Jiwaji University, Gwalior-474011
(Madhya Pradesh)

Syllabus

M.Sc. Biochemistry

(2025-27)

02 Year PG Programme

NEP 2020, Ordinance No – 14(2)

19/09/2025

For 2-Years PG Programme

Scheme B-1

Master of Science in Biochemistry (M.Sc. Biochemistry) – Major Practicum Component

Year / Semester		Course Type			Total Credits
		Core Courses	Practicum Courses	Internship/ Apprenticeship/ Seminar Or VAC (CHM/EESC)	
First Year	Sem-I	CC-11: Biomolecules and Bioinstrumentation (6 Credits)	PC-11 Biomolecules and Bioinstrumentation (4 Credits)	Internship/ Apprenticeship/ Seminar (2 Credits)	22
		CC-12: Cell Biology and Immunology (6 Credits)	PC-12: Cell Biology and Immunology (4 Credits)		
	Sem – II	CC-21 Molecular Biology and Recombinant DNA Technology (6 Credits)	PC-21 Molecular Biology and Recombinant DNA Technology (4 Credits)	VAC (CHM/EESC) (2 Credits)	22
		CC-22: Intermediary Metabolism And Enzymology (6 Credits)	PC-22: Intermediary Metabolism And Enzymology (4 Credits)		

OPTION-1: Only Course Work (Applicable to all UTDs/Colleges)

Second Year	Sem-III	CC-31: Physiology, Endocrinology and Clinical Biochemistry (6 Credits)	PC-31: Physiology, Endocrinology and Clinical Biochemistry (4 Credits)	Internship/ Apprenticeship/ Seminar (2 Credits)	22
		CC-32: Microbiology and Plant Biochemistry (6 Credits)	PC-32: Microbiology and Plant Biochemistry (4 Credits)		
	Sem-IV	CC-41: Tissue Culture Techniques and Frontiers in Biochemistry (6 Credits)	PC-41: Tissue Culture Techniques and Frontiers in Biochemistry (6 Credits)	VAC (CHM/EESC) (2 Credits)	22
		CC- 42: Fundamentals of Bioinformatics and Biostatistics (6 Credits)	PC- 42: Fundamentals of Bioinformatics and Biostatistics (4 Credits)		

OPTION-2: Course Work & Research Work (Applicable to the UTDs/Colleges having research Centers recognized by the University)

Second Year	Sem-III	CC-31: Physiology, Endocrinology and Clinical Biochemistry (6 Credits)	PC-31: Physiology, Endocrinology and Clinical Biochemistry (4 Credits)	Internship/ Apprenticeship/ Seminar (2 Credits)	22
		CC-32: Microbiology and Plant Biochemistry (6 Credits)	PC-32: Microbiology and Plant Biochemistry (4 Credits)		
	Sem-IV	-	-	Research Thesis/Project/Patent (22 Credits)	22

OPTION-3: Only Research Work (Applicable to the UTDs/Colleges having research Centers recognized by the University)

Second Year	Sem-III	Research Thesis/Project/Patent (22 Credits)	22
	Sem-IV	Research Thesis/Project/Patent (22 Credits)	22

Agrawal 19/09/2025

Jiwaji University, Gwalior

For 2 Year PG Programme
NEP 2020, Ordinance No. – 14(2)

Scheme B-1 Master of Science (M.Sc. Biochemistry) – Major Practicum Component

Course Structure and Scheme of Examination

First Year

M.Sc. Biochemistry I Semester

S. No.	Course Code	Course Name	Total Marks	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max.	Min.	Max.	Min.
1.	CC-11	Biomolecules and Bioinstrumentation	100	6	60	24	40	16
2.	CC-12	Cell Biology and Immunology	100	6	60	24	40	16
3.	PC-11	Biomolecules and Bioinstrumentation	100	4	60	24	40	16
4.	PC-12	Cell Biology and Immunology	100	4	60	24	40	16
5.		Internship/Apprenticeship or Seminar	100	2	-	-	100	40
		Grand Total	500	22				

19/09/2025

Jiwaji University, Gwalior

For 2 Year PG Programme
NEP 2020, Ordinance No. – 14(2)

Scheme B-1 Master of Science (M.Sc. Biochemistry) – Major Practicum Component

Course Structure and Scheme of Examination

First Year

M.Sc. Biochemistry II Semester

S. No.	Course Code	Course Name	Total Marks	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max.	Min.	Max.	Min.
1.	CC-21	Molecular Biology and Recombinant DNA Technology	100	6	60	24	40	16
2.	CC-22	Intermediary Metabolism And Enzymology	100	6	60	24	40	16
3.	PC-21	Molecular Biology and Recombinant DNA Technology	100	4	60	24	40	16
4.	PC-22	Intermediary Metabolism And Enzymology	100	4	60	24	40	16
5.		VAC (CHM/EESC)	100	2	100	40	-	-
		Grand Total	500	22				

19/09/2025

Jiwaji University, Gwalior

For 2 Year PG Programme
NEP 2020, Ordinance No. – 14(2)

Scheme B-1 Master of Science (M.Sc. Biochemistry) – Major Practicum Component

Course Structure and Scheme of Examination

Second Year

Option - 1 (Only Course Work)

M.Sc. Biochemistry III Semester

S. No.	Course Code	Course Name	Total Marks	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max.	Min.	Max.	Min.
1.	CC-31	Physiology, Endocrinology and Clinical Biochemistry	100	6	60	24	40	16
2.	CC-32	Microbiology and Plant Biochemistry	100	6	60	24	40	16
3.	PC-31	Physiology, Endocrinology and Clinical Biochemistry	100	4	60	24	40	16
4.	PC-32	Microbiology and Plant Biochemistry	100	4	60	24	40	16
5.		Internship/Apprentice ship or Seminar	100	2	-	-	100	40
		Grand Total	500	22				

19/09/2025

Jiwaji University, Gwalior

For 2 Year PG Programme
NEP 2020, Ordinance No. – 14(2)

Scheme B-1 Master of Science (M.Sc. Biochemistry) – Major Practicum Component

Course Structure and Scheme of Examination

Second Year

Option - 1 (Only Course Work)

M.Sc. Biochemistry IV Semester

S. No.	Course Code	Course Name	Total Marks	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max.	Min.	Max.	Min.
1.	CC-41	Tissue Culture Techniques and Frontiers in Biochemistry	100	6	60	24	40	16
2.	CC-42	Fundamentals of Bioinformatics and Biostatistics	100	6	60	24	40	16
3.	PC-41	Tissue Culture Techniques and Frontiers in Biochemistry	100	4	60	24	40	16
4.	PC-42	Fundamentals of Bioinformatics and Biostatistics	100	4	60	24	40	16
5.		VAC (CHM/EESC)	100	2	100	40	-	-
		Grand Total	500	22				

