning and genome centric cloning, Isolation, identification and characterization of gene.
ii. Screening and analysis of genomic and cDNA library by function and sequence based methods.

M.Sc BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May. 2023, 2024 and 2025

COURSE TITLE: GENETIC ENGINEERING

Course code: PSBCTC210	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

iii. Identification of interacting genes; two and three hybrid system, RNase protection assay and reporter assay

iv. Expression strategies for heterologous genes; vector engineering and codon optimization, host engineering, Expression in eukaryotic and prokaryotic systems *In vitro* transcription and translation, methods and application, Phage display,

UNIT-IV: ADVANCED TECHNIQUES IN GENETIC ENGINEERING

i. DNA sequencing; Sanger's Chain termination methods, next generation sequencing (NGS) methods ,
ii. Targeted sequencing and whole genome sequencing methods using NGS
iii. Genome engineering; Genome/gene editing methods, strategies and applications
iv. Introduction to synthetic biology; chemical synthesis of nucleic acids, methods, strategies and applications, Gene circuits.

UNIT-V: Application of genetic engineering

i. Protein engineering by directed mutagenesis e.g. site directed mutagenesis, strategies for protein engineering.

ii. Genetic engineering in molecular diagnostics, Nucleic based diagnostics and protein based diagnostics.

iii. Artificial intelligence and Machine learning in recombinant DNA technology and its application.

iv. Production of genetically engineered drugs and vaccines, industrial products of genetically modified organisms.

M.Sc BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May. 2023, 2024 and 2025

COURSE TITLE: GENETIC ENGINEERING

Course code: PSBCTC210	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

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. Brown, T. A. (2020) Gene Cloning and DNA Analysis: An Introduction. Wiley-Blackwell Publishing, UK..
2. Glick B. R and Patten C. L. (2017) Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press, USA.
3. Green M. R. and Sambrook J. (2012) Molecular Cloning: A Laboratory Manual. CSHL Press, USA.
4. Primrose, S. B. and Twyman, R. M. (2006) Principles of Genetic Manipulation and Genomics. Blackwell Publishing, UK.
5. Voet, D., Voet, J. G. and Pratt C. W. (2018) Voet's Principles of Biochemistry. John Wiley & Sons, UK.
6. Andreas Hofmann and Samuel Clokie (2018) Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.

M.Sc. BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 and May 2025

COURSE TITLE: ENZYMOLOGY

Course code: PSBCTC202	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course objective: The course is structured to provide the students insight into protein/ enzyme structure, folding, functional mechanisms, enzyme kinetics and regulation of enzyme action, purification and characterization, and bulk production of enzymes. The course also aims to acquaint students with application potential of enzymes for wide range industries.

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 cofactors, coenzymes, 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: ENZYME KINETICS AND REGULATORY ENZYMES

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

M.Sc. BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 and May 2025

COURSE TITLE: ENZYMOLOGY

Course code: PSBCTC202	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

ii. Steady state vs equilibrium assumption, Henri and Michaelis-Menten equations, Michaelis-Menten kinetics and its limitations, Lineweaver-Burk plots, Eadie-Hofstee and Hanes plots.
iii. Factors affecting enzyme activity: enzyme/substrate concentration, pH and temperature dependence of enzymes, Enzyme inhibition kinetics, Reversible and irreversible inhibition kinetics.
iv. General Mechanisms for enzyme based regulation of metabolic pathways, covalent and noncovalent modification of enzymes, feedback inhibition and repression, partial proteolysis

v. Allosteric enzymes, sigmoidal kinetics, importance of allosteric enzymes in physiology and metabolism

UNIT-IV: PRODUCTION, PURIFICATION AND IMMOBILIZATION OF ENZYMES

i. Strategies for bulk industrial enzyme production, scale up and optimization, sources of enzyme isolation
ii. Enzyme purification, criteria, aim and importance of purification, general techniques /steps involved

iii. Salt precipitation of enzymes, salting-in and out, Chromatography, ion exchange, adsorption, hydrophobic, and gel filtration; affinity chromatography, SDS/Native/2D PAGE, Zymography.
iv. Approaches for ascertaining the purity level of enzyme, specific activity; criteria of enzyme purity, characterization of a purified enzyme, molecular weight (Mr) assay
v. Enzyme immobilization, techniques and principles, industrial significance of immobilized enzymes.

M.Sc. BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 and May 2025

COURSE TITLE: ENZYMOLOGY

Course code: PSBCTC202	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

UNIT-V: ENZYME TECHNOLOGY

i. Industrial applications of enzymes, Desirable characteristics of enzymes for industrial applications, significance of using enzymes for industrial processes
ii. Enzymes for food processing, dairy, brewery, winery, and for production of industrial products, biofuels.
iii. Applications of enzymes in detergent, textile, leather industries
iv. Enzymes for diagnosis of diseases/disorders, and enzymes as therapeutic agents
v. Enzyme inhibitors as drugs; Enzyme engineering and design, new enzyme discovery.

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.

M.Sc. BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 and May 2025

COURSE TITLE: ENZYMOLOGY

Course code: PSBCTC202	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

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
Syllabi for the examinations to be held in the years May 2023, 2024 and 2025

COURSE TITLE: GENETICS AND GENOMICS

Course code: PSBCTC211
Contact hours: 48
Duration of Examinations **Credits: 4**
Minor Test: 1.5 hour **Max. Marks: 100**
Major Test: 3 hours **Minor Test 1: 20**
Minor Test 2: 20
Major Test: 60
Total: 100

Objectives: In recent years, genetics and genomics have grown explosively, generating large amount of new information regarding the fine structure of gene and gene expression in pro- and eukaryotes. Besides, the genomic approaches are being adopted in altering genotype and tailoring plants and animals to answer human needs. This course will introduce students to the basic concepts of genetics and genomics and prepare them to appreciate the boom of biotechnology and their participation in the on-going revolution.

