KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
COIMBATORE – 641029.
Programme Name: M.Sc. Biochemistry
Curriculum and Scheme of Examination under CBCS
(Applicable to the students admitted during the Academic Year 2024-2025 and onward)

Semester	Subject code	Title of the paper	Instruction hours/cycle	Exam Marks				Credits
				CIA	ESE	Total	Duration of Exam (hours)	
I	24PBC101	Core paper 1 Biomolecules and Bio polymers	5	25	75	100	3	4
	24PBC102	Core paper 2 Bioanalytical Techniques	5	25	75	100	3	4
	24PBC103	Core paper 3 Enzymes and Enzyme Technology	5	25	75	100	3	4
	24PBC104	Core paper 4 Cellular Biochemistry	5	25	75	100	3	4
	24PBC1CL	Core practical 1: Lab in Biomolecules, Bioinstrumentation, Enzymology and Cell Biology	5	40	60	100	6	4
	24PBC1E1	Major Elective- I	5	25	75	100	3	5
Total Hours			**30**			**600**	-	**25**
II	24PBC205	Core paper 5 Plant Biochemistry	5	25	75	100	3	4
	24PBC206	Core paper 6 Metabolism and Metabolic Regulation	5	25	75	100	3	4
	24PBC207	Core paper 7 Molecular Biology	5	25	75	100	3	4
	24PBC208	Core paper 8 Drug Biochemistry	5	25	75	100	3	4
	24PBC2CM	Core Practical 2 : Lab in Plant Biochemistry, Genetics and Molecular Biology	5	40	60	100	5	4
	24PBC2E2	Major Elective- II	5	25	75	100	3	5
Total Hours			**30**			**600**	-	**25**
III	24PBC309	Core paper 9 Advanced Immunology and immunological techniques	6	25	75	100	3	5
	24PBC310	Core paper 10 Biostatistics and Research Methodology	6	25	75	100	3	4
	24PBC311	Core paper 11 Advanced Clinical Biochemistry	7	25	75	100	3	4
	24PBC3CN	Core practical 3 : Lab in Immunology, Genetic Engineering and Clinical	5	40	60	100	5	4

		Biochemistry						
	24PBC3N1	Non-Major Elective – I	4	25	75	100	3	4
	24PBC3IT	Internship training*	-	-				-
		EDC	2	100	-	100	3	2
Total Hours			**30**			**600**	-	**23**
IV	24PBC412	Core paper 12 Hormonal Biochemistry	6	25	75	100	3	5
	24PBC413	Core paper 13 Genetic Engineering	5	25	75	100	3	5
	24PGI4N2	Non-Major Elective –II	4	100	-	100	3	4
	24PBC4Z1	Project and Viva-voce	15	20	80	100	-	3
Total Hours			**30**			**400**		**17**
GRAND TOTAL			**120**			**2200**		**90**

CBCS – Choice Based Credit system

CIA– Continuous Internal Assessment

ESE – End of Semester Examinations

**** The students shall undergo Intership training/ field work for a minimum period of 14 working days at the end of the second semester during summer vacation and submit the report in the third semester, which will be evaluated for 100 marks by the concerned guide and followed by an Internal viva-voce by the respective faculty or HOD as decided by the department. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85-100	O
70-84	D
60-69	A
50-59	B
40-49	C
<40	U(Reappear)

Major Elective Papers (2 papers are to be chosen from the following 4 papers)

1. Nanobiotechnology
2. Microbiology
3. Bioinformatics
4. Bioethics, Biosafety and IPR

Non Major Elective Papers (2 papers are to be chosen from the following 4 papers)

1. Information security #
2. Competitive Sciences
3. Bioprocess Technology
4. Cancer Biology

to be offered by the respective departments

Sub. Code & Title of the Extra Departmental Course (EDC):

24PBC3X1 – EDC Paper 1 - Nutritional Biochemistry

Note: In core subjects,no of papers both theory and practical are included wherever applicable. However, the total credits and marks for one subjects remain the same as stated below.

Tally Table:

Subject	No. of Subjects	Total Marks	Credits
Core – Theory / Practical / Project	17	1700	70
Major Elective Papers	2	200	10
EDC Paper	1	100	2
Non Major Elective Paper	2	200	8
Grand Total	**22**	**2200**	**90**

Extra credit courses:

ADVANCED LEARNERS COURSE (UNDER SELF STUDY SCHEME) (Optional)

24PBCOD1 Forensic Science

24PBCOD2 Nutraceuticals and Functional foods

24PBCOD3 Stem Cell Biology

JOB ORIENTED COURSE

Subject code	Title of the paper	Instruction hours/cycle	Exam Marks				Credits
			CIA	ESE	Total	Duration Exam(hours)	
24PBCOJ1	Bio entrepreneurship	4	25	75	60	3	2
24PBCOJ2	Food safety and Quality control	4	25	75	60	3	2
24PBCOJ3	Clinical and therapeutic nutrition	4	25	75	60	3	2

- 25 % CIA is applicable to all subjects except JOC, ALC and COP which are considered as extra credit courses.
- The students should complete any **MOOC on learning platforms like SWAYAM, NPTL, Course era, IIT Bombay spoken Tutorial etc.,** before the completion of the 3rd semester and the course completion certificate should be submitted through the HOD to the Controller of Examinations. Extra credits will be given to the candidates who have successfully completed.
- **Onsite Training** preferably relevant to the course may be undertaken as per the discretion of the faculty or HOD.

Components of Continuous Internal Assessment

<table>
<tr><th colspan="2">Components</th><th>Marks</th><th>Total</th></tr>
<tr><td colspan="4">Theory</td></tr>
<tr><td>CIA I</td><td>75</td><td rowspan="2">(75+75) = 150/10=15</td><td rowspan="4">25</td></tr>
<tr><td>CIA II</td><td>75</td></tr>
<tr><td colspan="2">Assignment/Seminar</td><td>5</td></tr>
<tr><td colspan="2">Attendance</td><td>5</td></tr>
<tr><td colspan="4">Practical</td></tr>
<tr><td colspan="2">CIA Practical</td><td>25</td><td rowspan="3">40</td></tr>
<tr><td colspan="2">Observation Notebook</td><td>10</td></tr>
<tr><td colspan="2">Attendance</td><td>5</td></tr>
<tr><td colspan="4">Project</td></tr>
<tr><td colspan="2">Review</td><td>15</td><td rowspan="2">20</td></tr>
<tr><td colspan="2">Regularity</td><td>05</td></tr>
</table>

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering;**K2**-Understanding;**K3**-Applying;**K4**-Analyzing;**K5**-Evaluating

Theory Examination:

i) CIA I & II and ESE: 75 Marks

Knowledge Level	**Section**	**Marks**	**Description**	**Total**
K1 Q1 to 10	A (Answer all)	1 x 10 = 10	MCQ	75
K1 – K5 Q11 to 15	B (Either or Pattern)	5 x 5 = 25	Short Answers	
K2 – K5 Q16 to 20	C (Either or Pattern)	5 x 8 = 40	Descriptive / Detailed	

2. Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4	Record Work	10	
K5			

Practical Examination mark breakup:

Knowledge Level	Section
K3 ↕ K5	**Experiments:** **Major:** Protocol -15 Performance-5 Result-5 **Minor:** Protocol -5 Performance-5 Result-5 Q&A – 5 Viva – 5
	Record work – 10

3. Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report	60	80
K4	Viva voce	20	
K5			

Project mark breakup:

Knowledge Level	Section
K3 ↕ K5	**Project Report:** Content – 20 Presentation – 20 R&D – 10 Review – 10
	Viva Voce: Layout of presentation – 10 Clarity – 5 Defense – 5

Sub. Code: 24PBC101

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 1 – Biomolecules and Biopolymers				
Batch 2024-2026	Hours/week 5	Total Hours 75	Credits 4	Employability/skill development/Entrepreneurship

Course Objectives

1. To learn about the chemistry and structures of Biomolecules
2. To know the properties of different Biomolecules
3. To know the physiological functions of Biomolecules

Course Outcomes (CO)

K1	CO1	Correlate the classification and functions of Biomolecules in energy Production.
	CO2	Apply the link between the structure and function of amino acids and Proteins in biological system.
TO	CO3	Able to know about execute of Biomolecules in human health
	CO4	Analyze and study the chemical and biochemical properties pharmacogenetics field
K5	CO5	Apply the structural studies to biological processes like replication, transcription and translation.

Syllabus

Unit I **(15 Hours)**

Carbohydrates: Structure, occurrence, properties and biological functions of Monosaccharides, Disaccharides, O-linked and N-linked oligosaccharides, Polysaccharides: Homoglycans: Structure, occurrence, properties and biological functions of starch, cellulose, glycogen and chitin. Heteroglycans: Structure, occurrence, properties and biological functions of glycosaminoglycans. Structure and biological role of peptidoglycans, lipopolysaccharides and proteoglycans.

Unit II **(15 Hours)**

Amino acids and water: Structure, nomenclature, classification, acid-base behavior and chemical reactions of amino acids; Stereoisomerism and optical properties of amino acids; Non-protein amino acids. Amino acid derivatives. Water and its physicochemical properties, Ionization of water, pH scale, Henderson-Hasselbalch equation.

Unit III **(15 Hours)**

Proteins: Structural organization of protein: Primary structure. Determination of protein

Sub. Code: 24PBC101

structure: Ramachandran plot. Polypeptide synthesis. Secondary structures – α-helix, β-sheet and β-turns, Pauling and Corey model for fibrous proteins, Reverse Turns and supersecondary structures, Collagen triple helix. Tertiary structure – α and β domains. Conformational properties of silk fibroin. Quaternary structure of proteins: Structure and functions of myoglobin and hemoglobin.

Unit IV **(15 Hours)**

Lipids: *Classification, structure, functions and properties of lipids. Fatty acids - saturated and unsaturated. Structure and functions: Phospholipids and glycolipids. Eicosanoids-structure and biological role of prostaglandins, thrombaxanes and leucotrienes. Steroids: structure and functions of cholesterol. Lipoproteins- classification and composition. Amphipathic lipids- emulsions and liposomes.

Unit V **(15 Hours)**

Nucleic acids: Structure of nucleic acids, DNA double helical structure– Watson and Crick model. A, B and Z DNA, Palindromes, Inverse repeats, cruciform and hairpins, Triple and quadruple structures. DNA sequencing Methods: – House Stream Geometry method and Sanger's Dideoxy chain termination method. Properties of DNA: UV absorption spectra, buoyant density, denaturation and renaturation, cot curves, DNA hybridization, DNA super coiling and linking number. Chemical synthesis of DNA. Structure and biological functions of major forms of RNA: mRNA, rRNA and tRNA.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Nelson, David L. and Cox. (2017). Lehninger Principles of Biochemistry.7th edition,W.H.Freemanand Co.,NY

2. U.Sathayanarayana. (2017). Biochemistry. 5th edition, Books and allied (P) Ltd., India

Reference Books:

1. Voet, D, Voet, J.G. and Pratt, C.W. (2013). Principles of Biochemistry. 4th edition, John Wiley & Sons, New Delhi -10002.

2. Garrette R. Hand Grisham, C. M. (2013). Principles of Biochemistry. 5th edition, Saunders college publishers.

Sub. Code: 24PBC101

3. Eric E.Conn, P.K. Stump f, G.Brueins and Ray H.Doi, John. (2005). Outlines of Biochemistry. 5th edition. Wiley and sons, Singapore.

4. Moran, Horton, Scrimgeour, Perry & Rawn (2013). Principles of Biochemistry, 5th edition Pearson New International Edition, UK.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	H	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code:24PBC102

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 2 – Bio analytical Techniques				
Batch 2024-2026	Hours/week 5	Total Hours 75	Credits 4	Employability/skill development

Course Objectives

1. To learn the principle and instrumentation of various separation techniques
2. To know the applications of various separation techniques in biological fields
3. To learn the concept of radioactivity and explore its role in various fields.

Course Outcomes (CO)

K1	CO1	Recall the principle and applications of bioinstrumentation
	CO2	The students will discern the principle, Instrumentation of different types of Bio analytical techniques
TO	CO3	The students also discern about applying the instrumentation techniques of Centrifugation, Electrophoresis and Chromatography in various research
	CO4	The students will determine the knowledge and practice concerning modern analytical instrumentation and students can able to enter into large scale Industries.
K5	CO5	Appreciate the principle, instrumentation and difference between various spectroscopic methods.

Syllabus

Unit I **(15 Hours)**

Introduction: Extraction, Pre-treatment, Stabilization and preparation methods of bio products for analysis. Electrophoretic Techniques: Principle, equipment and process, Agarose gel electrophoresis, gradient electrophoresis, horizontal and vertical gel electrophoresis, electrophoresis techniques, isoelectric focusing, capillary electrophoresis and application of electrophoresis in analyzing macromolecules.