19/09/2025

Jiwaji University, Gwalior

For 2 Year PG Programme
NEP 2020, Ordinance No. – 14(2)

Scheme B-1 Master of Science (M.Sc. Biochemistry) – Major Practicum Component

Course Structure and Scheme of Examination

Second Year

Option - 2 (Course Work and Research Work)

M.Sc. Biochemistry III Semester

S. No.	Course Code	Course Name	Total Marks	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max.	Min.	Max.	Min.
1.	CC-31	Physiology, Endocrinology and Clinical Biochemistry	100	6	60	24	40	16
2.	CC-32	Microbiology and Plant Biochemistry	100	6	60	24	40	16
3.	PC-31	Physiology, Endocrinology and Clinical Biochemistry	100	4	60	24	40	16
4.	PC-32	Microbiology and Plant Biochemistry	100	4	60	24	40	16
5.		Internship/Apprenticeship or Seminar	100	2	-	-	100	40
		Grand Total	500	22				

M.Sc. Biochemistry IV Semester

S. No.	Course Name	Total Marks	Credit (s)
1.	Research Thesis / Research Project / Patent	100 (50+50)	22

19/09/2025

Jiwaji University, Gwalior

For 2 Year PG Programme
NEP 2020, Ordinance No. – 14(2)

Scheme B-1 Master of Science (M.Sc. Biochemistry) – Major Practicum Component

Course Structure and Scheme of Examination

Second Year

Option - 3 (Only Research Work)

M.Sc. Biochemistry III Semester

S. No.	Course Name	Total Marks	Credit (s)
1.	Research Thesis / Research Project / Patent	100 (50+50)	22

M.Sc. Biochemistry IV Semester

S. No.	Course Name	Total Marks	Credit (s)
1.	Research Thesis / Research Project / Patent	100 (50+50)	22

Agrawal 19/09/2025

CC-11: Biomolecules and Bioinstrumentation (Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

1. Classification of carbohydrates, structure and function of monosaccharides, disaccharides
2. Homo and hetero-polysaccharides: Structure, types and functions
3. Glycoconjugates: Proteoglycans, Glycoproteins, Glycolipids: Structure and biological roles.of carbohydrates as informational molecules
4. Lipids: Types, structure, properties and biological roles; Fatty acids, saponifiable and non-saponifiable lipids
5. Lipoprotein, lipopolysaccarides and other hybrid molecules: Types, properties and functions

UNIT II

1. Amino acids : Structure, classification, abbreviations, properties and functions, peptides and polypeptides, Synthesis of peptides and protein sequencing
2. Proteins : Properties, covalent structure, secondary, tertiary and quaternary structure
3. Enzymes : Classification, mechanism of action, allosteric enzymes, multienzyme complex and basic concepts of Enzyme kinetics
4. Water soluble vitamins : Structure, distribution, interaction and biological functions
5. Fat soluble vitamins: Structure, distribution, interaction and biological functions

UNIT III

1. Nucleotides : Structure of purine and pyrimidine bases, nucleosides, nucleotides
2. DNA : Structure and Conformation, denaturation, degradation, modification, repair, recombination and rearrangement
3. RNA : Structure, types and functions Centrifugation: Basic principle, type, instrumentation and applications
4. Spectroscopy: Basic principles of colorimetry, and UV visible spectrophotometry, instrumentation and applications; Infra red spectroscopy – Principle, instrumentation and applications
5. Fluorimetry: Principle, instrumentation and applications

UNIT IV

1. Chromatography: Principle, types, instrumentation and applications
2. Affinity chromatography, HPLC and FPLC
3. Electrophoresis: Principle, types and applications, Isoelectricfocussing and isotachophoresis – Principle & Applications
4. Atomic absorption and flame emission spectroscopy: Principle, instrumentation and applications
5. Polarimetry, ORD and CD: Principle, instrumentation and applications

UNIT V

1. NMR and ESR: Principle, instrumentation and applications
2. X ray crystallography: Principle, instrumentation and applications
3. Mass Spectrometry: Principal, Mass Analyzers and Applications
4. Microscopy: Light, phase contrast, interference, fluorescence and polarization microscopy, Electron microscopy: Principle and Applications, Confocal Microscopy: Principle and Applications
5. Radioactivity: Principle, Geiger Muller Counter, liquid scintillation counter, solid scintillation counter, gamma counter

Agrawal 19/09/2025

1 Principles of Biochemistry by Nelson, Cox and Lehninger
2 Biochemistry by G. Zubay
3 Biochemistry by Stryer
4 Biochemistry by Garrett and Grisham
5 Biochemistry, D Voet and JG. Voet , J Wiley and Sons.
6 Biochemistry, D Freifilder, W.H. Freeman & Company.
7 Laboratory Techniques in Biochemistry and molecular Biology, Work and Work
8 A Biologist's guide to Principles and Techniques of Practical Biochemistry, Wilson & Goulding
9. Physical Biochemistry: Applications to Biochemistry and Molecular Biology by Freifelder
10. Biochemical Techniques: Theory and Practice by Robyt and White
11. Principles of Instrumental Analysis by Skoog and West
12. Analytical Biochemistry by Holme and Peck
13. Biological Spectroscopy by Campbell and Dwek
14. Organic Spectroscopy by Kemp
15. A Biologist's Guide to Principles and Techniques of Practical Biochemistry by Wilson and Goulding
16. Principles of Instrumental Analysis by Skoog, Hollar and Nicman

19/09/2023

PC-11: Biomolecules and Bioinstrumentation (Practicum Course)

Total Hrs: 60 **Credit: 4**

1 Qualitative analysis of carbohydrates
2 Qualitative analysis of proteins & amino acids,
3 Qualitative analysis of lipids,
4 Analysis of oils : iodine number, saponification value, acid number
5 Titration of amino acids
6 Colorimetric determination of pKa
7 Quantitative estimations of proteins- Biuret, Bradford, Lowery's, Spectrophotometric
8 Quantitative estimation of Carbohydrates
9 Verification of Beer's law
10 Determination of absorption maxima
11 Electrophoresis of Proteins-native and under denaturing conditions.
12 Amino acid and carbohydrate separations by paper & thin layer chromatography
13 Gas chromatography
14 Ion exchange and gel filtration chromatography
15 Separation of blood cells by density gradient centrifugation

Suggested Readings:

1. Plummer, D.T – An Introduction to Practical Biochemistry, Tata McGraw-Hill, 3rd Edition, ISBN (eBook)-9780070994874, P Book-0070994870
2. Jayaraman, J – Laboratory Mannual in Biochemistry, New Age International, 2nd Edition, ISBN (eBook)-9788122420976, P Book-8122420978
3. Varley, H., Gowenlock, A.H. and Bell, M. – Practical Clinical Biochemistry, CBS Publishers & Distributors, 6th Edition, ISBN (eBook)-9788123904871, P Book-8123904875
4. Sadasivam, S. & Manickam, A. – Biochemical Methods, New Age International, 2nd Edition, ISBN (eBook)-9788122418393, P Book-8122418399
5. Wilson, K. & Goulding. K.S. – Principles & Techniques of Practical Biochemistry, 4th Edition, ISBN (eBook)-9780340555750, P Book-0340555750