UNIT-I: GENETICS-I

i. Mendelian genetics: Laws of inheritance: Mendel's Laws, concept of dominance, segregation, independent assortment, Gene interaction and their types
ii. Chromosome theory of inheritance, tetrad analysis in *Neurospora crassa*, gene conversion
iii. Crossing over and Linkage, concept, molecular mechanism of crossing over, reciprocal and non- reciprocal recombination, Holliday Model of recombination
iv. Bacterial genetic system: transformation, transduction, conjugation and F-mediated sexduction, Site specific recombination.

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.

M.Sc. BIOCHEMISTRY
SEMESTER – II

Syllabi for the examinations to be held in the years May 2023, 2024 and 2025

COURSE TITLE: GENETICS AND GENOMICS

Course code: PSBCTC211
Contact hours: 48
Duration of Examinations **Credits: 4**
Minor Test: 1.5 hour **Max. Marks: 100**
Major Test: 3 hours **Minor Test 1: 20**
Minor Test 2: 20
Major Test: 60
Total: 100

UNIT- III: GENETICS-III

i. Multiple alleles, Non disjunction; Dosage compensation.
ii. Sex determination; Role of Y chromosome; Genetic recombination; Maternal inheritance.
iii. Structural aberrations of chromosomes: deletions, duplications, inversions and translocation
iv. Molecular cytogenetics: Fluorescence in situ hybridization (FISH); Genomic in situ hybridization (GISH), Comparative Genomic Hybridization (CGH).

UNIT- IV: GENOMICS- I

i. Molecular markers - hybridization and PCR based markers; RFLP, RAPD, STS, ESTs, SSR, AFLP, SNP markers
ii. DNA fingerprinting-principles and applications, Construction of high density linkage map and physical maps
iii. Gene pyramiding, Marker assisted Selection for major and minor genes, Fine mapping of the genes
iv. Chromosome walking and jumping, Human Genome Project, Genetic ethics

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UNIT- V: GENOMICS- II

i. Comparative genomics: method and applications, collinearity among the genomes
ii. Understanding evolution of eukaryotes, Orthologues and paralogues genes
iii. DNA microarrays: Concept, cDNA and oligonucleotide based microarrays, limitations and applications
iv. Concept of TILLING and Eco-TILLING, , Pan-genomics, concept and applications

M.Sc. BIOCHEMISTRY
SEMESTER – II
Syllabi for the examinations to be held in the years May 2023, 2024 and 2025

COURSE TITLE: GENETICS AND GENOMICS

Course code: PSBCTC211
Contact hours: 48
Duration of Examinations **Credits: 4**
Minor Test: 1.5 hour **Max. Marks: 100**
Major Test: 3 hours **Minor Test 1: 20**
Minor Test 2: 20
Major Test: 60
Total: 100

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 will cover upto 20% of syllabus. Minor test II will cover 21%- 40% of syllabus. Major test will cover 41% -100% of syllabus. Major test will have 7 questions. One question will be very short answer type of multiple parts compulsory spread over entire syllabus of 15 marks. The remaining 6 questions will be from remaining 41%-100% part of the syllabus of 15 marks each and the candidate will have to attempt any three of them. The major test will 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. (2017) Gene XII, John Goldstein and Stephen, Jones and Bartlett Publishers, Inc; 12th edition
2. Gardner, E.J., Simmons, M.J. and Snustad, D. P. (2015) Principles of Genetics. John Wiley and sons, New York. 7th edition
3. Erich Grotewold, Joseph Chappell, Elizabeth A. Kellogg (2015) Plant Genes, Genomes and Genetics. John Wiley & Sons
4. Michael Kaufmann, Claudia Klinger, Andreas Savelsbergh (2017) Functional Genomics Methods and Protocols, Humana Press, Springer
5. Watson, J.D., Hopkins, H.N., Roberts, W.J., Sleitz, J.A. and Weiner, M.A. (2007). Molecular Biology of G. The Benjamin/ Cumming Publishing Company, Inc. USA.
6. Ruthwell, N. V. (2008) Understanding Genetics : A molecular approach. Wiley-liss Pub.

M.Sc. BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 & May2025

COURSE TITLE: IMMUNOLOGY

Course code: PSBCTC205 **Contact hours: 48**

Duration of Examinations **Credits: 4**

Minor Test1: 1.5 hour **Max. Marks: 100**

Minor Test2: 1.5 hour **Minor Test1: 20**

Major Test: 3.0 hours **Minor Test2: 20**

Major Test: 60

Course objective: 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.
ii. 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.
iii. Nature and Biology of antigens and super antigens, Antibody structure and function, antibody mediated effector functions, antibody classes and biological activity.
iv. 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

M.Sc. BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 & May2025

COURSE TITLE: IMMUNOLOGY

Course code: PSBCTC205	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60

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 complex- 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.

M.Sc. BIOCHEMISTRY

SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 & May2025

COURSE TITLE: IMMUNOLOGY

Course code: PSBCTC205 **Contact hours: 48**

Duration of Examinations **Credits: 4**

Minor Test1: 1.5 hour **Max. Marks: 100**

Minor Test2: 1.5 hour **Minor Test1: 20**

Major Test: 3.0 hours **Minor Test2: 20**

Major Test: 60

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.