Unit II **(15 Hours)**

Chromatography and purification: *Classification, principles, techniques and applications of adsorption, reverse phase, ion exchange, size exclusion, TLC, Paper chromatography, hydrophobic interaction, bio-affinity and pseudo affinity chromatographic techniques. Sophisticated chromatographic technique: Principle, techniques and applications of HPLC, GCMS, LC-MS,

Sub.Code:24PBC102

Unit III **(15 Hours)**

Spectroscopy: Overview of introduction to spectroscopy. Principles, techniques and applications of UV-Visible spectroscopy, FTIR, Spectro fluorimetry, Flame photometry, Fluorescence spectroscopy, Raman spectroscopy, NMR Spectroscopy.

Unit IV **(15 Hours)**

Microscopic and nanomechanical microscopic Characterization: *overview of microscopy**,** Morphology and identification of cells using Cell fractionation and flow cytometry, SEM, TEM and Confocal Microscopy, EDAX, Elemental mapping, - Differential Scanning Calorimeter (DSC).

Unit V **(15 Hours)**

Clinical instrumentation: Diagnostic and therapeutic equipments – Blood pressure monitor, electrocardioscope, pulse ox meter, pH meter- autoanalyser, Pace makers, ultra sound imaging system-micro and macro, CT scan.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Upadhyay, Upadhyay and Nath. (2012). Biophysical Chemistry – Principles and Techniques, 4th Revised edition, Himalaya Publishing House Pvt. Ltd.

2. Keith Wilson, John Walker. (2000). A biologist's guide to Principles and Techniques of Practical Biochemistry, 5thedition, Cambridge University Press, New York.

3. Analytical techniques in biochemistry and molecular biology R. Katoch Springer, New York, 2011

4. Biological spectroscopy I. D. Campbell Benjamin/Cummings Pub. Co 1984

5. Separation Processes in Biotechnology Asenjo, Juan A. CRC / Taylor & Francis 1990

Reference Books:

1. D.J. Homie and H. Peck. (2003). Analytical Biochemistry. 1stedition, Rastogic CBS Publisher.

2. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch (2008).

3. Fundamentals of Analytical Chemistry. 4thedition, Barkha Nath Printers, India.

Sub.Code:24PBC102

Keith Wilson and John Walker. (2011). Principles and Techniques of Biochemistry and Molecular Biology.7th edition, Cambridge University Press, NewYork.

4. Chatwal, Gand Anand, S. (2005). Instrumental methods of chemical analysis. Himalaya Publishing House.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	H	M
CO2	H	S	M	M	S
CO3	H	M	S	H	M
CO4	M	S	S	H	S
CO5	M	S	H	S	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code : 24PBC103

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 3 – Enzymes and Enzyme Technology				
Batch	Hours/week	Total Hours	Credits	Employability/skill
2024-2026	5	75	4	development

Course Objectives

1. To know the classification and properties of enzymes
2. To learn about the mechanism of enzyme action
3. To know the applications of enzymes in clinical and diagnostic fields

Course Outcomes (CO)

K1	CO1	Remember the fundamentals of enzyme properties
	CO2	Conceive the different procedures involved in enzyme technology
TO	CO3	Able to assay the enzyme and their kinetics and also apply to this in the industry and other technological field
	CO4	Estimate enzyme technology for the commercialization purpose of biotechnological products
K5	CO5	Apply purification techniques of enzymes and immobilization techniques.

Syllabus

Unit I **(15 Hours)**

Classification, Purification And Active Site: Nomenclature and classification of enzymes, isolation and purification of enzymes – by different methods, criteria of purity - specific activity. Enzyme units - Katal, IU. Measurement of enzyme activity - two point assay, kinetic assay, using radiolabelled substrates. Active site - determination of active site amino acids - chemical probe, affinity label, and site-directed mutagenesis, intrinsic and extrinsic regulations. Investigation of 3-D structure of active site. A brief account of non protein enzymes – ribozymes.

Unit II **(15 Hours)**

Mechanism of Enzyme Action and Regulation :Enzyme specificity, Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, proximity and orientation effects, role of metal ion in enzyme catalysis, mechanism of serine proteases - chymotrypsin, lysozyme, and ribonuclease.

Sub.Code : 24PBC103

Regulation of enzyme activity- covalently modified regulated enzymes, allosteric enzymes, multienzyme complex - occurance, isolation and properties. Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthase. Isoenzymes-LDH.

Unit III **(15 Hours)**

Enzyme kinetic and inhibition : Kinetics of single substrate enzyme - catalysed reactions - Michaelis - Menten equation, importance of Vmax, Km, turnover number; Line weaver - Burk plot, Eadie - Hofstee plot, Hanes - Woolf plot and Eisenthal and Cornish - Bowden plot.

Kinetics of Allosteric enzymes - MWC and KNF models Hill' equation coefficient. Kinetics of multi - substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism. Reversible inhibition -competitive, uncompetitive, noncompetitive, mixed, substrate and allosteric inhibition. Irreversible inhibition. Feedback inhibition

Unit IV **(15 Hours)**

Coenzymes: Coenzymes - prosthetic group, classification - vitamin and non vitamin coenzymes, thiamine pyrophosphate - mechanism of oxidative and non oxidative decarboxylation, transketolase reaction, FMN and FAD - flavoprotein enzymes, mechanism of oxidation and reduction of: flavin enzymes, NAD and NADP role in enzyme catalysis, PALP and PAMP - role of PALP in transamination and decarboxylation reaction, ***Coenzyme A involved reactions**, biotin - carboxylation reaction, folate coenzymes, coenzyme role of vitamin Bl2 .

Unit V **(15 Hours)**

Enzyme Technology : Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerase, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production.

Clinical enzymology - Enzymes as thrombolytic agents, anti-inflammatory agents, digestive aids. Therapeutic use of asparginase, streptokinase. Diagnostic enzymes. Immobilization of enzymes and their applications. Abzymes

Immobilization techniques and applications: Adsorption, microencapsulation, entrapment, covalent and ionic bonding. Biosensors: Calorimetric, Potentiometric, Amperometric, immunosensors and optical biosensors. Ribozyme, abzyme. Purification of

Sub.Code : 24PBC103

protein.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Trevor Palmer. (2001). Enzymes: Biochemistry, Biotechnology and Clinical chemistry. Horwood Chemical Science Series. Horwood Publishers.

2. Anil Kumar & Sarika Garg, (2015), Enzymes and Enzyme Technology, Viva books, New Delhi.

Reference Books:

1. Talwar. G.P (2012), Text book of biochemistry and Human Biology, 3rd edition, Prentice Hall of India Private Ltd, New Delhi.

2. Balasubramanian *et al*., (2015). Concepts in Biotechnology, Universities Press India Ltd.

3. EE. Conn and PK. Stump f, G. Bruening and RY. Doi (2010), Outlines of biochemistry, 5thed, John Wiley and Sons, New York,USA.

4. Robert J. Whitehurst, Maarten Van Oort. (2010). Enzymes in Food Technology.2ndedition, John Wiley and SonsLtd.

5. David L Nelson, Micheal M Cox. (2013). Lehninger's Principles of Biochemistry, 6thedition, Replika Press (P) Ltd, India.

6 .Julio Polainaand Andrew P. (2007). Industrial Enzymes: Structure, Function and Applications (Springer). MacCabe (Editors).

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	M	H	S
CO2	S	H	M	S	H
CO3	M	S	H	M	M
CO4	S	H	S	H	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub. Code: 24PBC104

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 4 – Cellular Biochemistry				
Batch	Hours/week	Total Hours	Credits	Employability/skill
2024-2026	5	75	4	development/Entrepreneurship

Course Objectives

1. To learn the models and functions of biological membrane
2. To learn about the structure and functions of cytoplasmic organelles
3. To learn the mechanism of membrane transport in cells

Course Outcomes (CO)

K1	CO1	Recall the basic concepts of cells.
	CO2	Understand the knowledge of cell structure and function
TO	CO3	Employ their knowledge of cell biology to selected examples of changes or Losses in cell function.
	CO4	Analyze the cell structure, cell signaling and cell functions
K5	CO5	Decipher the intracellular signaling modes in mitochondria

Syllabus

Unit I **(15 Hours)**

Cellular organization: Introduction and contributions to membrane and its models Membrane models, chemical composition and bonds of membrane, membrane proteins, Transport and bulk transport across the cell membrane (osmosis, diffusion, endocytosis, phagocytosis, artificial liposomes) and its application.

Unit II **(15 Hours)**

Sub-cellular organelles: Structure and functions of intracellular organelles such as cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, mitochondria, chloroplasts, lysosomes, peroxisomes, glyoxisomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

Unit III **(15 Hours)**

Cell division and interactions: Over view of Cell division - mitosis and meiosis. Cell cycle – stages of interphase and M-phase – cell synchrony and its applications. Cell-Cell interactions - Metabolic cooperation, electrical coupling, contact inhibition, autocrine, paracrine and endocrine signalling.

Sub. Code: 24PBC104

Ecological amplitude of cells in high altitude, sediments, arctic, hot springs, arid, brackish and fresh water environments.

Unit IV **(15 Hours)**

Cell locomotion: Cytoskeletal elements - Microtubules, ***microfilaments** (actin and myosin), intermediary filaments - cell locomotion (amoeboid, flagella and ciliary), muscle and nerve cells as terminally differentiated cells, muscle cells, general structure of skeletal and smooth muscles, microfilament organization in skeletal and smooth muscles – sliding filament mechanism of contraction. Nerve cells – general structure of a neuron – synapses – types (electrical and chemical).

Unit V **(15 Hours)**

Cell differentiation, senescence and death Cell differentiation in plants: Fertilization, initial divisions, seed formation, germination, primordial layer formation, organogenesis (only sources of organs from each layer). **Cell differentiation in animals**: fertilization, implantation, blastula formation, gastrulation, primordial germ layers, organogenesis (only sources of organs from each layer). **Cell senescence**: Biochemical changes during senescence – role of telomere and telomerase. **Cell death** – necrosis and programmed cell death (apoptosis, paraptosis and autophagy).

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Dr.Veer Bala Rastogi (2018). A Textbook of Cell Biology and Genetics. KNRN Publishers. Meerut.

2. P.S. Vermaand V.K. Agarwal. (2014). Cell Biology, Genetics, Molecular biology, Evolutionand Ecology, S.Chand and Company,New Delhi.

Reference Books:

1. Harvey Lodish, Arnold Berk *et al*., (2007). Molecular Cell Biology. 6thedition, W H Freeman and Company, New York.

2. Garrette R.H and Grisham, C. M. (2013). Principles of Biochemistry. 5thedition, Saunders College Publishers.

Sub. Code: 24PBC104

3. Alberts *et al.*, (2014). Molecular biology of the cell. 6th edition, Garland Publishers.

4. David E Sadava. (2004). Cell Biology-Organelle structure and Function. Panima publishing Corporation, New Delhi.

5. G. Karp. (2001). Cell and Molecular Biology. 3rd edition, John Wiley & Sons publisher.

6. Geoffrey M.Cooper and Robert E. Hausman. (2009). The Cell: A Molecular Approach. 5th edition, ASM Press, Washington D.C.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	S
CO2	H	S	S	M	M
CO3	S	H	S	S	M
CO4	S	M	M	H	S
CO5	S	M	M	S	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code: 24PBC1CL

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Practical 1 – Biomolecules, Bioinstrumentation, Enzymology and Cell Biology				
Batch	Hours/week	Total Hours	Credits	Employability/skill
2024-2026	5	75	4	development/Entrepreneurship

Course Objectives

1. To get practical experience in analyzing the biochemical metabolites in biological samples, bioinstrumentation, enzyme technology and cell biology techniques
2. To have hands on experience on chromatography, electrophoresis, enzyme and cell biology techniques
3. To develop familiarity with bioanalytical techniques and applications of enzyme and cell biology in research and industries

Course Outcomes (CO)

K1	CO1	Reproduce various concepts in Biomolecules, Enzyme and Cell biology.
	CO2	Conceive the amount of Biomolecules, isolation, purification and determination of enzyme, preparation of buccal smears
TO	CO3	Apply the enzyme technology and cell biology skill in basic research projects
	CO4	Assign the principles of Biomolecules, enzyme and cell biology techniques to discovery novel drug development
K5	CO5	Be competent to perform various biochemical analysis.