19/09/2025

CC-12: Cell Biology and Immunology (Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

1. Cellular and Chemical Foundations of Life; Comparative Study of Prokaryotic & Eukaryotic Cells
2. An overview of Tools & Techniques used in Cell Biology; Experimental Models to study cell and molecular biology
3. Cell Membrane: Physicochemical Properties; Molecular Organization – asymmetrical organization of lipids, proteins and carbohydrates; and Functions, Molecular Models and Biogenesis of Cell Membrane
4. Transport of Small Molecules Across Cell Membranes: Types and Mechanism, Active Transport by ATP-Powered Pumps: Types, properties and mechanisms
5. Transport of proteins into mitochondria, chloroplast, endoplasmic reticulum and nucleus

UNIT II

1. Processing of Proteins in Endoplasmic Reticulum and Golgi Apparatus
2. Transport by vesicle formation: Endocytosis and Exocytosis,
3. Mechanism of vasicular transport
4. Intracellular Digestion: Ultra structure and Functions of Lysosomes, peroxisomes
5. Cell Motility and Shape: Structure and Functions of Microfilaments, microtubules and intermediate filaments

UNIT III

1. Intracellular communication through cell junctions: Structure, organization and functions of Occluding Junctions, Anchoring Junctions and Communicating Junctions
2. Molecular Mechanism of Cell-Cell Adhesion: Ca^{++} dependent and Ca^{++} independent cell-cell adhesion, Extra-cellular Matrix & their receptors in Animals: Molecular Composition, Organization and Functions; Integrins: Molecular Structure, Types and Distribution: Cell Signaling: Overview, signaling pathways and signaling in plants
3. Immune response: Innate immune mechanisms and characteristics of adaptive immune response: Antigens, epitopes, Hepten: Factors affecting immunogenicity, Super antigens, Anatomical organization of immune system: Primary lymphoid and Secondary lymphoid organs. Ontogeny and Phylogeny of lymphocytes, Lymphocyte traffic
4. Cell of the immune system: Hematopoiesis, Mononuclear cells and granulocytes, Antigen presenting cells, Lymphocytes and their subsets; Inflammation; its mediators and the process, Cell adhesion molecules and their role in inflammation, lymphocyte homing, tissue injury and immune response leading to an inflammatory reaction, role of anaphylatoxins, granulocytes in inflammatory process
5. Major histocompatibility systems: Structure of MHC I and II molecules, polymorphism, distribution variation and function. Organization of MHC complex in Mouse and Humans. Association of MHC with disease; Recognition of antigens by T and B Cells: Antigen processing, Role of MHC molecules in antigen presentation and Co-stimulatory signals; T – cell receptor complex, T-cell accessory membrane molecules, activation of T cells, Organization and arrangement of T-receptor genes

UNIT IV

1. B-cell receptor complex, Activation of B-cells, Immunoglobulins: Molecular structure, types and functions. Antigenic determinants on immunoglobulins; Molecular mechanism of antibody diversity: Organization of genes coding for constant and variable regions of heavy chains and light chains. Mechanisms of antibody diversity, Class switching; Antigen-Antibody interaction, avidity & affinity measurement

19/09/2025

2. Monoclonal antibodies: Production, characterization and applications in diagnosis, therapy and basic research, Antibody engineering; Complement system, components, activation pathways, and regulation of activation pathways, Complement deficiencies, Role of complement system in immune responses
3. Cytokines: Structure and functions, cytokine receptors, signal transduction mediated by cytokine receptors, cytokine regulation of immune responses, cytokine related diseases and therapeutic applications of cytokines, Cytotoxic T cells and their mechanism of action, NK cells and mechanism of target cell destruction.
4. Antibody dependent cell mediated cytotoxicity, Delayed type hypersensitivity. Techniques of Cell mediated immunity
5. Immunoregulation mediated by antigens, antibodies, immune complexes

UNIT V

1 Hypersensitivity: Definition, IgE mediated hypersensitivity, mechanism of mast cell degranulation, mediators of type-I reactions and consequences. Type II reactions, Immune complex mediated hypersensitivity and Delayed type hypersensitivity
2. Autoimmunity: Organ specific diseases, Systemic diseases, Mechanisms of autoimmunity and therapeutic approaches
3. Immunodeficiency syndromes: Primary immunodeficiencies and Secondary immunodeficiencies and their diagnosis and therapeutic approaches
4. Vaccines: Active and passive immunization, Whole organism vaccines, Macromoleculesas vaccines, Recombinant-vector vaccines, DNA Vaccines, Synthetic peptide vaccines and sub-unit vaccines
5. Immunodiagnostics : Precipitation techniques, Agglutination, Fluorescence techniques, ELISA, RIA, Western blotting and Immno-histochemical techniques

Suggested Readings

1. Molecular Biology of the Cell, Alberts, *et al*
2. Molecular Cell Biology, Lodish, et al
3. Working with Molecular Cell Biology: A study Companion, Storrie *et al*
4. Cell and Molecular Biology: Concepts and Experiments, Gerald Karp
5. The Cell: A Molecular Approach, G.M. Cooper
6. The Word of the Cell, Becker *et al*
7. Cell Proliferation and Apoptosis, Hughes and Mehnet
8. Essential Cell Biology, Alberts *et al*
9. Biochemistry and Molecular Biology of Plants, Buchanan *et al*
10. Harpers Biochemistry Murray *et al*
11. Kubey, Immunology, R.A. Goldsby, Thomas J. Kindt, Barbara, A. Osbarne. (Freeman).
12. Immunology-A short Course, -Eli Benjamini, Richard Coico, Geoffrey Sunshine.
13. Immunology by Tizzard
14. Fundamentals of immunology by William Paul.
15. Immunology by Roitt *et al*
16. Immunology by Abbas

19/09/2025

PC-12: Cell Biology and Immunology (Practicum Course)

Total Hrs: 60 **Credit: 4**

1. Sub cellular fractionation
2. Chromosome Preparation: Mitosis – Onion root tip, rat/mouse cornea, rat/mouse bone marrow, human lymphocytes
3. Chromosome Preparation: Meiosis – Rat/mouse testis, Grasshopper testis
4. Polytene chromosome preparation from Drosophila salivary gland
5. Identification of tissue typing: Histological preparation of tissue
6. Identification of different biomolecules in different tissues by histochemical techniques
7. Electron microscopy: Demonstration and good photographs for interpretation
8. Blood Film preparation and identification of cells.
9. Double diffusion and Counter Immunoelectrophoresis.
10. Immuno-electrophoresis; Radial Immunodiffusion.
11. Agglutination techniques: Direct & Indirect
12. Immunization and production of polyclonal antibodies
13. ELISA
14. Western –blotting.