M.Sc. BIOCHEMISTRY

SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 & May2025

COURSE TITLE: IMMUNOLOGY

Course code: PSBCTC205 **Contact hours**: 48

Duration of Examinations **Credits**: 4

Minor Test1: 1.5 hour **Max. Marks**: 100

Minor Test2: 1.5 hour **Minor Test1**: 20

Major Test: 3.0 hours **Minor Test2**: 20

Major Test: 60

BOOKS RECOMMENDED

1. Kuby Immunology, Eighth Edition 2019 by Jenni Punt; Sharon Stranford; Patricia Jones; Judy Owen
2. Janeway's Immunobiology by Kenneth Murphy, Casey Weaver (2017). Ninth edition New York: Garland Science.
3. Basic Immunology: Functions and Disorders of the Immune System by Abul K. Abbas, Andrew H. H. Lichtman, Shiv Pillai (2019)
4. Roitt's Essential Immunology by Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt (2017). Thirteenth edition
5. Brostoff, J., Seaddin, J. K., Male, D., & Roitt, I. M. (2002). Clinical Immunology. London: Gower Medical Pub.
6. Paul, W. E. (2012). Fundamental Immunology. New York: Raven Press.
7. Goding, J. W. (1996). Monoclonal Antibodies: Principles and Practice: Production and Application of Monoclonal Antibodies in Cell Biology, Biochemistry, and Immunology. London: Academic Press.
8. Parham, P. (2005). The Immune System. New York: Garland Science.
9. Relevant review articles/research papers/handouts provided in the course

M.Sc. BIOCHEMISTRY
SEMESTER – II

Syllabi for the examinations to be held in the years May 2023, May 2024 & May 2025

COURSE TITLE: MOLECULAR VIROLOGY

Course code: PSBCTC204 **Contact hours: 24**
Duration of Examinations **Credits: 2**
Minor Test1: 1 hour **Max. Marks: 50**
Minor test 2: 1 hour **Minor Test 1: 05**
Major Test2: 2.5 hours **Minor Test 2: 05**
Major Test: 40
Total: 50

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, diagnosis 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; 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

M.Sc. BIOCHEMISTRY
SEMESTER – II

Syllabi for the examinations to be held in the years May 2023, May 2024, May 2025

COURSE TITLE: MOLECULAR VIROLOGY

Course code: PSBCTC204	**Contact hours: 24**
Duration of Examinations	**Credits: 2**
Minor Test1: 1 hour	**Max. Marks: 50**
Minor test 2: 1 hour	**Minor Test 1: 05**
Major Test2: 2.5 hours	**Minor Test 2: 05**
	Major Test: 40
	Total: 50

NOTE FOR PAPER SETTING AND COURSE EVALUATION:

Minor test 1 should cover upto 20% of the syllabus. Minor test II should cover 21% - 40% of the syllabus. Major test should cover 41% - 100% of the syllabus. Major test will have 5 questions. One question of 10 marks will be very short answer type of multiple parts and is compulsory spread over entire syllabus. The remaining 4 questions will be from remaining41% - 100% part of the syllabus of 15 marks each and the candidate will have to attempt any two 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.

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
Syllabi for the examinations to be held in the years May 2023, May 2024 & May 2025

COURSE TITLE: RESEARCH METHODOLOGY AND SCIENTIFIC COMMUNICATION
Course Code: PSBCTC213
Contact hours: 12 **Credits: 1**
Duration of Examinations: **Major test Marks: 25**
Major test: 1.5 hr **Total Marks: 25**

Course objective: The objectives of this course are to give background on history of science, emphasizing methodologies used to do research, use framework of these methodologies for understanding effective lab practices and scientific communication and appreciate scientific ethics.

Unit I: History of science methodologies and Process of communication

Empirical science, manipulative experiments and controls, deductive and inductive reasoning, reductionist vs holistic biology. Concept of effective communication- setting clear goals for communication; determining outcomes and results; initiating communication; preparing and presenting using over-head projector, PowerPoint; defending interrogation; scientific poster preparation & presentation; Computing skills for scientific research - web browsing for information search; search engines and their mechanism of searching; hidden Web and its importance in scientific research; internet as a medium of interaction between scientists; effective email strategy using the right tone and conciseness.

Unit II: Scientific Communication

Technical writing skills - types of reports; layout of a formal report; scientific writing skills - importance of communicating science; problems while writing a scientific document; plagiarism, software for plagiarism; scientific publication writing: elements of a scientific paper including abstract, introduction, materials & methods, results, discussion, references; drafting titles and framing abstracts; publishing scientific papers - peer review process and problems, recent developments such as open access and nonblind review; plagiarism; characteristics of effective technical communication; scientific presentations; ethical issues; scientific misconduct.

NOTE FOR PAPER SETTING AND COURSE EVALUATION:

Major test should cover 100% of syllabus. The major test should test both the subjective and objective aptitudes of the students.

M.Sc BIOCHEMISTRY
SEMESTER-II

Syllabi for the examinations to be held in the years May 2023, May 2024 & May 2025

COURSE TITLE: RESEARCH METHODOLOGY AND SCIENTIFIC COMMUNICATION
Course Code: PSBTC213
Contact hours: 12 **Credits: 1**
Duration of Examinations: **Major test Marks: 25**
Major test: 1.5 hr **Total Marks: 25**

Books Recommended:

1. Valiela, I. (2001). Doing Science: Design, Analysis, and Communication of Scientific Research. Oxford: Oxford University Press.
2. On Being a Scientist: a Guide to Responsible Conduct in Research. (2009). Washington, D.C.: National Academies Press.
3. Gopen, G. D., & Smith, J. A. The Science of Scientific Writing. American Scientist, 78 (Nov-Dec 1990), 550-558.
4. Mohan, K., & Singh, N. P. (2010). Speaking English Effectively. Delhi: Macmillan India.
5. Movie: Naturally Obsessed, The Making of a Scientist

M.Sc. BIOCHEMISTRY
SEMESTER-III

Syllabi for the examinations to be held in the years Dec.2023, Dec.2024 & Dec.2025

COURSE TITLE: PLANT BIOCHEMISTRY
Course code: PSBCTC301
Contact hours: **48**

Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course 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

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.