Syllabus

Biomolecules

1. Estimation of Starch
2. Estimation of Fructose
3. Estimation of Glycogen
4. Estimation of Ascorbic acid
5. Estimation of Total Free Amino acids by Ninhydrin method
6. Extraction of total carotenoids and estimation of β-Carotene
7. Separation of plant pigments by paper chromatography

Sub.Code: 24PBC1CL

8. Separation of aminoacids by thin layer chromatography
9. PCR and Agarose gel electrophoresis (Demo)
10. Gel Documentation (Demo)
11. GC and HPLC (Demo)
12 Determination of Alanine transaminase activity
13. Determination of Lactate dehydrogenase activity
14 Isolation of mitochondria and estimation of succinate dehydrogenase
15 Animal cell types(Demo)
16 Cell Counting – RBC and WBC
17 Buccal smear – Identification of Barr body
18 Mitosis in onion root tip

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	M
CO2	H	S	S	M	M
CO3	M	H	H	S	S
CO4	M	M	M	S	S
CO5	M	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code: 24PBC205

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 5–Plant Biochemistry				
Batch 2024-2026	Hours/week 5	Total Hours 75	Credits 4	skill development

Course Objectives

1. To learn the mechanism and importance of photosynthesis in plants
2. To learn the role of hormones in the growth metabolism of plants
3. To know the latest genetic engineering techniques for plant development

Course Outcomes (CO)

K1	CO1	Recall the biosynthesis of primary and secondary metabolites, nitrogen metabolism involved in plants
TO	CO2	Understand the concept of plant tissue culture and plant transformation techniques
	CO3	Know about applications of phytoconstituents in development of new drug
	CO4	Experiment on new technologies in plant biotechnology
K5	CO5	Evaluate various gene transfer techniques

Syllabus

Unit I **(15Hours)**

Pigments: Plant genome organization. Introduction to the Structure, function and mechanisms of action of phytochromes (pigment system I and II), cryptochromes and phototropins, stomatal movement, transpiration, photoperiodism and biological clocks, plant movement.

(15Hours)

Unit II

Photosynthesis: Importance of photosynthesis (c3, c4 and CAM), cellular respiration and photorespiration pathways and their significance.

Nitrogen metabolism: Role of micro and macronutrients in plant growth. Significance of nitrogen. Ammonification, nitrification, nitrate reduction, Physical and biological nitrogen fixation-symbiotic, non-symbiotic. Symbiotic nitrogen fixation in leguminous plants, biochemistry of nitrogen fixation, denitrification and nitrogen cycle.

Unit III **(15Hours)**

Plant hormones: Factors affecting the growth of plants, characteristics and classification of plant hormones. Chemistry, biosynthesis, physiological effects, applications of auxins, gibberellins, cytokinins, abscicicacid, ethylene.

Sub Code: 24PBC205

Unit IV **(15Hours)**

Secondary metabolites and plant tissue culture: Biosynthesis, Functions and applications of of terpenoids, Functions of alkaloids, anthocyanins, Tannins and lignin. Applications of secondary metabolites. Plant tissue culture-Micropropagation, Callus induction, cell and protoplast culture, organogenesis and somatic embryogenesis. Haploid production-Anther, pollen, embryo and ovule culture and their applications. Applications of plant tissue culture.***Soma clonal variation.**

Unit V **(15Hours)**

Techniques for plant transformation: Agrobacterium mediated gene transfer and its applications, Ti plasmid, the process of T-DNA transfer to plants: Mechanism. Agrobacterium mediated gene transfer in tobacco. Bt-crops and golden rice production. Drought and herbicide resistance. Transformation methods: Particle bombardment, polyethyleneglycol (PEG) mediated transformation and electroporation. Validation of transformation – resistance genes, marker genes and transgene DNA.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. V.K. Jain. (2016). Fundamentals of Plant Physiology, 18 thedition, S.Chand and Company Pvt.Ltd, New Delhi.

2. S.K.Verma and Mohit Verma. (2008). A Textbook of Plant Physiology, Biochemistry and Biotechnology. 2ndedition. S.Chand and Company Pvt.Ltd, New Delhi.

Reference Books:

1. Plant Biochemistry, Dey J.B. Harborne, (2000). Academic Press.

2. Adrian Slater, Nigel W. Scott, Mark R. (2008). Plant Biotechnology: The genetic manipulation of plants. Fowler Oxford University Press.

3. C. Neal Stewart. (2008). Plant Biotechnology and Genetics-Principles, Techniques and Applications. Jr. John Wileyand sons Publishers, UK.

4. William G. Hopkins. (2008). Introduction to Plant Physiology, 2 ndedition, John Wiley and sons Publishers,UK.

5. RazdanM.K. (2003). An introduction to Plant Tissue culture. 2ndedition, Oxford & IBH Publishing Co, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	S	H	S	M
CO2	H	S	M	M	M
CO3	M	H	M	S	S
CO4	S	M	S	H	M
CO5	S	M	H	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code: 24PBC206

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 6 – Metabolism and Metabolic Regulation				
Batch 2024-2026	Hours/week 5	Total Hours 75	Credits 4	skill development

Course Objectives

1. To learn the metabolism of various Biomolecules in our system
2. To provide a basic understanding of the biochemical reactions of molecules
3. To study the interrelationship of various metabolic pathways

Course Outcomes (CO)

K1	CO1	Remember commemorate the overall concept of cellular metabolism
	CO2	Explain the metabolism of various biochemical pathways
TO	CO3	Execute the diseases associated with defective nucleotide biosynthesis
	CO4	Analyze the role of fat in energy production and membrane synthesis
K5	CO5	Define and explain the metabolism in various nutritional status and starvation.

Syllabus

Unit I **(15 Hours)**

Overview of metabolism

Interconversion of food stuffs. Metabolic profile of the liver, adipose tissue and brain. Integration of metabolic pathways- overview. Feedback and reciprocal regulation of metabolic pathways. Metabolic variations under altered nutritional/physiological status- starvation, well fed and pregnancy. Compartmentalization of metabolic pathway in the cell. Metabolic fuels: definition and Caloric value of metabolic fuels.

UNIT II **(15 Hours)**

Carbohydrate metabolism and regulation

Introduction to metabolism of cells, Aerobic glycolysis & Fermentation - Energetics of glycolysis. Gluconeogenesis, substrate cycle & reciprocal regulation of glycolysis & gluconeogenesis. Metabolism of glycogen & regulation. Maintenance of blood sugar by liver. Citric acid cycle and energetics. The amphibolic nature of the Citric acid cycle – Anaplerotic mechanism, HMP shunt, Uronic acid pathway, Cori's cycle, Glyoxalate pathway. Metabolism of fructose, Galactose & Mannose.

gluconeogenesis. Metabolism of glycogen & regulation. Maintenance of blood sugar by liver. Citric acid cycle and energetics. The amphibolic nature of the Citric acid cycle – Anaplerotic mechanism, HMP shunt, Uronic acid pathway, Cori's cycle, Glyoxalate pathway. Metabolism of fructose, Galactose & Mannose.

UNIT III **(15 Hours)**

Fatty acid metabolism and regulation

Oxidation of saturated & unsaturated fatty acids. Oxidation of fatty acids with even & odd numbered carbon atoms. Alpha, Beta & Omega oxidation. Ketogenesis, Biosynthesis of saturated & unsaturated fatty acids. Regulation of fatty acid metabolism. Mitochondrial and microsomal chain elongation. Metabolism of triacyl glycerol, phospholipids & sphingolipids. Cholesterol biosynthesis & regulation. Degradation of cholesterol, lipoprotein metabolism. Cyclic & linear pathways of Arachidonic acid metabolism – Prostaglandins, Prostacyclins and thrombaxenes metabolism.

UNIT IV **(15 Hours)**

Amino acid metabolism and regulation

Degradation of amino acids – transamination, oxidative and non - oxidative deamination, decarboxylation - Urea cycle and regulation. Catabolism of amino acids - carbon skeleton of amino acids to amphibolic intermediates, key role of glutamate dehydrogenase in nitrogen metabolism. Conversion of amino acids to specialized products: Serotonin, Gamma amino butyric acid, Dopamine, Epinephrine, Nor - Epinephrine, Melanin, Creatinine, Creatine. Integration of Metabolism - Interrelationship of Carbohydrates, Protein and Fat metabolism. Metabolism of individual amino acids; few important amino acids.

UNIT V **(15 Hours)**

Nucleotide Metabolism

Metabolism of Porphyrin - Biosynthesis and degradation of Porphyrin, Heme formation, Biosynthesis of Bilirubin, transport and excretion of bile pigment.

Metabolism of Nucleotides, De novo synthesis and Salvage pathway of Purine nucleotides, degradation of Purine nucleotides, De novo synthesis and Salvage pathway of Pyrimidine nucleotides. Degradation of Pyrimidine nucleotides, Inhibitors of Nucleotide metabolism

Sub.Code: 24PBC206

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Satyanarayana, U and Chakrapani, U. (2013). Biochemistry. 4 thedition, Books and Allied Pvt. Ltd, Kolkata, 700010.

2. Robert K. Murray, Daryl K. Granner and Victor W. Rodwell. (2008), Harper's illustrated Biochemistry. 29thedition, McGraw Hill Companies,Inc .New Delhi.

Reference Books:

1. Voet, D., Voet, J.G. and Pratt, C.W. (2013). Fundamentals of Biochemistry, Life at theMolecularLevel.4thedition, John Wiley&Sons,NewDelhi,110002

2. Garrette R.H and Grisham, C. M. (2012), Principles of Biochemistry. 5th edition, Saunders college publishers.

3. David L. Nelson, Micheal M. Cox. (2008). Lehninger's Principles of Biochemistry. Replika press (P) Ltd, India

4. Vasudevan D.M., Sreekumari S. and KannanVaidyanathan (2011). Text Book of Biochemistry for Medical Students, 6th ed., JAYPEE Brothers Medical PublishersPvt. Ltd., New Delhi, 110002.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	S
CO2	S	H	M	S	M
CO3	M	S	H	S	S
CO4	H	S	S	M	H
CO5	S	H	S	M	H

S-Strong **H**–H igh **M**–Medium **L** –Low

Sub.Code: 24PBC207

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 7 –Molecular Biology				
Batch	Hours/week	Total Hours	Credits	Employability/skill
2024-2026	5	75	4	development/Entrepreneurship

Course Objectives

1. To understand the molecular organization of genes and chromosomes
2. To learn the process of DNA synthesis, repair and function
3. To learn the various molecular events occurring in DNA with proposed theories

Course Outcomes (CO)

K1	CO1	Able to define the basic concepts of gene
	CO2	Recognize the different processes involved in replication, transcription and Translation
TO	CO3	Integrate scientific and technological knowledge on the use of genetics and molecular biology for industrial products on the cell and process level
	CO4	Examine the molecular mechanisms behind DNA damage and repair
K5	CO5	Appraise the various concepts of regulation of genes.

Syllabus

Unit I **(15Hours)**

Concept of gene: Molecular structure of gene and chromosomes. Mendelian Principles: Mono and dihybrid cross. Incomplete Dominance, over dominance, Codominance, Epistasis. Linkage and crossing over, Sex determination and Sex linkage in diploids. Polygenic inheritance. Chromosomal aberrations. Karyotyping. Human Genetic Diseases - Down's syndrome, Turner's syndrome, Klinefelter's syndrome.

Unit II **(15Hours)**

Gene mutation and recombination: Gene Mutation-Classification of mutations, DNA as a genetic material (Transformation, Conjugation and Transduction). Genetics of viruses: Lytic and Lysogenic life cycles of phages. Genetic Recombination (Homologous recombination-Holliday model). Modern concept of genes. Population genetics: Hardy-Weinberg law. Quantitative genetics and multifactorial interactions, causes of variation and artificial selection.

Sub.Code: 24PBC207

Unit III **(15Hours)**

Replication: Mechanism of replication in prokaryotes and eukaryotes, Theta and rolling circle model, Enzymology of replication. Replication of RNA genome- replicase and reverse transcriptase. Termination of replication-circular and linear replications.

Unit IV **(15Hours)**

Transcription and Translation: Universal genetic code and its feature. Prokaryotic and eukaryotic transcription. RNA processing and post- transcriptional modification. Regulatory sequences in protein coding genes. Transcription initiation by RNA polymerase I, II and III. Processing of eukaryotic pre mRNA, RNA splicing, snRNA, spliceosome. RNA editing.

Translation- activation of amino acids, initiation, elongation, termination in prokaryotes and eukaryotes. Translational proof-reading- Posttranslational processing of protein.

Unit V **(15Hours)**

Regulation of transcription and translation: Positive and negative control, Repressor and Inducer, concept of operon, lac-, ara-, trp operons. Catabolic repression, attenuation, anti-termination and methylation. Macromolecular transport across the nuclear envelope. Synthesis and targeting of peroxisomal proteins. Overview of secretory pathway. Translocation of secretory products across ER membrane.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books:

1. P.S. Verma and V.K. Agarwal. (2014). Cell Biology, Genetics, Molecular biology, Evolution and Ecology.S.Chandand Company, New Delhi.
2. Lodish, D. *et al.*, (2007). Molecular Cell Biology. 6thedition, Scientific American Books,Inc.

Reference Books:

1. De Robertis. (2001). Cell and Molecular Biology. 8thEdition, Dhanpat Rai Publisher.
2. Nalini Chandar, Susan Viselli. (2010). Lippincott Illustrated Reviews: Cell and Molecular Biology. LWW: North American Edition.