Suggested Readings:

1. Chaitanya, K.V. – Cell and Molecular Biology: A Lab Manual, PHI Learning, ISBN (e Book)-9789354432613, P. Book-9788120348004
2. Varley, H., Gowenlock, A.H.. and Bell, M. – Practical Clinical Biochemistry, Heinemann Medical Books, 6th Ed, ISBN 9788123914991
3. Vasudevan, D.M., Sreekumari, S. and Vaidyanathan, K. – Textbook of Biochemistry for Medical Students, Jaypee Brothers Medical Publishers, 8th Edition, ISBN (eBook)-9789354657630, P Book-9789354657630

19/09/2025

CC-21: Molecular Biology and Recombinant DNA Technology
(Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

1. DNA Replication : General features of Replication; DNA Replication Machinery in Prokaryotes & Eukaryotes
2. Enzymology of DNA Replication : DNA Polymerases; Primases; Ligases; Helicases; Topoisomerases; Gyrases and Single Stranded Binding Proteins and Regulation of DNA Replication
3. Transcription in Prokaryotes : Initiation, elongation and termination and Structure and functions of prokaryotic promoter; Structure and functions of RNA Polymerase; Sigma factors – Types and functions;
4. Control of Transcription in Prokaryotes: Intrinsic termination and rho factor dependent termination; attenuation and antitermination
5. Regulation of Gene Expression in Prokaryotes : Operon concept, induction and repression, Structure and regulation of lactose and tryptophan operons

UNIT II

1. Transcription in Eukaryotes : RNA Polymerases – Types and properties; Promoter – Types, structure and properties;
2. Transcription factors – Types and properties; Enhancers – Structure and properties; Response Elements,
3. Post-transcriptional Modification Eukaryotes – 5' and 3' modification of mRNA
4. Post-transcriptional Processing of pre tRNA, pre mRNA transcripts, pre rRNA and Catalytic RNA
5. Genetic Code: Evidence and properties; Wobble hypothesis; Translational adaptors and amino acyl tRNA synthetases;

UNIT III

1. Translation: Successive stages of protein synthesis in prokaryotes and its comparison with eukaryotes; Post-translational Modification: Types and Significance
2. Regulation of Gene Expression in Eukaryotes: *cis*-acting DNA Elements; Chromatin organization and regulation of gene expression; Regulation at the level of processing of transcripts; RNA Editing; DNA methylation and gene regulation; Regulation of gene expression by hormones; Regulation of gene expression at translational level
3. General concept, principle and applications of Recombinant DNA Technology; Enzymes: Nucleases and restriction endonucleases – properties and types; phosphomonoesterases; polynucleotide kinase; DNA ligase; DNA polymerase I; RNA Dependent DNA Polymerase; terminal deoxynucleotidyl transferase; poly A polymerase
4. Prokaryotic host-vector system: Characteristics of *E. coli* as host; vectors for cloning in *E. coli* (plasmid, bacteriophage and plasmid- phage); Other Prokaryotic host vector systems: Characteristics of Gram positive and Gram negative organisms as host and suitable vectors for cloning
5. Shuttle vectors: Features and Applications, Expression vectors for cloning in prokaryotes: Features and Applications, Factors affecting expression of cloned genes in prokaryotes

19/09/2025

UNIT IV

1. Cloning in Yeast: Properties of yeast as host for cloning and different types of vectors designed for cloning in yeast
2. Cloning in animals system: Animal system as a model host, Methods of introduction of foreign DNA in animal system;
3. Vectors for cloning in animal system – SV 40, bovine papilloma virus, adenovirus, vaccinia virus, baculovirus and retrovirus vectors
4. Methods for Constructing rDNA and cloning: Inserts; vector insert ligation; infection, transfection and cloning; Methods for selection and screening of recombinant clones
5. DNA Libraries: Types, advantages and disadvantages of different types of libraries; Different methods for constructing genomic and full length cDNA libraries

UNIT V

1. Gross anatomy of cloned insert – size, restriction mapping and location
2. Fine anatomy of DNA segment – General principle of chemical and enzymatic methods of nucleotide sequence analysis
3. Localization of cloned segments in genomes – molecular and chromosomal location; Methods for determination of copy number of a cloned gene in genome
4. Mutant construction: Introduction, deletion, insertion and point mutation
5. Biosafety Measures and Regulations for Genetically Engineered Products

Suggested Readings

1. Lewin's Genes XII
2. Molecular Biology by Tropp
3. Molecular Biology by Turner *et al*
4. Cell and Molecular Biology: Concepts and Experiments by Gerald Karp
5. Transcriptional Regulation in Eukaryotes by Carey and Smale
6. Translational control of gene Expression by Sonenberg *et al*
7. Chromatin and Gene Regulation by Turner
8. An Introduction to Genetic Analysis by Griffiths *et al*
9. Genome by T.A. Brown
10. Concepts of Genetics by Klug and Cummings
11. Proteins by Creighton
12. Molecular Cell Biology by Lodhish *et al*
13. Principles of Gene Manipulation and Genomics by Primrose & Twyman
14. Gene Cloning & DNA Analysis: An introduction by T.A. Brown
15. Recombinant DNA – By Watson et al
16. Biotechnology: Theory and Techniques (Vol I & II), by Chirikjian
17. Molecular Genetics of Bacteria by Dale
18. Molecular Cloning (Vol I, II & III) by Sambrook & Russell
19. Applied Molecular Genetics, by Miesfeld
20. Genes and Genome by Singer & Berg
21. Molecular Biotechnology by Glick & Pasternak
22. Plant Molecular Biology (Vol I & II) by Gilmartin & Bowler

19/09/2025

PC-21: Molecular Biology and Recombinant DNA Technology (Practicum Course)

Total Hrs: 60 **Credit: 4**

1. Isolation of genomic DNA and restriction digestion
2. Size fractionation of restricted DNA fragments by Agarose Gel Electrophoresis
3. Quantitation of DNA
4. Determination of Amax of purified DNA fragments
5. Determination of Tm of nucleic acid
6. Isolation of RNA
7. Fractionation of poly $(A)^+$ RNA
8. Bacterial Culture and antibiotic selection media. Preparation of competent cells
9. Isolation of plasmid DNA
10. Restriction digestion of plasmid DNA and analysis
11. Cloning in plasmid vectors
12. Gene expression in *E .coli* and analysis of gene product
13. Polymerase Chain Reaction