M.Sc. BIOCHEMISTRY
SEMESTER-III

Syllabi for the examinations to be held in the years Dec.2023, Dec.2024 & Dec.2025

COURSE TITLE: PLANT BIOCHEMISTRY
Course code: PSBCTC301
Contact hours: **48**

Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

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, Defense mechanism in plants against pathogens.
iv. 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.

M.Sc. BIOCHEMISTRY
SEMESTER-III

Syllabi for the examinations to be held in the years Dec.2023, Dec.2024 & Dec.2025

COURSE TITLE: PLANT BIOCHEMISTRY
Course code: PSBCTC301
Contact hours: **48**

Duration of Examinations — **Credits: 4**
Minor Test1: 1.5 hour — **Max. Marks: 100**
Minor Test2: 1.5 hour — **Minor Test1: 20**
Major Test: 3.0 hours — **Minor Test2: 20**
Major Test: 60
Total: 100

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.

RECOMMENDED BOOKS:

1. Nelson, D. L. and Cox, M. M. (2003) *Lehninger's Principles of Biochemistry*, 4th edition, W. H. Freeman and company, New York.
2. Dey, P. M. and Harborne J. B (1997). *Plant Biochemistry*, 1st edition. Academic Press.
3. Goodwin, T. W. and Mercer, E. I (1972). *Introduction to Plant Biochemistry,* Pergamon Press.
4. Heldt, H. S. (2005). *Plant Biochemistry and Molecular Biology,* 2nd edition. Oxford University Press.
5. Guyton, A. C. (2015). *Text Book of Medical Physiology*, 13th edition. W. B. Saunders Co., USA
6. Plummer, D. T. (2017). *An Introduction to Practical Biochemistry*,3rd edition. Mc Graw Hill Education (India) Pvt. Ltd.
7. Chawla, R. (2014). *Practical Clinical Biochemistry; Methods and Interpretations,* 4th edition. Jaypee Brothers Medical Publisher (P) Ltd.
8. Rizvi, E. H. *Laboratory Manual of Biochemistry & Biotechnology,* Mr. Books Fairdeal Shopping Complex Residency Road Srinagar.

M.Sc. BIOCHEMISTRY
SEMESTER –III

Syllabi for the examinations to be held in the years Dec.2023, Dec.2024 & Dec.2025

COURSE TITLE: INTERMEDIARY METABOLISM

Course code: PSBCTC302	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course 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. Introduction to metabolism, methods of studying metabolism, bioenergetics and biological oxidation. Digestion and absorption of carbohydrates, glycolysis, glycogenesis, glycogenolysis, gluconeogenesis.
ii. Citric acid cycle, amphibolic role of citric acid cycle, Oxidative Phosphorylation, Uncouplers of oxidative phosphorylation, effect of starvation and diabetes mellitus on carbohydrate metabolism.
iii. Pentose phosphate pathway, shuttle and other minor pathways.
iv. Biosynthesis of polysaccharides, 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. 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:

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.

M.Sc. BIOCHEMISTRY
SEMESTER –III

Syllabi for the examinations to be held in the years Dec.2023, Dec.2024 & Dec.2025

COURSE TITLE: INTERMEDIARY METABOLISM

Course code: PSBCTC302	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

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

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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 test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

i. Berg JM, Tymoczko, JL and Stryer L, Gregory Gatto (2019) Biochemistry, 9th Edition, WH Freeman & Co., New York.
ii. Cohn EE, Stumph PK, Bruening G and Doi RH (1987) Outlines of Biochemistry, 5th Edition, John Wiley & Sons, New York.
iii. Victor W. Rodwell, David Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil (2018). Harper's Illustrated Biochemistry, 31st Eidtion, Applaton and Lange Publications, California, USA.
iv. Nelson DL and Cox MM. (2021) Lehninger Principles of Biochemistry, 8th Edition. Macmillan Worth Publishers, New Delhi.
v. Voet D, Voet JG and Pratt CW (2016). Fundamentals of Biochemistry, 5th Edition. John Wiley & Sons. New York.

M.Sc. BIOCHEMISTRY
SEMESTER – III

Syllabi for the examinations to be held in the years Dec 2023, Dec 2024 & Dec 2025

COURSE TITLE: BIOINFORMATICS AND BIOSTATISTICS

Course code: PSBCTC311	**Contact hours: 24 hrs**
Duration of Examinations	**Credit: 2**
Max. Marks: 50	**Minor Test1:05**
Minor Test1: 1 hour	**Minor Test2:05**
Minor Test2: 1 hour	**Major Test: 40**
Major Test: 2.0 hours	**Total: 50**

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: Binomial, 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: INTRODUCTION TO BIOINFORMATICS AND BIOLOGICAL DATABASES

i. Internet and the biologist, Scope of Bioinformatics, Biological Databases; Primary, Secondary & Composite databases.
ii. Nucleotide Sequence Databases; GenBank, EMBL, DDBJ
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-III: INFORMATION RETRIEVAL, SEARCHING AND COMPUTATIONAL ANALYSIS OF BIOLOGICAL DATABASES

i. Retrieval Systems: SRS (Sequence Retrieval System) for flat file format libraries, ENTREZ Global Query for NCBI Search, DBGET/LinkDB: Database of link information
ii. Sequence Similarity Search: BLAST, FASTA, CLUSTALW.
iii. Sequence submission tools: BankIt, Sequin, Webin, SAKURA.