Sub.Code: 24PBC207

3. Robert Franklin Weaver. (2011). Molecular Biology. 5th edition, Mc-Graw Hill science.
4. Alberts *et al., (*2014). Molecular Biology of the Cell. 6th edition, Garland Publishers.
5. Benjamin Lewin. (2007). Genes IX. 9th edition, Jones & Bartlett Learning.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	S
CO2	S	M	M	S	H
CO3	S	M	M	H	S
CO4	M	S	H	M	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code:24PBC208

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 8– Drug Biochemistry				
Batch	Hours/week	Total Hours	Credits	Employability/skill
2024-2026	5	75	4	development

Course Objectives

1. To learn the mechanism of drug action in various diseases
2. To learn about different drugs available for treatment
3. To learn about the designing mechanisms for drug development

Course Outcomes (CO)

K1	CO1	Repeat the concept of pharmacology
	CO2	Describe the mechanism of action of drug inside the system
	CO3	Employ the drug discovery and drug design procedures.
TO	CO4	Examine the treatment of various disorders using drug molecules
	CO5	Contribute in understanding the mode of action of antibiotics.
K5		

Syllabus

Unit I **(15 Hours)**

General Pharmacology

Introduction to pharmacology**,* sources of drugs**, Classification of drugs, dosage forms, route of administration, site of action of drugs. Mechanism of action, concept of receptors, combined effect of drugs, factors modifying drug action. Dose response curve- ED50 and LD50.

Unit II **(15 Hours)**

Pharmacodynamics

Definition. Drug receptors: Types, classification, drug- receptor interaction (binding and affinity, signal transduction, efficacy, receptor regulation and drug tolerance). Dose-response relationships (gradal and quantal).

Pharmacological activities: consequences of non-specific interaction. Drug metabolism; Chemical pathways of drug metabolism– Biotransformation reactions- Phase I and phase II reactions – Microsomal and non-microsomal metabolism of drugs – role of cytochrome p450 enzyme subtypes.

Sub.Code:24PBC208

Unit III: (15 Hours)

Drug Therapeutics

Biochemical mode of action of antibiotics- penicillin and chloramphenicol, actions of alkaloids, antiviral and antimalarial substances. Biochemical mechanism of drug resistance- sulphonamides. Drug potency and drug efficacy. General principles of chemotherapy: chemotherapy of parasitic infections, fungal infections, viral diseases. Introduction to immunomodulators and chemotherapy of cancer.

Unit IV: (15 Hours)

Screening for pharmacological activity

Analgesic, anti-inflammatory and antipyretic agents, gastrointestinal drugs, antiulcer and laxatives, antioxidants, anticancer and anti-fertility agents. Drugs for metabolic disorders like antidiabetic, anti-hyperlipidemic, anti-obesity and hepatoprotective agents.

Unit V: (15 Hours)

Clinical Toxicology

Definition, classification of toxicity – occupational, environmental and pharmaceutical. Types of toxins and their mechanism of action. Factors affecting toxicity- Drug tolerance, intolerance, addiction, allergy, hypersensitivity, antagonism and synergism. Methods of detection. Drug abuses and their biological effects. Rational prescription of drugs. Toxicity of anticancer drugs. Clinical symptoms of toxicity and marker parameters.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text books:

1. Richard.D.Howland, Mary. J.Mycek. Lippincott William and Wilkins. (2006). Lippincott's illustrated reviews: pharmacology. 3rd edition, Wolters Kluwer health (India) Pvt. Ltd., New Delhi.

2. R.S.Satoskar, Nirmala N. Reje, S. D.Bhandarkar. (2011). Pharmacology and Pharmacotherapeutics. 22nd edition, Popular Prakashan Pvt.Ltd.

Sub.Code:24PBC208

Reference Books:

1. H L Sharma and K K Sharma. (2011). Principles of Pharmacology

2nd edn. Paras Medical Publisher, India.

2. George M.Brunner, Craig W. Stevans. (2011). Pharmacology.3rd edition, Saunders, an imprint of Elsevier Inc.

3. James Ritter, Rod Flower, Graeme Henderson and Humphrey Rang (2011). Rang & Dale's Pharmacology. 7th Edition. Churchill Livingstone.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	M	S
CO2	S	M	S	H	L
CO3	H	S	M	S	M
CO4	S	H	M	M	H
CO5	S	H	M	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code:24PBC2CM

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Practical 2 – Lab in Plant Biochemistry, Genetics and Molecular Biology				
Batch	Hours/week	Total Hours	Credits	Employability/skill
2024-2026	5	75	4	development/Entrepreneurship

Course Objectives

1. To learn the techniques of plant tissue culture
2. To get an hands-on-training on molecular techniques
3. To implement the applications of plant tissue culture, microbes, genetics and molecular techniques in research and industries

Course Outcomes (CO)

K1	CO1	Correlate the principles of plant biochemistry, microbes, molecular biology and genetic techniques
TO	CO2	Demonstrate the technical skills involved in plant tissue culture, counting cells, identification of gene and its expressions
	CO3	Develop and apply the modern technology of plant biochemistry, microbial techniques, molecular biology and genetics in industries and research
K5	CO4	Examine the results obtained using plant biochemistry, sterilization techniques, molecular biology and genetics
	CO5	Be competent in handling the microbial cultures and plant samples.

Syllabus

Plant Biochemistry

1. Preparation of plant tissue culture media and sterilization*
2. Estimation of chlorophyll
3. Estimation of flavonoids
4. Estimation of total phenols
5. Maintenance of microbial cultures
6. Isolation and biochemical identification of bacteria from soil
7. Motility test
8. Bacterial growth curve (Demo)
9. Antibiotic susceptibility test by Kirby-Bauer method

Sub.Code:24PBC2CM

10. Isolation of Genomic DNA from onion and Agarose gel electrophoresis*
11. Isolation of Plasmid DNA from bacteria*
12. Extraction of total RNA*
13. Estimation of DNA by Diphenyl amine method
14. Estimation of RNA by Orcinol method
15. SDS-PAGE*
16. Blotting techniques (anyone)*
17. Animal housekeeping, care, feed preparation and breeding of common laboratoryanimal-mice
18. Laboratory ethics (IAEC guidelines)

*Denotes group experiments

Teaching Methods

Demonstration/ Video lectures/ Laboratory visits/ Institutional visits

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	M	M
CO2	H	S	M	H	M
CO3	M	H	H	S	S
CO4	H	M	M	S	H
CO5	S	H	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code :**24PBC309**

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 9 – Advanced Immunology and immunological techniques				
Batch	Hours/week	Total Hours	Credits	Employability/skill development/Entrepreneurship
2024-2026	6	90	5	

Course Objectives

1. To learn about the various cells of immune system and their functions
2. To know about the specificity of antigen-antigen interaction and their possible mechanisms
3. To know the role of immunological cells in the treatment of different diseases

Course Outcomes (CO)

K1	CO1	Recall the types and functions of different immune cells
	CO2	Employ the mechanism of action of different immune cells and them resultant reaction responses
TO	CO3	Decipher the underlying causes of inherited or autoimmune diseases and consequences
	CO4	Experiment the new technologies involving immune cells in treating many diseases
K5	CO5	Contribute in understanding the important concepts of recombinant vaccine.

Syllabus

Unit I **(18 Hours)**

Lymphoid organs and cells: Introduction to immunology and immune system, **organs:** primary and secondary lymphoid organs. Cells: Lineages (lymphoid and myeloid), Differentiation and maturation of B-cells and T-cells. Primary and secondary immune responses: Phagocytosis, inflammation, NK activity, ADCC, fever, chemical defenses.

Unit II **(18 Hours)**

Antigens, antibodies and complement Antigens – types and properties of antigens and requirement for antigenicity. Antigen processing and presentation cells (TCRs and BCRs). Antibodies - general structure, classes, properties and functions of immunoglobulins. Complement – Outlines of classical and alternative pathways, intermediates formed and biological functions.

Sub.Code **: 24PBC309**

Unit III **(18 Hours)**

Cell mediated immunity and immune response – Innate and acquired immunities: Humoral and cell – mediated immunities. Mechanism of T cell and NK cell mediated lysis, antibody dependent cell mediated cytotoxicity and macrophage mediated cytotoxicity, Cytokines and their role in immune regulation, Immune suppression and immune tolerance.

Unit IV **(18 Hours)**

Disorders of the Immune System: Hypersensitivity – elementary concepts of hypersensitivities – Types I-IV, Autoimmunity – basic concepts, causes and types of auto immune diseases, organ specific - Hashimoto's thyroiditis and Systemic Lupus - Erythematosis. Transplantation immunology – organ and bone marrow, immunity to infectious diseases- bacteria and virus.

Unit V **(18 Hours)**

Vaccine technology: Over view of Recombinant vaccines and Immunization procedures. Role of B and T epitopes for vaccine development. Vaccines – killed, attenuated, toxoids, recombinant, DNA, synthetic peptide vaccines.

Immuno techniques – Separation of lymphocytes. Features of antigen–antibody interactions. Precipitation reactions – immunodiffusion, immune electrophoresis. Agglutination reactions – blood grouping, haemagglutination. Assays with tagged antigen/antibody – RIA, ELISA, immunoblotting, immunofluorescence.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. J.Kuby. (2018). Immunology. 10th edition, W.H. Freeman and Company,Newyork.
2. C.V.Rao. (2002). An Introduction to Immunology. Narosa Publishing House, Chennai.

Reference Books:

1. Roitt, I., Brostoff, J. and Male, D. (2012). Essential Immunology, Twelfth Edition, Wiley Blackwell Publishers, New York. 2. Tizard, I.R. (2005).
2. Immunology – An Introduction, Fourth Edition, Saunders College Publishing, New York.

Sub.Code **: 24PBC309**

3. Rao, C.V. (2006). An Introduction to Immunology, Second Edition, Narosa Publishing House, Delhi, Chennai, Mumbai, Kolkata.

4. Immunology5th ed Janis Kuby, W.H.Freeman& Co Ltd; 5th Revised edition.

5. Fundamental Immunology 5th edition (August 2003): by William

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	S	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code**:24PBC310**

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 10 –Biostatistics and research methodology				
Batch	Hours/week	Total Hours	Credits	Employability/Entrepreneurship
2024-2026	6	90	4	

Course Objectives

1. To learn the different methods of collecting data and processing
2. To know about the different statistical methods to interpret the collected statistical data
3. To know the concept of article writing, report writing and thesis making so on

Course Outcomes (CO)

K1 TO K5	CO1	State an idea on choosing the appropriate method of collecting data
	CO2	Employ the statistical method and process the collected data
	CO3	Illustrate the device and standardize the statistical methods
	CO4	Discriminate the concept in preparing a report, publishing an article and writing a project thesis
	CO5	Contribute the research knowledge in report writing.

Syllabus

Unit I **(18 Hours)**

Research: Definition, Introduction, objectives, motivation, types, approaches, significance. Research Methods versus Methodology. **Research process:** formulating the research problem, extensive literature survey, developing the hypothesis, preparing the research design, determining sample design, collecting the data, execution of the project, analysis of data, hypothesis testing, generalizations and interpretation, and preparation of the report or presentation of the results. Criteria of a good research. Problems encountered by researchers in India.

Unit II **(18 Hours)**

Research problem: Selection, necessity and techniques (statement of the problem in a general way, understanding the nature of the problem, surveying the available literature, developing the ideas through discussions and rephrasing the research problem into a working proposition).

Research design: Introduction, necessity, features, concepts relating to research design, types of research design, basic principles of experimental design (Principle of Replication, Principle of Randomization and Principle of Local Control).

Sub.Code **: 24PBC310**

Sub.Code**:24PBC310**

Unit III **(18 Hours)**

Methods of Data Collection: Collection of Primary Data: Observation Method, Interview Method, questionnaire method (merits, demerits and main aspects), schedules, difference between questionnaire and schedules. Other methods of primary data collection (Warranty cards, Distributor or store audits, Pantry audits, Consumer panels, Use of mechanical devices, Projective techniques). **Collection of Secondary Data:** characteristics, Selection of appropriate method, Case Study method.

Unit IV **(18 Hours)**

Classification and tabulation of data. Diagrammatic & graphic presentation of data. Problems involving arithmetic mean, median, mode, quartiles, deciles and percentiles. Measure of variation - range, quartile deviation, mean deviation, standard deviation, Coefficient of variation. Student's "t" distribution and its applications. **ANOVA:** Principle, technique, setting ANOVA table, short cut method, coding method (necessary illustrations) for one way ANOVA. Two way ANOVA: Principle, technique, setting ANOVA table (necessary illustrations). ANOVA in Latin-Square design (necessary illustrations).

Unit V **(18 Hours)**

Interpretation and Report Writing: Introduction, Techniques and precautions in interpretation, Report writing – significance, different steps, layout, types (technical and popular), mechanics (with examples) and precautions. Publication in a scientific journal. Project proposal writing to funding agencies, Career opportunities in research.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. C.R.Kothari.Research Methodology: Methods and Techniques (2004). New Age International (P) limited. Publishers.
2. N.Gurumani (2015). Introduction to Biostatistics. MJPPublishers.
3. S.P.Gupta. (2009). Statistical Methods, 28th edition, Sultan Chand&Sons

Reference Books:

1. SundarRao, JesudianRichard. (2009). AnIntroduction to Bio-Statistics.4th edition, Prentice-Hall of India Pvt.Ltd.
2. Naren Kr. Dutta (2002). Fundamentals of Biostatistics: Practical Approach. Kanishka

Sub.Code **: 24PBC310**

Publisher.