Suggested Readings

1. Lewin's Genes XII
2. Molecular Biology by Tropp
3. Cell and Molecular Biology: Concepts and Experiments by Gerald Karp
4. An Introduction to Genetic Analysis by Griffiths *et al*
5. Principles of Gene Manipulation and Genomics by Primrose & Twyman
6. Gene Cloning & DNA Analysis: An introduction by T.A. Brown
7. Recombinant DNA – By Watson et al
8. Biotechnology: Theory and Techniques (Vol I & II), by Chirikjian
9. Molecular Cloning (Vol I, II & III) by Sambrook & Russell
10. Molecular Biotechnology by Glick & Pasternak

19/09/2015

CC-22: Intermediary Metabolism and Enzymology (Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

1. First and second laws of thermodynamics
2. Concept of free energy, ATP Cycle, ATP as high energy compound, functions of ATP
3. Other high energy biological compounds
4. Basic Concepts of intermediary metabolism
5. Carbohydrate metabolism: Glycolysis, Kreb's cycle, glycogenolysis, glycogenesis, pentose phosphate pathway, glyconeogenesis, glyoxalate pathway

UNIT II

1. Regulation of carbohydrate metabolism
2. Inborn errors of carbohydrate metabolism
3. Electron transport and oxidative phosphorylation
4. Biosynthesis and degradation of lipids
5. Regulation of lipid metabolism and Inborn errors of lipid metabolism

UNIT III

1. Nitrogen assimilation
2. Biosynthesis and degradation of amino acids and regulation of amino acid metabolism; Inborn errors of amino acid metabolism
3. Nucleic acid metabolism; Inborn errors of nucleic acid metabolism and Integration of metabolism and metabolomics
4. Enzyme: Historical aspects, classification and nomenclature, EC number; Mechanism of enzyme catalysis and action
5. Sub cellular localization and organization of enzymes; Methods of enzyme assay: continuous and sampling techniques, coupled enzyme assay and methods and significance of enzyme turnover number; specific activity

UNIT IV

1. Enzyme purification techniques: objectives and strategy; methods of homogenization; method of isolation; purification and crystallization
2. Criteria of purity and tabulation of purification data; stable storage of enzymes; Characterization of purified enzyme
3. Coenzymes, Cofactors and Isoenzymes
4. Enzyme Kinetics: Equilibrium and steady state theory, rate equation and determination of Km and Vmax, Factors affecting rate of enzyme reaction: pH, temperature and pressure
5. Enzyme inhibition: reversible and irreversible inhibition, their type, inhibitor constant and its significance; Rapid reaction techniques, Efficiency of enzymes in non-aqueous environment

UNIT V

1. Protein-ligand binding: types, cooperativity, Hill and Scatchard plot, Allosteric enzymes: Models of allostery, types and kinetics, Regulation of enzymes
2. Mechanism of action of Chymotrypsin; Ribonuclease; Lysozyme; Metallo-enzymes
3. Enzymes during aging and Degradation of enzymes
4. Enzyme immobilization; techniques; experimental procedures and effect of immobilization on kinetic parameters
5. Principle and Industrial application of immobilized systems, Biosensors, Enzymes in Medical diagnosis and enzyme therapy

19/09/2015

Suggested Readings

1. Principles of Biochemistry by Nelson, Cox and Lehninger
2. Biochemistry by G. Zubay
3. Biochemistry by Stryer
4. Biochemistry by Garrett and Grisham
5. Biochemistry, D Voet and JG. Voet , J Wiley and Sons.
6. Biochemistry, D Freifilder, W.H. Freeman & Company.
7. Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work
8. A Biologist's guide to Principles and Techniques of Practical Biochemistry, Wilson & Goulding
9. The Nature of Enzymology by R.L. Foster
10. Enzymes by Dixon and Webb
11. Fundamentals of Enzymology by Price and Stevens
12. Enzyme Catalysis and Regulation by Hammes
13. Enzyme Reaction Mechanisms by Walsch
14. The Enzymes vol I and II by Boyer
15. Enzyme Structure and Mechanism by Alan Fersht
16. Enzyme Assays: A Practical Approach by Eisenthal and Danson
17. Enzyme Biotechnology by G. Tripathi

19/09/2015

PC-22: Intermediary Metabolism and Enzymology (Practicum Course)

Total Hrs: 60 **Credit: 4**

1. To observe the catabolism of carbohydrates by micro-organisms
2. To observe the production of gas by micro-organisms during fermentation
3. To demonstrate the production of pyruvate and acetaldehyde during fermentation of glucose by yeast
4. To demonstrate biological oxidation and electron transport in heart muscle tissue
5. To observe the effect of fasting on the metabolism of rats
6. Urease estimation in plant tissues
7. Assay of Acid phosphatase in plant seeds
8. Assay of Alkaline phosphatase in Kidney and Liver
9. Determination of optimum pH, temperature & time
10. Determination of Km value of alkaline phosphatase
11. Acetylcholinesterase estimation in Rat /Goat Brain
12. Enzyme purification: Ammonium sulphate precipitation, Ion exchange chromatography, molecular sieve chromatography.
13. Determination of purity of enzyme by PAGE
14. Determination of molecular weight of enzyme by Gel Filtration
15. Immobilization of HRP (Horse reddish peroxidase).
16. Sub-cellular fractionation of rat liver and marker enzyme assays.

Suggested Readings

1. Principles of Biochemistry by Nelson, Cox and Lehninger
2. Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work
3. A Biologist's guide to Principles and Techniques of Practical Biochemistry, Wilson & Goulding
4. The Nature of Enzymology by R.L. Foster
5. The Enzymes vol I and II by Boyer
6. Enzyme Assays: A Practical Approach by Eisenthal and Danson

Approved 19/09/2015

CC31: Physiology, Endocrinology and Clinical Biochemistry (Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

1. Composition of Blood: Structure, functions and biogenesis of RBC, f unctions of hemoglobins, plasma proteins
2. Circulatory System (Open and closed circular, lymphatic systems), Mechanism of blood coagulation : extrinsic and intrinsic pathways, inhibitors of coagulation
3. Urine formation: Formation of dilute and concentrated urine, and Regulation of water electrolyte balance and role of kidney and hormones
4. Acid-base balance and its regulation by kidney and hormones
5. Digestive system

UNIT II

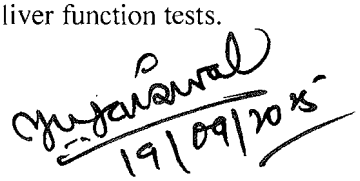
1. Nerve impulse transmission: structure of neuron, mechanism of conduction of nerve impulse along axon, neurotransmitters, Presynaptic and post-synaptic events of neuromuscular junctions
2. Ultra structure and molecular mechanisms of contraction of skeletal muscles and its regulation, energetics of muscle contraction, relaxation, Contraction of smooth muscles
3. General characters and classification of hormones, receptors and mechanism of action of hormones
4. Structure, synthesis, secretion, transport, metabolism and function of the hormones secreted by the pituitary and parathyroid
5. Hormones of the thyroid, adrenal medulla and cortex: structure, synthesis, secretion, transport, metabolism and functions