M.Sc. BIOCHEMISTRY
SEMESTER – III

Syllabi for the examinations to be held in the years Dec 2023, Dec 2024 & Dec 2025

COURSE TITLE: BIOINFORMATICS AND BIOSTATISTICS

Course code: PSBCTC311	**Contact hours: 24 hrs**
Duration of Examinations	**Credit: 2**
Max. Marks: 50	**Minor Test1:05**
Minor Test1: 1 hour	**Minor Test2:05**
Minor Test2: 1 hour	**Major Test:40**
Major Test : 2.0 hours	**Total:50**

iv. Introduction to Human Genome Project, Genome Sequencing, Genome Maps & their uses.
v. Sequence assembly, Genome analysis, Phylogenetic analysis.
vi. Comparative genomics: cluster of orthologous groups(COGs), Homologene at NCBI

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 5 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 4 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any two 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. The question paper will have 9 questions in all. question 1, based on material from all 4 units will be compulsary and will have minimum of 4 parts. Besides, there will be 8 other questions, 2 from each unit. the students will be required to attempt the compulsory question and 4 others, one from each unit.

BOOKS RECOMMENDED

1. Lesk, A. M. (2002). Introduction to Bioinformatics. Oxford: Oxford University Press.
2. Mount, D. W. (2001). Bioinformatics: Sequence and Genome Analysis.Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
3. Baxevanis, A. D., & Ouellette, B. F. (2001). Bioinformatics: a Practical Guide to the analysis of Genes and Proteins. New York: Wiley-Interscience.
4. Pevsner, J. (2015).Bioinformatics and Functional Genomics. Hoboken, NJ.: Wiley-Blackwell.
5. Bourne, P. E., & Gu, J. (2009). Structural Bioinformatics. Hoboken, NJ: Wiley-Liss.
6. Lesk, A. M. (2004). Introduction to Protein Science: Architecture, Function, and Genomics. Oxford: Oxford University Press.
7. Baxevanis, A.D. and Francis Onellete, B.F. (2001). Bioinformatics. Wiley Interscience. John Wiley and Sons Inc. New York.
8. Attwood, T.K. and Parry-Smith, D.J. (1999). Introduction to Bioinformatics. Pearson Education Ltd., Singapore.
9. Mueller, J.P. and Sheldon, T. (1998). Internet information server 4. Tata McGraw Hill Publishing Company Ltd., New Delhi.

10.M.Sc. BIOCHEMISTRY
11.SEMESTER – III

Syllabi for the examinations to be held in the years Dec 2023, Dec 2024 & Dec 2025

COURSE TITLE: BIOINFORMATICS AND BIOSTATISTICS

Course code: PSBCTC311	**Contact hours: 24 hrs**
Duration of Examinations	**Credit: 2**
Max. Marks: 50	**Minor Test1:05**
Minor Test1: 1 hour	**Minor Test2:05**
Minor Test2: 1 hour	**Major Test: 40**
Major Test : 2.0 hours	**Total:50**

14. Curtin, D.P. et al. (1999). Information Technology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
15. Dhar, M.K. and Kaul, S. (1997). Statistics in Biology. Malhotra Brothers, Jammu.
16. Snedecor, G.W. and Cochran, W.G. (1989). Statistical methods. Iowa State University Press, Ames.
17. Steel, R.G.D. and Torrie, J.H. (1981). Principles and procedures of statistics: A Biometrical approach. McGraw-Hill Book Company, Singapore.
18. Ye, Q. S. (2008). Bioinformatics: A practical approach. Champman & Hall/ CRC.
19. Noah, H. (2008) Bioinformatics Genomics and postgenomics. Wiley.
20. Tramontano Anna (2008). Int. to Bioinformatics. Chapman & hall/ CRC.

M. Sc BIOCHEMISTRY
SEMESTER-III

Syllabi for the examinations to be held in the years Dec. 2023, Dec. 2024 & Dec. 2025

COURSE TITLE: MAMMALIAN HORMONES

Course code: PSBCTC308 **Contact hours: 24**
Duration of examinations **Credits: 2**
Minor Test1: 1 hour **Max. Marks: 50**
Minor Test2: 1 hour **Minor Test1: 05 marks**
Major Test: 2.5 hours **Minor Test 2: 05 marks**
Major Test: 40 marks
Total: 50 marks

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
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
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.

M.Sc BIOCHEMISTRY
SEMESTER-III

Syllabi for the examinations to be held in the years Dec. 2023, Dec. 2024 & Dec. 2025

COURSE TITLE: MAMMALIAN HORMONES

Course code: PSBCTC308 **Contact hours: 24**
Duration of examinations **Credits: 2**
Minor Test1: 1 hour **Max. Marks: 50**
Minor Test2: 1 hour **Minor Test1: 05 marks**
Major Test: 2.5 hours **Minor Test 2: 05 marks**
Major Test: 40 marks
Total: 50 marks

NOTE FOR PAPER SETTING

Minor test I and Minor test II should cover upto 20% of syllabus from Unit 1. Major test will have three questions. One question of 20 marks will be of short answer type of multiple parts compulsory spread over entire syllabus. The remaining two questions will be from Unit II and Unit III of the syllabus of 10 marks each and the candidate will have to attempt two questions, selecting one from each unit.