3. S.P.Gupta. (2016). Fundamentals of Statistics. 6 thedition, SultanChand.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	S	M	H	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code :**24PBC311**

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper11– Advanced Clinical Biochemistry				
Batch 2024-2026	Hours/week 7	Total Hours 105	Credits 4	Employability/skill development/Entrepreneurship

Course Objectives

1. To learn the methodologies for the detection of abnormalities in blood
2. To learn the process of different sample collection and processing
3. To know about the markers in the various metabolic disorders like cancer

Course Outcomes (CO)

K1	CO1	Corelate the important laboratory biochemical tests
TO	CO2	Employ the methods of specimen collection and processing and analyzing the results
	CO3	Investigate the role of enzymes in clinical diagnosis of diseases
	CO4	Critisize the diagnostic procedures for tumor development
K5	CO5	Evaluate the role of free radicals in various diseases.

Syllabus

Unit I **(21 Hours)**

Clinical chemistry/biochemistry: concept, definition and scope; Biological samples: types, collection, processing, stability and storage; **Collection of urine:** Timed urine specimens, urine preservatives. Clinical significance of urinary components with reference to sugars, proteins, ketone bodies, and bilirubin. Physical and chemical examinations of urine samples. Microscopic examination of urine, Abnormal and normal constitute of urine. Body fluids-CSF, gastricjuice, ascitic fluid, synovial fluid and amniotic fluid: Composition, collection and analysis.

Unit II **(21 Hours)**

Serology and hematology: Introduction. Anti serum, anti sera raising, chick and snake venom antibody. Principle of agglutination and precipitation. C-reactive protein and pregnancy test, Rhumatoid arthritis (RA) test. ESR, Coagulation test, prothrombin test. WIDAL test, ELISA, chemiluminescence, CMIA, ECLIA, flow cytometry. **Hemoglobin:** Normal and abnormal Hb, Separation of hemoglobin by electrophoresis. Hemoglobinopathies and its types.

Sub.Code :**24PBC311**

Unit III **(21 Hours)**

Clinical enzymology and endocrinology: Factors affecting enzyme levels in blood. Principle, assay and clinical significance of liver markers: AST, ALT, gamma- glutamyl transferase, amylase and lipase. Cardiac markers: creatine kinase, CKMB, lactate dehydrogenase, troponin (I and T). Bone markers: ALP. Prostate marker: ACP. Clinical significance of pancreatic hormones and TFT.

Unit IV **(21 Hours)**

Organ function test and related disorders: Jaundice, cirrhosis, hepatitis (HBV virus and types), fatty liver and gall stones. Renal function test and related disorder: Acute renal failure, glomerular disease. Gastric and pancreatic function test. Estimation of GFR and cystatin C in serum. Hyper and hypo lipoproteinemias and diagnostic test for lipoprotein disorders. Diabetes mellitus. Investigations of diabetes mellitus – OGTT – Indications, procedure, Interpretation and types of GTT curve. HbA1c. Fatty acid disorder – atherosclerosis.

Unit V **(21 Hours)**

Free radicals and Antioxidants: Introduction, ***Types of free radicals**. Generation of free radicals and lipid peroxidation Antioxidants:Role of free radicals, (Enzymic: SOD, Catalase, Glutathione Peroxidase, Glutathione Reductase; Non Enzymic: Vitamin A, Ascorbic acid, Tocopherol, Reduced Glutathione).

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Ambika Shanmugam (2008), Fundamentals of Biochemistry for Medical Students, 7th edition
2. Stevans,C.D.(2016).Clinical Immunology and Serology: A Laboratory Perspective. 4thedition. F.A. DavisCompany

Reference Books:

1. Carl A. Burtis, Edward R. Ashwood, Norbert W. Tietz. (2012).TietzTextbook of Clinical Chemistry and molecular diagnostics. 5th ed, Saunders college publishing, Harcourt Brace College Publishers, Philadelphia, Newyork,Tokyo.

2. VasudevanD.M, SreekumariSand KannanVaidyanathan, (2011), Text Book of Biochemistry for Medical Students,6thed., Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi,110002.

Sub.Code :**24PBC311**

3. Thomas M. Devlin (2010) Textbook of Biochemistry with Clinical Correlations, 7th Edition, john Wiley &Sons, Inc,US.

4. Larry Jameson *et al*., (2015). Harrison's Principles of internal medicineVol. I and II. 14th edition, McGraw HillPublishers

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code : **24PBC3CN**

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Practical 3 – Lab in Immunology, Genetic Engineering and Clinical Biochemistry				
Batch	Hours/week	Total Hours	Credits	Employability/skill
2024-2026	5	75	4	development/Entrepreneurship

Course Objectives

1. To enhance the students to have practical experience on techniques in immunological tests
2. To learn the methods of estimation of clinical parameters
3. To have hands on experience in genetic engineering

Course Outcomes (CO)

K1	CO1	Recall the basic principles involved in immunology, clinical biochemistry and genetic engineering
TO	CO2	Demonstrate the techniques involved in immunology, clinical biochemistry and genetic engineering
	CO3	Develop and apply the recent technology involved in diagnostic techniques of immunology, clinical biochemistry and genetic
	CO4	Examine and analyze the results involved in immune techniques, clinical biochemistry and genetic engineering
K5	CO5	Be competent in handling the blood and urine samples.

Syllabus

Immunology

1. ELISA method
2. WIDAL test
3. Single radial immunodiffusion
4. Double immunodiffusion
5. Ouchterlory double diffusion
6. Immunoelectrophoresis
7. Rocket immune electrophoresis

Sub.Code : **24PBC3CN**

8. Restriction digestion and ligation*

9. cDNA synthesis*

10. Bacterial transformation*

Estimation of the following parameters in urine

11. Urea

12. Uricacid

13. Creatinine

14. Glucose by Benedictsmethod

15. Bilirubin

16. Sodium

Estimation of the following parameters in blood

17. Hemoglobin

18. Totalcholesterol

19. Glucose tolerancetest

20. Glucose by GOD/PODmethod

*Denotes group experiments

Teaching Methods

Demonstration/Video lectures/Laboratory visits/Institutional visits

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	S
CO2	H	S	S	S	M
CO3	M	M	H	M	S
CO4	S	H	M	H	M
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code:**24PBC412**

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 12 – Hormonal Biochemistry				
Batch 2024-2026	Hours/week 5	Total Hours 75	Credits 5	Employability/skill development/Entrepreneurship

Course Objectives

1. To learn about the system of hormonal functioning in biological systems
2. To know the regulation and action of different hormones at different conditions
3. To get an in depth knowledge on diabetes mellitus

Course Outcomes (CO)

K1	CO1	List the diverse group of hormones and their specific mechanism of action in the bodily metabolism
TO	CO2	Understand the regulatory functions of various hormones and their interrelationship in the endocrine disorders
	CO3	Discuss the pathophysiology, diagnosis, treatment and management of endocrine disorders
K5	CO4	Differentiate the role of hormones in various biological organs
	CO5	Evaluate the biological action of different hormones .

Syllabus

Unit-I **(15Hours)**

Concepts of endocrinology: History, definition and classification of hormones, normal range, Scope of Endocrinology, Hormone Secretion, Transport, and Degradation. Functions of Hormones – Growth, Maintenance of Homeostasis and Reproduction. Hormonal Feedback Regulatory Systems-Paracrine and autocrine control, Hormonal Rhythms.

Unit-II **(15 Hours)**

Hormone Receptor - Receptor Families, hormone Action through Receptors – Membrane, Nuclear and Cytosolic Receptors.

Hypothalamus and pituitary hormones: Hypothalamic and pituitary axis hormones-Chemistry &biochemical functions; Hypothalamic releasing factors. Pituitary gland:

Sub.Code:**24PBC412**

hormones of the pituitary gland- Chemistry& biochemical functions.

Pineal gland- hormones of the pineal gland- Chemistry& biochemical functions.

Unit-III **(15Hours)**

Pancreatic hormones: Chemistry and biochemical functions. Parathyroid hormone: Calcitonin and its functions. Pancreatic hormone: Insulin, glucagon, somatostatin, pancreatic polypeptide-chemistry and biochemical functions.

Unit-IV **(15Hours)**

Adrenal gland: Hormones of adrenal gland-chemistry and biochemical functions; FSH, TSH, Gastrointestinal hormones-cholecystokinin, Substance P, summary of the neuroendocrine control of GI; Neurohormones- the brain-renin-angiotensin and urotensin.

Unit-V **(15Hours)**

Reproductive endocrinology: Male reproductive system: androgens: Source, synthesis, chemistry, metabolism, Physiological roles, mechanism of action and pathophysiology. Female reproductive system: estrogen and progesterone Synthesis, physiological role and mechanism of action of ovarian steroid hormones. Endocrinology of pregnancy, parturition and lactation, ***Hormonal contraception**, menopause and pathophysiology.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. MacE.Hadley(2009).Endocrinology.4th edition.PrenticeHallInternationalInc
2. Harrison's Endocrinology, (2017). 4nd edition, Edited by J. Larry Jameson, TheMcGraw Hill Companies, Inc.USA.

Reference Books:

2. A. Longstaff. (2002). Instant notes: Neuroscience. 1 stIndian edition, BIOS Scientific Publishers Ltd, UK John E. Hall, Mario Vaz, AnuraKurpad, Tony Raj. (2016).
3. Guyton &Hall (2016). Textbook of Medical Physiology. 2ndSouth Asian edition, Elsevierpublications.
4. ShlomoMelmed*etal*., (2011). William's Textbook of endocrinology. 12thedition, Philadelphia:Elsevier/Saunders.

Sub.Code:**24PBC412**

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code**:24PBC413**

Programme Code: 07	M.Sc Biochemistry			
Title of the paper: Core Paper 13. Genetic Engineering				
Batch 2024-2026	Hours/week 5	Total Hours 75	Credits 5	Employability/skill development/Entrepreneurship

Course Objectives

1. To enable the students to learn the principle and application of genetic engineering
2. To implement and transmission of a genetic material at molecular and cellular levels.

Course Outcomes (CO)

K1	CO1	Enshrine the principles of genetic engineering and the vectors used in cloning and expression
	CO2	Grasp the different cloning strategies and their expression
TO	CO3	Demonstrate about implementation of genetic engineering for different purposes
	CO4	Investigate the different strategies of rDNA technology and resolve the problems encountered
K5	CO5	Analyse the various techniques of gene therapy.

Syllabus

Unit I **(15 hours)**

Scope of Genetic Engineering: Milestones in Genetic Engineering, Cloning and patenting of life forms. Genetic engineering guidelines, Molecular tools (Restriction enzymes, modification enzymes, DNA and RNA markers, Linker, adaptors, and homopolymers), Gene isolation, purification and yield analysis.

Unit II **(15 hours)**

Cloning vectors: Plasmids (pBR322 and pUC18), Phages(l phage and M13 vectors), Phagemids (pBluescript, pGEM), Cosmids (pJB8) and Artificial Chromosomes (BAC and YAC). Plant and Animal viruses as vector, binary and shuttle vectors, expression vectors for prokaryotes and eukaryotes, expression cassettes

U**nit III** **(15 hours)**

Gene transfer methods: preparation of competent cells and selection. calcium phosphate

Sub.Code**:24PBC413**

co-precipitation, electroporation, lipofection, viruses, biolistics, microinjection. Screening of recombinants: marker inactivation (antibiotic resistance, blue-white selection), colony hybridization, immunological screening.

Sequencing techniques: High throughput sequencing and shotgun sequencing. PCR and RT-PCR. Complementary DNA (cDNA). Human Genome Project (HGP) - features. Positional cloning. Identifying disease genes and Gene therapy

Unit IV **(15 hours)**

Cloning strategies: Cloning and expression of cloned genes Construction of genomic and cDNA libraries. Differences between genomic and cDNA libraries. Chromosome walking, chromosome Jumping, HRT and HART. Reporter genes – CAT, GFP, luciferase.

Basic principle and application of PCR – DNA Polymorphism –***RFLP,** RAPD, VNTR, SSR, AFLP, STS, SCAR, SNP. DNA sequencing and fingerprinting. DNA microarrays.

Unit V **(15 hours)**

Application: Transgenic animals as models in the prevention of human diseases like muscular dystrophy and anticancer therapy. Production of recombinant insulin, vaccines and growth hormone. Gene therapy: Stem cell gene therapy, Somatic cell gene therapy, Antisense RNA therapy, genetherapy for inherited diseases; familial hypercholesterolemia, hemophilia, ADA deficiency (SCID), SCP and Cystic fibrosis.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Twyman, B. Old and S. B. Primrose (2001). Principles of Gene Manipulation: An Introduction to Genetic Engineering, 6th edition,JohnWiley and sons Publishers,UK.

2. Primrose *et al*., (2001). Principles of gene manipulation. 6th edition, Blackwell Scientific Publishers.

Reference Books:

2. Brown, T.A. (2010).Gene cloning - An Introduction, Sixth Edition, Wiley Publishers, USA.

3. Lucia, L.A. and Rojas O.J.(2009).The Nanoscience and Technology of Renewable Biomaterials, Wiley and Sons Publishers, New York.