UNIT III

1. Hormones of the pancreas: structure, synthesis, secretion, transport, metabolism and functions
2. Hormones of the testis and ovary: structure, synthesis, secretion, transport, metabolism and functions
3. Basic concepts of laboratory diagnoses: Concept of accuracy, precision, normal and reference value determination and factors affecting reference values, Types of diagnostic specimens, collection, processing and preservation of specimens, Types of anti-coagulants and their mode of action.
4. Organization and basic requisites of Clinical Biochemistry laboratory viz., Instrumentation, Biowaste management, Quality control: Internal and External
5. Clinical significance of specific plasma/ CSF proteins, Clinical applications of serum protein eletrophoresis, Phenyl ketonuria. Hemoglobinopathies; Hemoglobin, porphyrin and related compounds : Disorders and diagnosis

UNIT IV

1. Disorders of Carbohydrate metabolism: Glucose metabolism and role of Insulin. Diabetes mellitus, types, etiology and pathogenicity, ketone bodies, Hypoglycemia. Carbohydrate intolerance.
2. Lipid metabolism: Diagnostic significance of analysis of serum lipids, chlolesterol and heart disease, Lipoprotein metabolism and heredity disorders of lipid metabolism.
3. Enzymes as diagnostic markers, Tissue distribution of enzymes, Diagnostic significance of acid phosphates, alkaline phosphatase, amylase, cholinesterase, creatine kinase, gamma glutamyl transfearse, lactate dehydrogenase, lipase etc.
4. Liver: Role of liver in biochemical processes, Bilirubin metabolism, ammonia metabolism, liver diseases and liver function tests.



CC31: Physiology, Endocrinology and Clinical Biochemistry (Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

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2. Circulatory System (Open and closed circular, lymphatic systems), Mechanism of blood coagulation : extrinsic and intrinsic pathways, inhibitors of coagulation
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UNIT II

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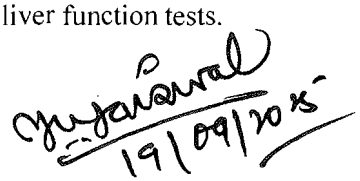

5. Kidney: Role of kidney in biochemical processes, Renal clearance, renal diseases and kidney function tests

UNIT V

1. Thyroid Disorders- Cretinism, Goitre, Grave's disease, Hashimoto thyroiditis
2. Cushing's syndrome, Acromegaly
3. Adrenal and gonads: Addision's disease
4. Polycystic ovary syndrome
5. Tumors of endocrine glands

Suggested Readings

1. Physiology by Guyton
2. Medical Physiology by Best and Taylor
3. Physiology by Garrett
4. Harper's Reviews of Biochemistry
5. Tietz Text book of Clinical Chemistry
6. Clinical Biochemistry by Varley
7. Practical Biochemistry- Plummer

PC31: Physiology, Endocrinology and Clinical Biochemistry (Practicum Course)

Total Hrs: 60 **Credit: 4**

1. To determine Hb% by Sahli's hemometer in blood samples
2. To determine the hematocrit
3. To determine the concentration of heparin in blood samples
4. To determine the PTT in blood samples
5. To demonstrate the effect of diet and hormones on the glycogen content of rat liver
6. Electrophoretic separation of serum proteins on agarose gel
7. Estimation of serum albumin and determination of albumin : globulin ration
8. Estimation of blood glucose by glucose-oxidase method
9. Estimation of serum triglycerides
10. Estimation of serum total cholesterol, HDL cholesterol, LDL cholesterol
11. Estimation of serum bilirubin
12. Electrophoretic separation of sickle hemoglobin
13. Estimation of serum acid phosphatase
14. Estimation of serum alkaline phosphatase
15. Estimation of serum aspartate transaminase
16. Estimation of serum creatinine

Suggested Readings

1. Physiology by Guyton
2. Medical Physiology by Best and Taylor
3. Physiology by Garrett
4. Harper's Reviews of Biochemistry
5. Tietz Text book of Clinical Chemistry
6. Clinical Biochemistry by Varley
7. Practical Biochemistry- Plummer

19/09/2015

CC-32: Microbiology and Plant Biochemistry (Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

1. Classification of Microorganisms: Basis of microbial classification, Haeckel's three kingdom, Whittaker's five kingdom concept.
2. Morphology and fine structure of eubacteria and archeobacteria cell wall, cytoplasmic membrane and other organelles.
3. Pure culture techniques and preservation methods, Preparation of Culture media, microbial staining. Sterilization: Physical and chemical methods
4. Microbial Growth: Bacterial growth curve, Mathematical expression, measurement of Growth and factors affecting growth. Microbial Nutrition: Nutritional classification of Microorganisms, common nutritional requirements, mode of nutrition, transport of nutrients across the bacterial membrane
5. Oxygen toxicity: Study of catalase, peroxidase, superoxide dismutase, mechanism of oxygen toxicity.

UNIT II

1. Virus: Types, Isolation, cultivation, identification and viral replication. Structure and morphology of Bacteriophage, Lytic and lysogenic cycle.
2. Life cycle of DNA Viruses: SV 40, RNA Viruses: Retroviruses, Cynobacteria : General account and their importance
3. Infection and disease, types of Infection, Mechanism of pathogenicity
4. Bacterial Diseases: Staphylococcal and Clostridial food poisoning, Salmonellosis Shigellosis
5. Fungal diseases: Histoplasmosis, Aspergillosis. Viral diseases: Chicken pox, Hepatitis B, and Poliomyelitis, Mycoplasmas and diseases caused

UNIT III

1. Bacterial Recombination: Transformation, Conjugation, Transduction, Plasmids and transposons
2. Chemotherapeutic agents: Classification of antibiotics, Broad spectrum antibiotics, Antibiotics from prokaryotes. Anti-fungal and antiviral antibiotics, mode of action of antibiotics and resistance to antibiotics
3. Specialized plant organelles : Cell plate, Cell wall- Chemical and physical composition, biosynthesis, primary and secondary cell walls, Plasmadesmata, Plasids- Types and functions, Importance of vacuoles and microbodies, Meristematic cells an root quiescent zone
4. Absorption, adsorption and transport of water and ions in plants. Translocation of inorganic and organic substances
5. Structure and biogenesis of organelles involved in photosynthesis in plants