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-III
Syllabi for the examinations to be held in the years Dec. 2023, Dec. 2024 & Dec.2025

Course Title: IPRs, BIOETHICS AND ENTREPRENEURSHIP DEVELOPMENT

Course code: PSBCTC309	**Contact hours: 24**
Duration of Examinations	**Max. Marks: 50**
Credits: 2	**Minor Test1: 05 marks**
Minor Test1: 1 hour	**Minor Test 2: 05 marks**
Minor Test 2:1 hour	**Major Test: 2.5 hours**
Major Test:40 marks	**Total: 50 marks**

Objectives: This course will cater to various aspects of IPR like procedure, limit and variety of patent laws. Further it will also address bioethical concerns arising from the commercialization of biological products, GM foods, stem cell research, organ transplantation etc. The course will also provide the concept of enterprise, generating ideas, financial and legal issues of entrepreneurship in Biotechnology/Microbiology/Biochemistry based industries (agri/pharma).

UNIT-I: INTELLECTUAL PROPERTY

i. Role of IPRs in Biotechnology/Microbiology/Biochemistry, types of IPRs, Purpose of a Patent.
ii. Material transfer Agreements, Promoting Technological Advancement. Patentable Inventions, Biological Patents, Patent Requirements, Patenting Organisms.
iii. Research and IP, Patent Application, Introduction to Indian and US patent offices, Patent Licensing.
iv. TRIPS and various provisions in the TRIPS Agreement, Benefits of securing IPRs; Indian legislations for the protection of various types of IPs; National Biodiversity protection initiatives.

UNIT-II: BIOETHICS

i. Traditional knowledge and bioethics, bioactivities, Ethical Issues, Statement of Bioethical Principles.
ii. Gene Therapy, Germ line Gene therapy Moratorium.
iii. Medical Privacy and Genetic Discrimination.
iv. Ethical issues: Stem Cells, Organ Transplantation, Animal Cloning, GM foods; Use of animals in research.

UNIT-III: ENTREPRENEURSHIP DEVELOPMENT

i. Introduction to social and business entrepreneurship; Basic characteristics, Developing entrepreneurship through training and motivation
ii. Concept of enterprise, Leveraging resources and creating value categories of value: Enhancements, Extensions and Specializations

M.Sc. BIOCHEMISTRY
Semester-III
Syllabi for the examinations to be held in the years Dec. 2023, Dec. 2024 & Dec.2025

Course Title: IPRs, BIOETHICS AND ENTREPRENEURSHIP DEVELOPMENT

Course code: PSBCTC309 **Contact hours**: 24
Duration of Examinations **Max. Marks**: 50
Credits: 2 **Minor Test**1: 05 marks
Minor Test1: 1 hour **Minor Test 2:** 05 marks
Minor Test 2:1 hour **Major Test:** 2.5 hours
Major Test:40 marks **Total**: 50 marks

iii. Entrepreneurial opportunities in Biotechnology/Microbiology/Biochemistry; Structure and different stages of companies working in different areas of specialization (agri-based, pharma -based etc.). Policy making relevant to the Biotechnology/Biochemistry/Microbiology industry
iv. Concept of startups and challenges, incubation center, various schemes supporting startups in Biotechnology/ Microbiology/ Biochemistry

NOTE FOR PAPER SETTING AND COURSE EVALUATION:

Minor test I and Minor test II should cover upto 20% of syllabus from Unit 1. Major test will have five questions. One question of 20 marks will be of short answer type of multiple parts compulsory spread over entire syllabus. The remaining two questions will be from Unit II and Unit III of the syllabus of 10 marks each and the candidate will have to attempt two questions, selecting one from each unit.

SUGGESTED READINGS:

1. Ahmetoglu et al., (2017) The Wiley handbook of entrepreneurship, John Wiley and sons.
2. Ahuja VK; (2015) Intellectual Property Rights in India Lexis, Nexis, and New Delhi.
3. Arthur William *et al*.; (2005) Expanding Horizons in Bioethics, Springer.
4. Craig S; (2020) Biotechnology entrepreneurship, Academic Press (Elsevier), UK.
5. Ganguli P.; (2006) Intellectual Property Rights, Tata Mcgraw Hill Publishing Co Ltd.
6. Padma N; (2017) An introduction to Ethical, Safety and intellectual property rights issues in Biotechnology, Academic press (Elsevier), UK.
7. Patzelt, H, Brenner T; (2008) Handbook of Bioentrepreneurship, Springer Publications.
8. Rao MB; (2008) Biotechnology, IPRs and biodiversity, Pearson Publications.
9. Singh HB, Jha A and Keswani C; (2016) Intellectual property issues in Biotechnology, CABI, UK.
10. Hopkins T and Perui O (2019) The smart start up, Jaico publishing house, Mumbai
11. Venkatratnam JB (2009) Entrepreneurship Development, Heritage Printers, Hyderabad.
15. Zaware N; (2018) Entrepreneurship development and start up management, Educreation publishing, New Delhi

M.Sc. BIOCHEMISTRY
SEMESTER -III

COURSE TITLE: Nanotechnology in Biology

Course code: PSBCTC317 **Contact hours: 24**
Duration of Examinations **Credits: 2**
Minor Test: 1 hour **Max. Marks: 50**
Major Test: 2.5 hours **Minor Test1: 05 marks**
Minor Test 2: 05 marks
Major Test: 40 marks
Total: 50 marks

Syllabi for the examinations to be held in the years Dec 2023, Dec 2024 & Dec 2025

Course Objectives: Understanding and applied prospective of nanoscience in biological system

UNIT- I: Introduction

i. Introduction to History of nanotechnology - Origin and fundamental concepts
ii. Types of nanomaterials and their classifications Definition of a Nano system - Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D)
iii. Basic properties of nanomaterials- mechanical, thermal, optical and electrical properties
iv. Different formats of nanomaterials and applications, Cellular Nanostructures; Nanopores; Biomolecular motors; Bio-inspired Nanostructures