4. Primrose, S.B., Twyman, R.M. and Old, R.W. (2006).Principles of Gene Manipulation, Seventh Edition, Blackwell Publishing Company, USA.

Sub.Code**:24PBC413**

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	S	M
CO2	H	S	H	M	M
CO3	M	H	H	H	H
CO4	M	S	M	S	M
CO5	M	S	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code**:24PBC4Z1**

Programme Code: 07	M.Sc Biochemistry		
Title of the paper : Project and Viva-voce			
Batch 2024-2026	Semester IV	Credits 3	Employability/skill development/Entrepreneurship

Course Objectives

1. The student will be able to choose an appropriate topic for study and will be able to clearly formulate and state the research problem
2. For a selected research topic, student will be able to compile the relevant literature and frame hypotheses for research as applicable.
3. Based on the analysis and interpretation of the data collected, student will be able to arrive and propose suitable recommendations on the research problem
4. Student will be able to create a logically coherent project report and will be able to defend his / her work in front of a panel of examiner.

Course Outcomes (CO)

K1	CO1	Choose an appropriate research topic
	CO2	Summarize the findings through the literature survey
TO	CO3	State exactly the problem of the experimental study/ research undertaken
	CO4	Interpret the results of the research using the statistical tools.
K5	CO5	Evaluate the research outcomes and present them in oral presentation

Component for project

CIA/ESE	**PARTICULARS**	**Project out of 100 Marks**
CIA	Project review	15
	Regularity	5
	Total Internal Marks	**20**
ECE	Project Report Present	60
	Viva-Voce	20
	Total External Marks	80
Total Marks (CIA+ESE)		**100**

Project mark breakup

Knowledge Level	Section
K3 ↕ K5	**Project Report:** Content – 20 Presentation – 20 R&D – 10 Review – 10
	Viva Voce: Layout of presentation – 5 Clarity – 5 Defense – 10

Note: The project dissertation evaluation and Viva-voce examination will be conducted by the Internal and External Examiners.

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	Major Elective: Nanobiotechnology			
Batch	Hours / Week	Total Hours	Credits	Skill development
2024-2026	5	75	5	

Course Objectives

1. To get an idea about the application of nanotechnology in biological research
2. To learn the properties and functions of nanomaterials in biological systems
3. To learn the applications of nanomaterials in drug delivery and treatment

Course Outcomes (CO)

K1	CO1	Insight about the nanotechnology concepts
	CO2	Explain the methods of nanoparticle synthesis
	CO3	Use properties of nanoparticles
TO	CO4	Apply the knowledge of nanotechnology in biological research
K5	CO5	Employ and apply the knowledge of nanotechnology in wastewater treatment, agriculture and diseases.

Syllabus

Unit I **(15Hours)**

Introduction to Nanotechnology: Introduction to nanoparticles. Nanoscience and its importance. Definition: Nanotechnology - Nanobiotechnology- Nanomaterial - Nanocomposites- Classification of nanostructures – Top down and Bottom Up approach - Quantum dots -Bio-inspired nanomaterials.

Unit II **(15Hours)**

Herbonanotechnology: Physical synthesis - Ball Milling - Thermal evaporation - Chemical synthesis – Solgel Process - Hydro thermal Synthesis-Biological Synthesis – Plant, Microbial compound based synthesis

Unit III **(15Hours)**

Properties of Nanomaterials: Preparation of nanoparticles Physical properties - Optical,

Magnetic, Surface Plasmon resonance - Electrochemical Properties of Nanoscale Materials, Intramolecularbonding, Inter-molecular bonding,

***Nanocatalysis**, Self-assembly – DNA, Protein.

Unit IV **(15Hours)**

Characterization methods: UV - Visible Spectrophotometer, X-ray diffraction (XRD), Scanning Electron Microscope (SEM) Transmission, Electron Microscope (TEM), Fourier Transform InfraRed Spectrometer (FTIR), EDAX, Dynamic Light Scattering(DLS).

Unit V **(15Hours)**

Applications of Nanoparticles: Nanoparticles in waste water treatment, cancer therapy, Biosensors- DNA Microarrays - CellBiochips - Nanoparticles for Bioimaging– Textile and pharma industries. Application in environment, agriculture and pesticide diagnosis.Nanorobotics. Military applications of Nanotechnology - Nanomaterialsfor food Applications.Diagnosis and nanoToxicityof Nanoparticles - Future Perspectives.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. T.Pradeep. (2008) Nano: The Essentials: Understanding Nanoscienceand Nanotechnology. Tata McGraw-Hill Publishing Company Limited, NewDelhi.
2. Robert W. Kelsall, Ian W. Hamleyand Mark Geoghegan. (2005).NanoscaleScienceandTechnology.JohnWiley&Sons,Ltd.,UK.

Reference Books:

1. GuozhongGao. (2004). Nanostructures &Nanomaterials: Synthesis, Properties &Applications, Imperial College Press.
2. Mick Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons, BurkhardRaguse. (2005). Nanotechnology: Basic Science and Emerging Technologies. OverseasPress.
3. Vladimir P Torchilin. (2006). Nanoparticles as Drug carriers. Imperial College Press,USA.

4. M.Niemeyer, Chad A.Mirkin. (2004). Nanobiotechnology: Concepts, Applications and Perspectives. Wiley-VCH,Weinheim.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	M	M	M
CO2	S	M	H	S	H
CO3	H	S	M	M	S
CO4	S	M	S	S	M
CO5	S	M	S	M	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	Major Elective: Microbiology			
Batch 2024-2026	Hours / Week 5	Total Hours 75	Credits 5	Employability/skill development/Entrepreneurship

Course Objectives

1. To learn about the microbiological techniques for microbial studies
2. To learn the energy process taking place in microbes
3. To learn about the food poisoning and pathogenicity of microbes

Course Outcomes (CO)

K1	CO1	Commemorate the general bacteriology and microbial techniques.
TO	CO2	Understand the basic microbial structure and function
	CO3	Implement the handling techniques and staining procedures in laboratory
	CO4	Resolve the microbial techniques and its applications
K5	CO5	Employ the role of microbes in pathogenesity.

Syllabus

Unit I **(15 Hours)**

Morphology and Ultrastructure: History of microbiology. Classification of microbes. Ultra structure and characteristics of fungi, algae and protozoa. Bacterial morphology and fine structure; cell wall, cell membrane, intra cytoplasmic structures and external structures-bacterial growth curve, synchronous growth, continuous culture. Factors affecting bacterial growth. Staining techniques-simple Differential Special staining techniques and negative staining.

Unit II **(15 Hours)**

Microbiological techniques: Culture techniques: Isolation of microbes from various sources, serial dilution techniques, pure culture techniques, Anaerobic culture methods-chemical and physical methods. Culture preservation techniques.

Nutritional requirements: different kinds of media, composition of media -carbon sources, nitrogen sources, vitamin and growth factors, mineral, inducers, precursors and inhibitors.

Sterilization methods. Anaerobic fermentation- Alcoholic fermentation, propionic acid fermentation, formic acid fermentation.

Unit III **(15 Hours)**

Food Microbiology: Food poisoning – Food borne diseases- Bacterial and Non- Bacterial. Microbial quality and safety – Determining microorganisms in foodculture, Microscopy and sampling methods-Chemical and immunological methods. Principles of food preservations: Asepsis, Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.

Unit IV **(15Hours)**

Medical Microbiology: Infectious Diseases process-Diagnosis-Process of sample collection, transport and examinations of the specimens. Antibiogram. Bacteriology: Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of Grampositive organisms-*Staphylococcus aureus*, Mycoplasma; Gram negative organisms: *E.coli*.

Unit V **(15Hours)**

Pathogenicity and Laboratory Diagnosis: ***Virology-Basic concepts of virology**. General properties of Human viruses, Approaches to viral diagnosis-Serological and Molecular techniques of viral infections-Hepatitis.Mycology: General properties and approaches tolaboratory diagnosis. Mycosis-Superficial, Subcutaneous and Systemic infections-*Candida allbicans*. Parasitology: Pathogenicity and laboratory diagnosis of *Plasmodiumvivax.*

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Prescott. (2003). Microbiology. 3rd edition, Magrawhill, Boston

2. Pelczar M.J., Ried, RD and Chan, ECS. (2000). Microbiology. 5 thedition, McGrawHill

Reference Books:

1. Ananthanarayananand JayaramPaniker. (2005). Text Book of Microbiology.6th edition Orient Longman, Hyderabad.

2. Standby and Wittaker. (2008). Principles of Fermentation Technology. 2ndedition.

3. Davis*etal*.,(2001).Microbiology.4thedition,LippincottWilliamsandWilkins.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	S	H
CO2	S	H	S	H	H
CO3	M	S	M	H	S
CO4	H	M	H	S	M
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	Major Elective: Bioinformatics			
Batch 2024-2026	Hours / Week 5	Total Hours 75	Credits 5	Employability/skill development/Entrepreneurship

Course Objectives

1. To learn the role of computer programmes in studying the biological processes
2. To know about the different software's for data analysis
3. To learn about the methods of data retrieval from various databases

Course Outcomes (CO)

K1	CO1	Learn about the basics and beginning developments in computer usage
	CO2	Employ the basics of bioinformatics
TO	CO3	Differentiate various bioinformatics softwares
	CO4	Apply the role bioinformatics in biological science research
K5	CO5	Apply bio informatics in proteomics and human genome project.

Syllabus

Unit I **(15 Hours)**

Bioinformatics: Introduction, fields related to bioinformatics, objectives, scope, genome mapping as a source of bioinformatics. Applications of bioinformatics in various fields*.Chronological history of events in bioinformatics.Role of computers in bioinformatics.Major categories of bioinformatics tools.Applications of programmes inbioinformatics.

Unit II **(15 Hours)**

Biological databases: database, database management system and its advantages. Biological databases and information resources. Classification of biological databases: general databases, protein families & sequence motif database, signal sequence databases, protein – protein interaction databases, pathways databases, structural databases, SNPs database, histology database, standards, PUBMED, ENTREZ. Searching and retrieving data from databases- FASTA and BLAST. Linking databases with sequence retrieval systems (SRS).Advantages of SRS.OMIM, ExPASy, EMBL-Bank, ENSEMBL and its advantages.

Unit III **(15 Hours)**

Genomics: gene, genome, genomics: genome mapping & genome projects, methods of gene sequence analysis: Genbank, Genbank assembly, genome annotation, genome

similarity. Types of genomics: comparative, structural and functional genomics. Gene functions: analysis of gene expression, DNA microarray or DNA chip, serial analysis of gene expression.

Unit IV **(15 Hours)**

Proteomics: Introduction, methods of studying proteins: determining the post translationally modified proteins, determining the existence of proteins in complex mixtures, establishing protein-protein interactions. Protein structure classification: CATH, SCOP, DALI, FSSP, SSAP, protein structure bioinformatics resource. Protein structure prediction: ROSETTA, protein folding, protein folding disorders. Protein function prediction: automated protein function prediction, diversity in protein function.

Unit V **(15 Hours)**

Human Genome Project: Milestones, types of sequences in Human Genome Project, impact, potential benefits, ethical, legal and social issues. **Gene therapy:** Principles, current status of gene therapy research. Factors affecting gene therapy.Recent developments in gene therapy.**Drug designing:** Objectives, rational drug design, computer assisted drug design, drug development. **Pharmacogenomics:** prospects, uses, barriers toprogress.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. PrakashS.Lohar (2009). Bioinformatics. MJPPublishers.
2. Jean-Michel Claverieand Cedric Notredame. (2012) Bioinformatics-A beginner‟sguide. 1st edition, Wiley- Dream TechIndia Pvt. Ltd.

Reference Books:

1. David. W. Mount. (2001). Bioinformatics. CBS publishers anddistributers.
2. D.R. Westhead, J. H. Parish and R. M. Twyman. (2002). Instant notes in bioinformatics. Oxford,UK.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	S
CO2	S	M	S	M	S
CO3	S	H	M	S	H
CO4	H	M	H	M	M
CO5	S	M	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	Major Elective: Bioethics, Biosafety and IPR			
Batch 2024-2026	Hours / Week 5	Total Hours 75	Credits 5	Employability/skill development/Entrepreneurship

Course Objectives

1. To learn about the demerits of biotechnological applications in recent research
2. To know the ethical issues to be concerned in the course of biological research
3. To know about the intellectual property rights of individual researchers

Course Outcomes (CO)

K1	CO1	Remember the ethical issues of scientific research
TO	CO2	Employ the various regulations in biosafety and bioethics
	CO3	Decipher the awareness of the intellectual property rights
	CO4	Experiment the secured and ethical way of research
K5	CO5	Contribute the knowledge in filing the patents.

Syllabus

Unit I **(15Hours)**

Ethics/bioethics: Introduction, framework for ethical decision making; biotechnology and ethics-benefits and risks of genetic engineering-ethical aspects of genetic testing- ethical aspects relating to use of genetic information-genetic engineering and biowarfare.