UNIT IV

1. Chloroplast membrane and molecular organization of thylakoids, proton gradient and electron transfer in chloroplasts of plants and in purple bacteria-difference from mitochondria
2. Light receptors- Chlorophyll, light harvesting complexes, bacteriorhodopsin as ion pump
3. Photosystem I and II- Location, mechanism of energy transfer between pghotosystems, ferrodoxin, plastocyanin, plastoquinones and carotenoids; Hill reaction and photophosphorylation
4. The Calvin Cycle- Evidence, mechanism and stoichiometry, role of light in activation of dark phase enzymes.
5. Photorespiration: Mechanism and regulation

19/09/2018

UNIT V

1. The C4 mode of photosynthesis: Mechanism, stoichiometry and purpose, difference from C3 in relation to plant productivity. Crassulacean Acid Metabolism: Mechanism and regulation
2. Biological Nitrogen Fixation: Formation of ammonia, conversion of nitrate to ammonia, assimilation and secondary assimilation of ammonia, inhibitors
3. Molecular properties of nitrogenase system, *nif* genes and their regulation, applications of biological nitrogen fixation
4. Molecular effects and mechanism of action of Auxin, Gibberellic Acid, Ethylenes, Cytokinins, Abscisic acid
5. Secondary metabolites: Plant alkaloids and Phenolics- Distribution, localization, biosynthesis and biological functions. Biochemistry of seed development and fruit ripening and Defense system in plants

Suggested Readings

1. General Microbiology, R.Y. Ingraham, J.L. Wheelis, M.L. and Painter, P.R. The MacMillan Press Ltd.
2. Brock Biology of Microorganism, M.T. Martinko, J.M. and Parker, J. Prentice-Hall.
3. Microbiology, Pelzar, M.J., Chan , E.C.S. and Kreig, N.R., Tata McGraw Hill.
4. Microbial Genetics, Maloy , S.R., Cronan, J.E.Jr and Freifelder, D. Jones, Bartlett Publishers.
5. Microbiology-a Laboratory Manual, Cappuccino, J.G. and Sherman, N. Addison Weseley.
6. Microbiological Applications, (A Laboratory Manual in General Microbiology) Benson, H.J. WCB: Wm C. Brown Publishers
7. Handbook of Photosynthesis by Mohammad Pe Sarakle
8. Plant Physiology by Salisburry and Ross
9. Introduction to Plant Biochemistry by Goodwin and Mercer
10. Seed: Physiology of Development and Germination by Bewley and Balck
11. Biochemistry of Energy Utilization in Plants by Blakie
12. Plant Biochemistry by Dey and Harbome

19/09/2025

PC-32: Microbiology and Plant Biochemistry (Practicum Course)

Total Hrs: 60 **Credit: 4**

1. Preparation of liquid and solid media for growth of microorganisms.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution methods. Slants and stab cultures. Storage of microorganisms
3. Isolation of pure cultures from soil and water.
4. Growth; Growth curve; Measurement of bacteria population by turbidometry and serial dilution methods. Effect of temperature, pH and carbon and nitrogen sources on growth.
5. Microscopic examination of bacteria, Yeast and molds and study of organisms by Gram stain, Acid fast stain and staining for spores.
6. Study of mutations by Ames test.
7. Assay of antibiotics and demonstration of antibiotic resistance.
8. Analysis of water for portability and determination of MPN.
9. Bacterial transformation.
10. Biochemical characterization of selected microbes.
11. One step growth curve of coliphage.
12. Estimation of plant proteins
13. Estimation of plant lipids and carbohydrates
14. Isolation of plant pigments, their analysis and determination of absorption Maxima
15. Chloroplast isolation
16. Hill Reaction
17. Estimation of nitrogenase
18. Estimation of nitrate reductase- *in vivo* method
19. Estimation of total phenolic compounds
20. Estimation of anthrocyanin pigments
21. Preparation of liquid and solid media for growth of microorganisms.
22. Isolation and maintenance of organisms by plating, streaking and serial dilution methods. Slants and stab cultures. Storage of microorganisms

Suggested Readings

1. Microbiology-a Laboratory Manual, Cappuccino, J.G. and Sherman, N. Addison Weseley.
2. Microbiological Applications, (A Laboratory Manual in General Microbiology) Benson, H.J. WCB: Wm C. Brown Publishers
3. Handbook of Photosynthesis by Mohammad Pe Sarakle
4. Plant Physiology by Salisburry and Ross
5. Introduction to Plant Biochemistry by Goodwin and Mercer
6. Biochemistry of Energy Utilization in Plants by Blakie
7. Plant Biochemistry by Dey and Harbome

19/09/2015

CC-41: Tissue Culture Techniques and Frontiers in Biochemistry (Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT I

1. Introduction and organization of animal cell and tissue culture laboratory, Contamination, Primary and established cell line culture
2. Serum and protein free defined media and their applications, measurement of viability and cytotoxicity
3. Introduction to balanced salt solutions and simple growth medium: Brief introduction of the chemical, physical and metabolic functions of different constituents of culture medium, Role of carbon dioxide and supplements
4. Biology and characterization of the cultured cells, measurement of parameters of growth
5. Basic techniques of mammalian cell culture: Disaggregation of tissues, Primary and established cell line cultures and mass culture techniques

UNIT II

1. Stem cell technology: Types of stem cell, manipulations of stem cells, Factors governing manipulation of stem cell, Therapeutic cloning for embryoinic stem cell, Applications of stem cell cultures
2. Commercial application of Cell Culture: 3D Animal Cell Culture
3. Introduction to plant tissue culture and laboratory organization, Tissue culture media: Composition and preparation, initiation and maintenance of callus and suspension culture, single cell clones
4. Organogenesis: Somatic embryogenesis, transfer and establishment of whole plant in soil
5. Protoplast isolation, culture, regeneration and somatic hybridization and applications of plant tissues culture

UNIT III

1. Nanobiotechnology: Introduction to nanoscience, Tools for measuring nano structures
2. Biosensor development and its applications
3. Microarray chips: Types of DNA chips and their production
4. SNP's and GMS (Genome mismatch repair)
5. Flow Cytometery: Principle and Applications

UNIT IV

1. Functional proteomics: Methods of proteome analysis
2. Human Genome Project (HGP): The human genome/ Social implications
3. Forensic applications of DNA analysis
4. Latest techniques in molecular Biology: Next generation sequencing, genome editing, CRYSPR
5. Intellectual property: Various forms of IP, Patents: Conditions of patentability, the process of obtaining a patent, who can obtain a patent, Why obtain patent, source of patent information, Recent changes in IPR and Patent policies, IP in Biochemistry

UNIT V

1. Drug Discovery: Overview of drug discovery, from natural products
2. Drug development, pharmacokinetics and clinical trials
3. Single Molecule Techniques
4. Artificial Intelligence: identification of biomarkers, discovery of new drug targets, and personalize medicine.
5. DNA Nanotechnology: Principle, Methods and Applications