UNIT - II: Synthesis and characterization

i. Different types of Nanomaterials and synthesis (bottom up and top down methods), Biogenic synthesis of nanoparticles, Growth and stabilization, self assembling.
ii. Characterization of Nanomaterial: Size (particle size analyzer), Electron microscopy and its modifications: TEM, SEM, EDS, cryo Electron microscopy
iii. Technique and principle of FT-IR and UV-VIS, basics of X-Ray diffraction (XRD), TGA, BET etc.
iv. Nanoparticles for drug delivery, concepts and advantages

UNIT- III: **Nanotechnology and its application**

i. Nanotechnology in food industry, food packaging, overview of Nanotoxicology
ii. Nanotechnology in Agriculture, Precision farming, Smart delivery system
iii. Nanotechnology in health, drug delivery, biomedical applications and
iv. Nanotechnology application in energy and environment

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Major test will have 5 questions. One question of 10 marks will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 4 questions will be from remaining 21%-100% part of the syllabus of 15 marks each and the candidate will have to attempt any two of them. The major test should test

M.Sc. BIOCHEMISTRY
SEMESTER –III

COURSE TITLE: Nanotechnology in Biology

Course code: PSBCTC317
Duration of Examinations
Minor Test: 1 hour
Major Test: 2.5 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test1: 05 marks
Minor Test 2: 05 marks
Major Test: 40 marks
Total: 50 marks

Syllabi for the examinations to be held in the years Dec 2023, Dec 2024 & Dec 2025

both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching.

BOOKS RECOMMENDED:

1. Nano: The Essentials, T.Pradeep. Tata McGraw Hill, New Delhi, 2007.
2. Bharat Bhusan, "Springer Handbook of Nanotechnology", springer, Newyork, 2007.
3. Instrumental Methods of Analysis, Willard. Merritt, Dean & Settle, CBS Publications, 6th Edition, 2000.
4. Nalwa HS. 2005. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology. American Scientific Publ.
5. Niemeyer CM & Mirkin CA. 2005. Nanobiotechnology. Wiley Interscience.
6. Vinod Saharan and Ajay Pal 2016. Chitosan Based Nanomaterials in Plant Growth and Protection,springerbrief
7. Fundamental Properties of Nanostructured Materials, Fiorani. D., Sberveglieri, G, World Scientific, 1994.
8. Challa Kumar (Ed) – Biological and Pharmaceutical Nanomaterials, Wiley – VCH Verlag , Weinheim, 2006
9. Ralph. S. Greco, Fritz B. Prinz and R. Lane Smith (Eds) - Nanoscale Technology in Biological Systems, CRC Press, 2005.
10. Challa Kumar(Ed) - Nanomaterials for Medical Diagnosis and Therapy, Wiley-VCH, 2006.
11. A. S. Edelstin and R. C. Cammarata - Nanomaterials: Synthesis, Properties and Applications, Taylor & Francis, 1996.
12. Plant Nanotechnology: Principles and Practices. 2016. Chittaranjan Kole, D. Sakthi Kumar, Mariya V. Khodakovskaya. (Eds.) Springer-Verlag, New York, USA ISBN 978-3-319-42152-4. 383 p.
13. Nano: The essentials understanding nanoscience and Nano- T.Pradeep - 2009 – Mc Graw Hill.
14. Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B.Chandrasekaran and C. Ramasamy – 2008.
15. Bionanotechnology: Lessons from Nature by David S. Goodsell 2. Nanomedicine, Vol. IIA: Biocompatibility by Robert A. Freitas
16. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology - Hari Singh Nalwa
17. Nanobiotechnology; ed. C.M.Niemeyer, C.A. Mirkin.

M.Sc BIOCHEMISTRY
SEMESTER-III

Syllabi for the examinations to be held in the years Dec. 2023, Dec. 2024 & Dec. 2025

COURSE TITLE: Project Writing
Course Code: PSBTC316
Contact hours: 12 **Credits: 1**
Duration of Examinations: **Major test Marks: 25**
Major test: 1.5 hr **Total Marks: 25**

Course objective: The purpose of this course is to help students organize ideas, material and objectives for their dissertation and to begin development of communication skills and to prepare the students to present their topic of research and explain its importance to their fellow classmates and teachers.

UNIT I: SELECTION OF RESEARCH LAB AND RESEARCH TOPIC AND WRITING RESEARCH PROPOSAL

Students should first select a lab wherein they would like to pursue their dissertation. The supervisor or senior researchers should be able to help the students to read papers in the areas of interest of the lab and help them select a topic for their project. The topic of the research should be hypothesis driven. Review of literature: Students should engage in systematic and critical review of appropriate and relevant information sources and appropriately apply qualitative and/or quantitative evaluation processes to original data; keeping in mind ethical standards of conduct in the collection and evaluation of data and other resources.

With the help of the senior researchers, students should be able to discuss the research questions, goals, approach, methodology, data collection, etc. Students should be able to construct a logical outline for the project including analysis steps and expected outcomes and prepare a complete proposal in scientific proposal format for dissertation.

UNIT II: POSTER AND ORAL PRESENTATION

Students will have to present the topic of their project proposal after few months of their selection of the topic. They should be able to explain the novelty and importance of their research topic. At the end of their project, presentation will have to be given by the students to explain work done by them in detail. Along with summarizing their findings they should also be able to discuss the future expected outcome of their work.

NOTE FOR PAPER SETTING AND COURSE EVALUATION:

Major test should cover 100% of syllabus. The major test should test both the subjective and objective aptitudes of the students.