Unit II **(15Hours)**

Ethical implications of cloning: Reproductive cloning, therapeutic cloning; Ethical, legal and socioeconomic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research-GM crops and GMO's – biotechnology and biopiracy– ELSI of human genome project.

Unit III **(15Hours)**

Biosafety: Introduction, biosafety issues in biotechnology – risk assessment and risk Management – safety protocols: risk groups – biosafety levels – biosafety guidelines and regulations (National and International) – operation of biosafety guidelines and regulations – types of biosafety containment.

Unit IV **(15Hours)**

Introduction to intellectual property and intellectual property rights: types: patents, copy rights, Trade marks, design rights, geographical indications– importance of IPR - world intellectual Property rights organization (WIPO).

Unit V **(15Hours)**

What can and what cannot be patented? Patenting life – legal protection of biotechnological Inventions – Patenting in India: ***Indian patent act.**

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Jose Cibelli, Robert P. lanza, Keith H. S. (2002). Principles of cloning,. Campbell, Michael D.West, Academic Press.

2. Sasson A. (2000). Biotechnologies in developing countries present and future, UNESCO Publishers

Reference Books:

1. Singh, K. (2000). Intellectual Property Rights on Biotechnology. BCll, New Delhi. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt.Ltd.,

2. Kankanala C., (2007) Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt.Ltd.,

3. Gurumani, N. Research Methodology (2006). For Biological Sciences . MJP Publishers, Chennai

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	M	M	S
CO2	S	S	H	M	H
CO3	H	M	S	H	M
CO4	S	M	S	H	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	M.Sc Biochemistry			
Course Code: 24PGI4N2	**Non-Major Elective Paper : Information security**			
Batch	Hours / Week	Total Hours	Credits	skill development
2024-2026	5	75	4	

Course Objectives

1. Students will identify the core concepts of Information security.
2. To examine the concepts of Information Security.
3. To design and implement the security features for IT and Industrial sectors.

Course Outcomes(CO)

K1	CO1	To Learn the principles and fundamentals of information security.
	CO2	To Demonstrate the knowledge of Information security concepts
to	CO3	To Understand about Information Security Architecture.
	CO4	To Analyze the various streams of security in IT and Industrial sector.
K5	CO5	To know about Cyber Laws and Regulations.

UNIT I **(15 Hours)**

Information Security basics: Definition of Information Security - History of Information Security - Characteristics of Information Security - Components of Information Security - Security System Development Life Cycle (SDLC).

Information Security for technical administrators: Server Security – Network security- Social Media Security.

UNIT II **(15 Hours)**

Cryptography: Basic concepts - plain text - Cipher text - Encryption Principles - CRYPT Analysis - Cryptographic Algorithms - Cryptographic Tools – Authentication -Biometrics* - passwords - Access Control Devices - Physical Security - Security and Personnel.

Language-based Security: Analysis of code for security errors, Safe language and sandboxing techniques.

UNIT III **(15 Hours)**

Firewalls, Viruses & Worms & Digital Rights Management : Viruses and Worms-Worms - Digital Rights Management – Firewalls - Application and Circuit Proxies - Stateful Inspection - Design Principles of Firewalls.

Logical Design: Access Control Devices- Physical Security-Security and Personnel - NIST Models-VISA

International Security Model- Design of Security Architecture-Planning for Continuity.

UNIT IV **(15 Hours)**

Hacking : Introduction – Hacker Hierarchy – Password cracking – Phishing - Network Hacking - Wireless Hacking - Windows Hacking - Web Hacking*- Ethical Hacking.

Security Investigation: Need for Security- Business Needs-Threats- Attacks- IP Addressing and Routing - Social Media

UNIT V **(15 Hours)**

Cyber Laws : What is Cyber Law? - Need for Cyber laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

TEXT BOOK:

Information Security –Textbook prepared by KONGUNADU ARTS AND SCIENCE COLLEGE, Coimbatore -29, 2022.

REFERENCE BOOKS:

1 Charles P Pfleeger and Shai Lawrence Pfleeger, **"Security in Computing",** Fourth & Third Edition, Prentice Hall, 2007 & 2011.
2 Ross J. Anderson and Ross Anderson, "Security Engineering: A guide to building Dependable Distributed System", Wiley,2009.
3 Thomas R. Peltier, Justin Peltier and John Bleckley, "Information Security Fundamentals",2nd Edition, Prentice Hall 1996.
4 Gettier, Urs E. Information Security: Strategies for Understanding and Reducing Risks John Wiley & Sons, 2011.
5 "Principles of information security". Michael Whiteman and Herbert J. Mattord,2012.
6 Information security -Marie wright and John kakalik,2007.
7 Information security Fundamentals- Thomas R. Peltier, Justin Peltier and John Blackley-2005.
8 Information Security theory and practical PHI publication, Dhiren R. Patel-2008.
9 Debby Russell and Sr.G.T. Gangemi," computer Security Basics,2nd edition, O'Reilly Media,2006.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	H	S	S
CO2	M	H	H	S	H
CO3	H	S	S	M	S
CO4	H	M	H	S	H
CO5	H	S	H	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	Non Major Elective – Competitive Science			
Batch	Hours / Week	Total Hours	Credits	skill development
2024-2026	4	60	4	

Course Objectives

1. To insist the various facts of life sciences in detail
2. To learn the various information regarding the biological processes
3. To expose the students to the online examination

Course Outcomes (CO)

K1	CO1	Recall all concepts of biochemistry in detail
	CO2	Explain the consolidated view of life science subjects
TO	CO3	Develop the analytical capability by learning the objective type questions
	CO4	Undertake competitive examinations will necessary preparation
K5	CO5	Apply the knowledge of various fields of biochemistry.

Syllabus

Unit I **(12Hours)**

Molecules and their Interaction relevant to Biology: Structure of atoms, molecules and chemical bonds - Composition, structure and function of biomolecules - Stabilizing interactions - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties) - Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes- Conformation of proteins - Conformation of nucleic acids – Stability of proteins and nucleic acids - Metabolism of carbohydrates, lipids, amino acids nucleotides and***vitamins.**

Unit II **(12Hours)**

Cellular Organization: Membrane structure and function - Structural organization and function of intracellular organelles - Organization of genes and chromosomes - Cell division and cell cycle - Microbial Physiology. FundamentalProcesses: DNA replication, repair and recombination - RNA synthesis and processing – Protein synthesis and processing - Control of gene expression at transcription and translation level.

Unit III **(12Hours)**

System Physiology –Plant: Photosynthesis -Respiration and photorespiration – Nitrogen metabolism - Plant hormones – Sensory photobiology- Solute transport and photo assimilate translocation – Secondary metabolites - Stressphysiology.

System Physiology –Animal: Blood and circulation - Cardiovascular System - Respiratory system - Nervous system - Sense organs - Excretory system - Thermoregulation -Stress and adaptation - Digestive system - Endocrinology and reproduction.

Unit IV **(12Hours)**

Cell Communication and Cell Signalling: Host parasite interaction - Cell signalling- Cellular communication - Cancer - Innate and adaptive immune system. Methods in Biology: Molecular Biology and Recombinant DNAmethods - Histochemicaland Immunotechniques- Biophysical Methods - Statistical Methods - Radiolabelling techniques - Microscopic techniques - Electrophysiological methods - Methods in field biology.

Unit V **(12Hours)**

Applied Biology: Microbial fermentation and production of small and macro molecules - Application of immunological principles, vaccines, diagnostics - Tissue and cell culture methods for plants and animals - Transgenic animals and plants, molecular approaches to diagnosis and strain identification - Genomics and its application to health and agriculture, including gene therapy – Bioresource and uses of biodiversity - Breeding in plants and animals, including marker – assisted selection - Bioremediation and phytoremediation- Biosensors.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Textbooks:

1. Kumar. (2016). ArihantPublications. 3rd edition.
2. Nithin Sharma (2020). Ace The Race: CSIR-UGC NET Life Sciences (JRF & LS) 2nd Edition.

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MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	H	S	M	S
CO2	S	S	M	H	M
CO3	M	M	S	S	H
CO4	S	S	M	S	M
CO5	S	S	M	M	S

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	Non Major Elective – Bioprocess Technology			
Batch 2024-2026	Hours / Week 4	Total Hours 60	Credits 4	Employability/skill development/Entrepreneurship

Course Objectives

1. To understand the basics of fermentation techniques
2. To learn the concepts of screening, optimization and maintenance of cultures
3. To provide the basics of bioprocess technology

Course Outcomes (CO)

K1	CO1	Remember the basics of bioreactors
TO	CO2	Understanding of the various aspects of bioprocess techniques
	CO3	Employ in biotechnological industries
	CO4	Distinguish the fermentation process and its kinetics
K4	CO5	Appraise the role of bioreactors in various industries.

Syllabus

Unit I **(12Hours)**

Introduction: Basic principles*, Historical development in fermentation, strain improvement and inoculum development. Types of fermentation: batch, fed batch and continuous. Isolation, screening, and maintenance of microbes for industrial process. Strain selection and improvement methods.

UNIT II **(12 Hours)**

Bioreactor: Components design, parts and its functions. Types of bioreactors: CSTR, packed bed, batch, Air lift bioreactor, Bioreactors for immobilized cells, animal cells, waste water and effluent treatment. Specialized bioreactors: pulsed, fluidized and photobioreactors.

UNIT III **(12 Hours)**

Upstream processing: Introduction, principles of microbial nutrition, Media formulation and optimization. Sterilization: Methods of sterilization- Batch and

continuous sterilization. Air sterilization, design and air filters, aseptic operation of fermentor. Inoculadevelopment for Industrial fermentations.Scale up and scale down.

UNIT IV **(12 Hours)**

Transport phenomena: Mass and heat transfer mechanism. Mass, heat and oxygen transfer coefficients. Rheological properties of a fermentation broth. Bioprocess monitoring and control: On-line and Off-line analysis. Monitoring variables: pH, temperature, DO_2, agitation and foam level. PID control and computer aided control.

UNIT V **(12 Hours)**

Downstream processing: Overview.Primary separation - Cells, Solid matter and foam-precipitation, filtration, centrifugation, celldisruptions(Mechanical, enzymatic and chemical).Product isolation - solvent extraction, adsorption, aqueous two-phase system and precipitations. Purification techniques: Chromatography (ion - exchange, gel-permeation and affinity), membrane separation (microfiltration, Ultrafiltration and reverse osmosis). Product recovery; product polishing (drying and crystallization).

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Textbooks:

1. El – Mans, E.M.T., and Bryce, C.F.A. (2002). Fermentation Microbiology and Biotechnology. Taylor &Francisgroup

2. Stanbury, P. F. &A. Whitaker. (2003). Principles of Fermentation Technology. Pergamann Press,Oxford.

Reference books:

1. M.L.Shuler andF. Kargi.(2003). Bioprocess engineering: Basic Concepts. Prentice Hall, EngelwoodCliffs.

2. W. Cruger&A. Cruger. (2003). A Textbook of Industrial Microbiology. PanimaPub. Corp., NewDelhi.

3. R.K. Rajput. (2003). Heat and Mass Transfer in SI units. S Chand and Co. Ltd.,NewDelhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	S
CO2	H	S	S	H	M
CO3	S	H	S	M	S
CO4	M	S	H	S	S
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	Non Major Elective – Cancer Biology			
Batch 2024-2026	Hours / Week 4	Total Hours 60	Credits 4	Employability/skill development/Entrepreneurship

Course Objectives

1. To know the biology of cancer development
2. To know the features of various cancer types
3. To know about the mechanism of cancer cell cycle
4. To learn the screening and diagnosis methods for cancers
5. To learn the treatment strategies for various cancers

Course Outcomes (CO)

K1 TO K5	CO1	Remember the basic knowledge on cancer development
	CO2	Understand the molecular mechanisms of cancer cell cycle
	CO3	Apply the techniques for diagnosis of various cancers
	CO4	Contribute the role of different treatment strategies and its application
	CO5	Employ various strategies in the treatment of cancer

Syllabus

Unit I **(12 Hours)**

Cancer: Introduction, Normal cells and tissues, Control of growth in normal Tissues, Tumour growth, the process of carcinogenesis*, Genes involved in carcinogenesis, Factors influencing the development of cancers. **Risk factors for cancer:** Tobacco, infections, dietary-related factors, reproductive and hormonal factors, radiation, occupational carcinogens, medical carcinogens (non-radiation), environmental pollution, genetic predisposition, mutagens and mutational spectra in relation to cancer types.

Unit II **(12 Hours)**

Epidemiology, Etiology, pathology, Clinical Features, Diagnosis and Evaluation, Management of breast, oral, cervical, gastric, lung and skin cancer. Role of tumour suppressor genes (Rb, p53, NF1, BRCA 1 & 2) in cancer prevention and the mechanism leading to loss of function.

Unit III **(12 Hours)**

Cancer cell cycle: Introduction, cell cycle events in normal and neoplastic cells, restriction point control and its loss, initiation of DNA replication, completion of DNA replication, checkpoint

responses to DNA damage in G1 and S phase, from G2 to mitotic metaphase, checkpoints controlling mitotic entry, centrosome duplication and the maintenance of ploidy, the metaphase–anaphase transition and exit from mitosis, cell cycle proteins as prognostic markers and drug targets.