19/09/2025

Suggested Readings:

1. Freshney's Culture of Animal Cells: A Mannual of Basic Technique and Specialized Applications, by Capes-Davis, A and Freshney, R.I. (2021) 8 Edition, Willey-Blackwell Publications, ISBN: 9781119513049 (eBook), P Book 1119513049
2. Protein-Protein Interactions by Erica Golemis
3. Modern Genetic Analysis by Anthny J.F. Griffiths et al.
4. Nanobiotechnology- Next Big Idea by Mark, Ratner, Daniel Ratner
5. Gene Cloning by T.A.Brown
6. DNA Microarrays and Gene Expression by P. Baldi and G.W.Hatfield
7. Experiments in Microbiology, Plant Pathology and Biotechnology by Aneja, K.R. (2003) 4th Edition, New Age International, ISBN: 812241494-X

19/09/2025

PC-41: Tissue Culture Techniques and Frontiers in Biochemistry (Practicum Course)

Total Hrs: 60 **Credit: 4**

1. Organization of animal cell culture laboratory
2. Preparation of different types of animal cell culture media
3. Culturing of primary and established cell lines
4. Measurement of cell viability and and cell toxixcity by use of trypan blue and MTT assay
5. Preparation of nanoparticles
6. Characterization of nano structures
7. Organization of plant tissue culture laboratory
8. Preparation of plant material for culture
9. Preparation of plant tissue culture media
10. Plant cell culture and single cell culture
11. Plant regeneration from callus or plant tissue
12. Isolation and culture of plant protoplast
13. Protoplast fusion
14. Production of pathogen free plant through meristem culture
15. Patent literature search and dissection of patents
16. Searching patents in the field of Biochemistry and finding out the inventions covered by them
17. Writing a research brief fro patent drafting

Suggested Readings:

1. Freshney's Culture of Animal Cells: A Mannual of Basic Technique and Specialized Applications, by Capes-Davis, A and Freshney, R.I. (2021) 8 Edition, Willey-Blackwell Publications, ISBN: 9781119513049 (eBook), P Book 1119513049
2. Protein-Protein Interactions by Erica Golemis
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4. Nanobiotechnology- Next Big Idea by Mark, Ratner, Daniel Ratner
5. Gene Cloning by T.A.Brown
6. DNA Microarrays and Gene Expression by P. Baldi and G.W.Hatfield
7. Experiments in Microbiology, Plant Pathology and Biotechnology by Aneja, K.R. (2003) 4th Edition, New Age International, ISBN: 812241494-X

19/09/2025

CC-42: Fundamentals of Bioinformatics and Biostatistics
(Theory Course)

Total Hrs: 90 **Credit: 6**

UNIT-I

1. Definition, History, Branches of Bioinformatics, Aims, Scope and Research Areas, Human Genome Project
2. Internet and its resources. Role of computers in Bioinformatics
3. Search engines: Google, Pub Med, NCBI, EMBL
4. Current Scenario of Bioinformatics in India, Future Prospects of Bioinformatics.
5. Various applications of Bioinformatics.

UNIT-II

1. Introduction to Biological Databases
2. Types of Biological Databases: Nucleic Acid Databases, Protein Databases, Specialized Genome Databases, Structure Database and Structure Classification Databases, Indian Biological Databases
3. Data Acquisition - concept and purposes, Information Retrieval from Biological Databases: Entrez and SRS
4. Concept of Digital Libraries, Methods for presenting large quantities of data.
5. Government schemes for commercialization of technology, public policy, regulatory and ethical challenges facing in entrepreneurship, Business Development for Medical products and consumable products

UNIT-III

1. Introduction and scope of statistics in biological studies and basic concepts.
2. Presentation of data: Tabulation, Frequency distribution drawings,
3. Collection of data, Data presentation
4. Sampling methods
5. Measures of central tendency, Measures of Dispersion , standard error

UNIT-IV

1. Confidence limits for mean and proportion.
2. Probability with basic concepts, Normal and binomial distribution.
3. Sampling variability and Significance
4. Correlation and regression analysis for a bivariate data
5. Test of Hypothesis, Type I and Type II errors

UNIT-V

1. Z test, t-test , Chi-square test
2. Analysis of Variance: One way ANOVA, Two way ANOVA
3. Other Non parametric methods
4. Discriminate Analyses: Two group and Multiple Discriminate Analysis
5. Statistical Software: SPSS

Suggested Readings:

1. Bioinformatics, Andreas D. Baxevanis, David S. Wishart, Gary D. Bade, Wiley, United Kingdom, 2019.
2. Essential Bioinformatics, Xiong, Jin, Cambridge University Press, United States, 2014
3. Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers & Distributors, India, 2005.

19/09/2025

4. Introduction to Bioinformatics, Lesk, Arthur M, Oxford University Press, USA, 2019. 5th edition
5. Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C., PHI Learning, India, (2013).
6. Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012.
7. Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015. 3rd edition.
8. Daniel, W.W. & Cross, C.L. Biostatistics: A Foundation for Analysis in the Health Sciences, Wiley
9. Zar, J.H. Biostatistical Analysis, Pearson
10. Sullivan, L.M. Essentials of Biostatistics in Public Health, Jones & Bartlett Learning
11. Altman, D.G. Practical Statistics for Medical Research, Chapman and Hall/CRC
12. Moore, D.S., Mccabe, G.P. and Craig, B.A. Introduction to the Practice of Statistics, W.H. Freeman

Agrawal
19/09/2025

PC-42: Fundamentals of Bioinformatics and Biostatistics (Practicum Course)

Total Hrs: 60 **Credit: 4**

1. Introduction to NCBI. Search Literature Databases using Entrez
2. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored and Analyzing DNA sequence.
3. Retrieving Protein sequence from GenPept (NCBI) and Expasy and Analyzing Protein Sequences.
4. Sequence alignment using BLAST (Basic Local Alignment Search Tool) and FASTA.
5. Representation of statistical data: Histogram, Pie Chart, Bar Chart
6. Collection of data using different sampling methods
7. Determination of central tendency.
8. Determination of dispersion.
9. Applications of t-test using real data.
10. Applications of Chi test using real data.
11. Basic statistics in Excel
12. Power point presentation of statistical applications

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1. Bioinformatics, Andreas D. Baxevanis, David S. Wishart, Gary D. Bade, Wiley, United Kingdom, 2019.
2. Essential Bioinformatics, Xiong, Jin, Cambridge University Press, United States, 2014
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10. Sullivan, L.M. Essentials of Biostatistics in Public Health, Jones & Bartlett Learning
11. Altman, D.G. Practical Statistics for Medical Research, Chapman and Hall/CRC
12. Moore, D.S., Mccabe, G.P. and Craig, B.A. Introduction to the Practice of Statistics, W.H. Freeman

19/09/2025