Textbooks Recommended:

1. Green, M. R. & Sambrook, J., Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press. 2012.

M.Sc. BIOCHEMISTRY
SEMESTER-IV
Syllabi for the examinations to be held in the years May 2024, May 2025 & May 2026

COURSE TITLE: NUTRITIONAL BIOCHEMISTRY

Course code: PSBCTC403	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course 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. Water: Dietary requirement.
ii. Macro-minerals: Nutritional Significance of Calcium, Phosphorus, Magnesium, Sodium, Cobalt, Potassium, Chloride. RDA and Food Source.
iii. Micro-minerals: Nutritional significance of dietary Iron, Iodide, Zinc, Copper, Selenium, Chromium, Manganese, Molybdenum and Fluoride. RDA and Food Source. Ultra trace

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	Major Test: 60
	Total: 100

Minerals: Arsenic, Boron, Nickel, Silicon, Vanadium and Cobalt: Digestion & absorption, Functions, Toxicity, interaction with other Nutrients. RDA and Source.

iv. Dietary sources, biochemical functions, deficiency disease and RDA of : Water Soluble and Fat Soluble Vitamins

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. Diet for Hepatic Disorders (Jaundice, Viral Hepatitis, Fatty Liver, Cirrhosis, Alcohol liver disease, Liver Transplant), Diabetics, Obesity, hyperlipidemic, hyperuricemic, patients.
iii. Diet for Cancer, Renal disorders (Acute and Chronic Glomerulonephritis, Nephrosis, Acute and Chronic Renal Failure, Kidney transplant, Urinary Calculi, Dialysis)
iv. Dietary management of Hypotension, Hypertension, CVDs (Ischemic Heart Disease and Non-Ischemic Heart disease).

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 will cover upto 20% of syllabus. Minor test II will cover 21%- 40% of syllabus. Major test will cover 41% -100% of syllabus. Major test will have 7 questions. One question will be very short answer type of multiple parts compulsory spread over entire syllabus of 15 marks. The remaining 6 questions will be from remaining 41%-100% part of the syllabus of 15 marks each and the candidate will have to attempt any three of them. The major test will test both the subjective and objective aptitudes of the student. Minor test 1 will be held after

M.Sc. BIOCHEMISTRY
SEMESTER-IV
Syllabi for the examinations to be held in the years May 2024, May 2025 & May 2026

COURSE TITLE: NUTRITIONAL BIOCHEMISTRY

Course code: PSBCTC403 | **Contact hours**: 48

Duration of Examinations | **Credits**: 4

Minor Test1: 1.5 hour | **Max. Marks**: 100

Minor Test2: 1.5 hour | **Minor Test1**: 20

Major Test: 3.0 hours | **Minor Test2**: 20

Major Test: 60

Total: 100

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. Delvin, T. M. *Textbook of Biochemistry with Clinical Correlations,* John Wiley & Sons, Inc
2. Gibson, R. *Principles of Nutritional Assessment*, Oxford University Press
3. Jain, J. L., Jain, S. and Jain, N. *Fundamentals of Biochemistry,* S. Chand.
4. Satyanarayana, U. and Chakrapani, U. *Biochemistry*, Arunabha Sen Books and Allied (P) Ltd
5. Thimmaiah, S. R. *Standard Methods of Biochemical Analysis*, Kalyani Publisher.

M.Sc. BIOCHEMISTRY
SEMESTER-IV

Syllabi for the examinations to be held in the years May 2024, May 2025 & May 2026

COURSE TITLE: CLINICAL BIOCHEMSITRY

Course code: PSBCTC404	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test1: 1.5 hour	**Max. Marks: 100**
Minor Test2: 1.5 hour	**Minor Test1: 20**
Major Test: 3.0 hours	**Minor Test2: 20**
	Major Test: 60
	Total: 100

Course 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 and Factors influencing accuracy of results.
ii. Principles of diagnostic methodologies, end-point and Kinetic measurements; Quality control in Clinical Biochemistry: control of pre-analytical variables, external and internal quality control; Quality assurance and related statistics. Chemistry analyzers and use of enzymes and coupled enzyme assays in the quantification of analytes
iii. Body Fluids: Biochemistry of urine, blood and cerebrospinal fluid, normal and abnormal constituents and clinical entities in body fluids.
iv. Water, Distribution of water in body, water turnover and balance. Electrolyte composition of body fluids, regulation of electrolyte balance.

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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, Clinical interrelationships of lipids, lipoproteins and apolipoproteins
iii. Disorders of nucleic acid metabolism (Purine and Pyrimidine metabolism).
iv. Disorders of iron, porphyrin and mineral metabolism, Metabolism under stress conditions.

M.Sc. BIOCHEMISTRY
SEMESTER-IV

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Major Test: 3.0 hours **Minor Test2: 20**
Major Test: 60
Total: 100

UNIT IV HEMATOLOGY, ACID-BASE BALANCE AND DETOXIFICATION

i. Haematology: Haemolytic anaemia, G6PDH deficiency, Hemoglobinopathies, Thalassemias, thrombosis
ii. Blood clotting-extrinsic and intrinsic pathways, Bleeding and clotting time.
iii. Production of acids and bases by the body, maintenance of body pH. 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. Hepatic 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

M.Sc. BIOCHEMISTRY
SEMESTER-IV

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Major Test: 60
Total: 100

BOOKS RECOMMENDED:

1. Smith, A.F., Beckett, G.J., Walker, S.W. and Rae, P.W.H. (2013): Clinical Biochemistry. 8th Edition, Blackwell Science.
2. Gaw, A., Cowan, R.A., O'Reilly, D.S.J., Stewart, M.J., Shepherd, J. 5th Edition (2013) 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.