Unit IV **(12 Hours)**

Screening of cancer: Introduction, Types of screening tests, Safety and acceptability, Evaluation of screening (Evaluating the test, Potential biases, Randomized trials, Screening programmes), Types of screening test (Visual inspection, Palpation, Analysis of exfoliated cells, Imaging, Serum and urine markers, screening for and treatment of infections), Screening for specific cancers (Cervix cancer, Breast cancer, Colorectal cancer, Prostate cancer).

Unit V **(12 Hours)**

Local treatment of cancer: Introduction, Skin cancers, Breast cancer, Lung cancer, Prostate cancer, Colo rectal cancer. **Chemotherapy:** Mechanisms of action and resistance to traditional cytotoxic drugs, Therapeutic principles of traditional cytotoxic chemotherapy. **Radiotherapy. Immunotherapy of cancer:** Introduction, Specific Immunotherapy (Human tumour antigens & genetically enhanced T cells), Non-specific immunotherapy (Immunotherapy withcytokines).

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Textbook:

1. Introduction to the Cellular and Molecular Biology of Cancer. Margaret A.Knowles Peter J. Selby. Oxford University Press 2005, Fourth Edition

Reference books:

1. Franco Cavalli, Stan B. Kaye, Heine, H.Hansen, James O. Armitage, Martine J. Piccart- Gebhart (2009). Textbook of Medical Oncology. Fourth Edition. InformaHealthcare.

2. Raymond W. Ruddon (2007). Cancer Biology Fourth Edition, Oxford UniversityPress.

3. Arthur B. Pardee. Gary S. Stein (2009). The Biology and Treatment of Cancer. Understanding Cancer by John Wiley & Sons, Inc.

4. Harvey Lodish, Arnold Berk*et al*., (2007). Molecular Cell Biology. 6th edition, W HFreeman and Company, NewYork.

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MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	S
CO2	M	H	M	H	M
CO3	S	M	S	M	H
CO4	S	H	M	H	M
CO5	S	M	S	M	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code :**24PBC3X1**

Programme Code: 07	M.Sc Biochemistry			
Title of the paper	EDC – Nutritional Biochemistry			
Batch 2024-2026	Hours / Week 2	Total Hours 30	Credits 2	Employability/skill development/Entrepreneurship

Course Objectives

1. To impart the knowledge on historical overview of nutrition, essential nutrients for metabolism
2. To provide an overview of the major macro and micronutrients relevant to human health
3. To discuss the scientific rationale for defining nutritional requirements in healthy individuals and populations, with reference to specific conditions such as pregnancy, lactation, and older age

Course Outcomes (CO)

K1	CO1	Assess the nutritional status of community in order to determine the type magnitude and distribution of malnutrition
TO	CO2	Describe the biochemical and physiological functions of the nutrients and their integrated role.
	CO3	Evaluate the therapeutic role of key nutrients in maintaining health.
	CO4	Discriminate the diseases caused due to protein deficiency
K5	CO5	Employ the role of diet in various diseases.

Syllabus

Unit-I **(6 Hours)**

Introduction: Nutrition – concepts - role of nutrition in maintaining health, basic food groups - energy yielding, body building and protective foods. Basic concepts of energy expenditure, unit of energy – Kcal - energy requirements of different categories of people - RQ of foods - Body Mass Index (BMI) - Basal Metabolic Rate (BMR) – determination and factors influencing

Unit-II **(6 Hours)**

Nutritional significance of dietary components: Physiological role and nutritional significance of carbohydrates, lipids, proteins, vitamins (water soluble and fat soluble) minerals and fiber, Dietary sources, Functions, Digestion, absorption and storage, metabolism of carbohydrates – lipids – proteins.

Unit-III **(6 Hours)**

Nutritive value of proteins: Essential amino acids, Biological values of Proteins (animal and plant proteins). Evaluation of proteins by nitrogen balance method-DC, BV, NPU and NAP of animal and plant proteins, single cell proteins, factors influencing protein requirements, Effect of excess protein intake

Sub.Code :**24EDC301**

Unit-IV **(6 Hours)**

Protein calorie malnutrition: Protein malnutrition (Kwashiorkor) and under nutrition (marasmus) their preventive and curative measures – composition of balanced diet and RDA for infants, children, adolescent, adult male and female, pregnant, lactating women and geriatrics

Unit-V **(6 Hours)**

Nutrition and body defenses: Effect of drugs on food and nutrients, drug - nutrient interaction - nutritional therapy food preparation and management. Role of diet and nutrition in the prevention and treatment of diseases – Diabetes mellitus, hypertension, infections, CVD, liver and kidney disorders.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books:

1. Srilakshmi, B. (2013) Nutrition Science Revised Fourth Edition, New Age International Publishers, NewDelhi.
2. Paul, S. (2005) A Textbook of Bio-nutrition – Curing Diseases through Diet, First Edition, CBS Publishers and Distributors, NewDelhi.
3. Swaminathan, M.(2004) Advanced Textbook of Food and Nutrition, Volume II, Second Edition, The Bangalore Printing and Publishing Co. Limited,India.

Reference Books:

1. Geissler, C. and Powers, H.(2010)Human Nutrition, Twelfth Edition, Churchill Livingstone,USA.
2. Brody, T. (2006) Nutritional Biochemistry, Second Edition, Academic Press,USA.
3. Eastwood, M. (2003) Principles of Human Nutrition, Second Edition, Wiley - Blackwell Science Ltd Publishers, USA.

Sub.Code :**24EDC301**

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	S	M
CO2	H	S	H	M	M
CO3	M	H	H	H	H
CO4	M	S	M	S	M
CO5	M	S	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code:**24PBCOJ1**

Programme Code: 07	**Programme Title:** M.Sc Biochemistry			
Title of the paper JOC –Bio-Entrepreneurship				
Batch 2024-2026	Hours / Week 4	Total Hours 60	Credits 2	Employability

Course Objectives

1. To learn about the concepts of entrepreneurship
2. To study the various opportunities in launching and running abusiness
3. To know the various strategies of effective entrepreneurship

Course Outcomes (CO)

K1 TO K5	CO1	List the concepts of entrepreneurship
	CO2	Report the different strategies adopted for a better entrepreneurship
	CO3	Discriminate the various biological entrepreneurshipprogrammes
	CO4	Apply the quipped enough to become an entrepreneur
	CO5	Employ in understanding about the marketing of products.

UnitI **(12 Hours)**

Basics of Bioentrepreneurship Introduction to bioentrepreneurship– Biotechnologyin a global scale, Scope in Bioentrepreneurship, Importance of entrepreneurship. Meaning of entrepreneur, function of an entrepreneur, types of entrepreneur, advantagesof being entrepreneur. Innovation – types, out ofbox thinking, opportunities for Bioentrepreneurship. Entreprenuership development programs of public and private agencies (MSME, DBT, BIRAC, Startup and Makein India). Patent landscape, IP protection and commercializationstrategies.

UnitII **(12 Hours)**

Management, Accounting andFinance Management principles of Henry Fayol. Business plan preparation: business feasibility analysis by SWOT, socio-economic costs benefit analysis, Sources of financial assistance – making a business proposal, approaching loan from bank and other financial institutions, budget planning and cash flow management, basics in accounting

practices - balance sheet, P&Laccount, double entry book keeping, estimation of income, expenditure and Income tax. Collaborations and partnerships, information technology for business administration and expansion.

UnitIII (12 Hours)

Knowledge Centre and R&D Knowledge centers - Universities, innovation centre, research institutions and business incubators. R&D - technology development and upgradation, assessment of technology development, managing technology transfer, industry visits to successful bio-enterprises, regulations for transfer of foreign technologies, quality control, technology transfer agencies, Understanding of regulatory compliances and procedures (CDSCO, NBA, GLP, GCP & GMP)

UnitIV

(12Hours)

Medium &Small Scale Industry Definition, characteristics, need and rationale, objectives, scope and advantages of small scale industries.Types of bioindustries– Pharma, AgriandIndustry.Biofertilizers production - *Azospirillium, Azolla, Cyanobacteria and its applications.Biopecticides production- Bacterial, fungal, viraland plant insecticides. Sericulture. Apiculture. Dairy farming.Single Cell ProteinProductionand applications.Vermicomposting anditsapplications.Mushroom cultivation and its application.Ancillary and tiny industries

UnitV

(12Hours)

Marketing and Human Resource Development Assessment of market demand for potential product(s) of interest, Market conditions, segments, prediction of market changes, identifying needs of customers including gaps in the market. Branding issues, developing distribution channels – franchising policies, promotion, advertising, branding and market linkages. Marketing of agro products. Recruitment and selection process, leadership skills, managerial skills, organization structure, training, team building andteamwork.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books

1. "Entrepreneurship and Business of Biotechnology", S. N. Jogdand, Himalaya Publishing Home,2007.

Reference Books

1. Stephon, Robbins. (2003). Management.17th edition, Pearson Education.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	M
CO2	H	S	M	S	H
CO3	S	M	S	H	S
CO4	H	M	M	M	S
CO5	H	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code:**24PBC0J2**

Programme Code: 07	**Programme Title:** M.Sc Biochemistry			
Title of the paper JOC - Food Safety and Quality Control				
Batch 2024-2026	Hours / Week 4	Total Hours 60	Credits 2	Employability

Course Objectives

1. To learn the principles of food quality control
2. To learn the methodologies to standardize and ensuring food safety
3. To gain knowledge on the framed food safety regulations

Course Outcomes (CO)

K1	CO1	Repeat the various steps in the quality control of food items
TO	CO2	Classify the various food standards
	CO3	Illustrate the various methods to determine the quality of foods
	CO4	Examine the various regulations concerned with the food quality issues
K5	CO5	Evaluate the methods in standardization of quality control of foods.

UnitI **(12Hours)**

Principles of Quality control of food: Raw material control, processed control and finished product inspection. Leavening agents, classification, uses and optimum levels. Food additives - Preservatives, colouring, flavouring, sequestering agents, emulsifiers,antioxidants.

UnitII **(12Hours)**

Standardisation systems for quality control of foods: National and International standardization system, Food grades, Food laws-compulsory and voluntarystandards. Food adulteration - Common adulterants in foods and tests to detect common adulterants.

UnitIII **(12Hours)**

Standards for foods: Cereals and pulses, sago and starch, milk and milk products, Coffee, tea, sugar and sugar products.

UnitIV **(12Hours)**

Methods for determining quality: Subjective and objective methods. Sensory assessment of food quality-appearance, color, flavour, texture and taste, different methods of sensory analysis,

preparation of score card, panel criteria, sensory evaluation room.

UnitV **(12Hours)**

Food safety, Risks and hazards: Food related hazards, Microbial consideration in food safety, HACCP-principles and structured approach. Chemicalhazardsassociated with foods**.*FSSAI.**

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Food Science-Srilakshmi (2001). 2nd edition, New age international publishers- (2001)

Reference Books

1. Swaminathan M. (2014). Essentials of Food and Nutrition.2 nd edition.Bappco.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	S	S	M	M
CO2	H	S	S	M	S
CO3	M	M	M	S	H
CO4	S	S	M	M	M
CO5	S	M	S	M	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code:**24PBCOJ3**

Programme Code: 07	**Programme Title:** M.Sc Biochemistry			
Title of the paper JOC –Clinical and Therapeutic Nutrition				
Batch 2024-2026	Hours / Week 4	Total Hours 60	Credits 2	Employability

Course Objectives

1. To enable the basic principles of clinical nutrition
2. To understand the clinical significance of biochemical findings
3. To develop skills in planning and prep aration of therapeutic diets for various diseases

Course Outcomes (CO)

K1	CO1	Commemorate the basics of nutritional care
	CO2	Explain the relation between nutrition and health
TO	CO3	Interpret the lifestyle and nutritional assessment techniques
	CO4	Analyze the main nutrients and its functions in the body
K5	CO5	Appraise the role of probiotics in diet.

UnitI **(12Hours)**

Guidelines for dietary planning: ***Weights and Measures.** Nutritional Assessment .Nutritional care process. Nutritional intervention: Objectives of diet therapy, Therapeutic modification of the normal diet : diet prescription. Routine Hospital diet

- regular diets, clear fluid diet, full fluid diet, soft diet, modifications of food and nutrient intake, Enteral nutrition, parenteral nutrition, Refeeding syndrome, Transitional feeding. Medical and nutritional care record types and uses, Format for medical and nutrition charting and documentation record.

UnitII **(12Hours)**

Dietician and Nutrition counselling: Role of dietician on hospitalized and outdoor patients and development of nutritional careplan. Specific functionsof atherapeutic, administrative and consultant dietician. Team approachinpatientcare.

Psychological considerations in feeding the patients. Inter personal relationship with patients. Nutrition counseling- concept, components, activities for behavior changes ,intervention counseling models, types of counselling session in patient

UnitIII **(12Hours)**

Weight imbalances, anorexia nervosa and Bulimia nervosa, cardio vasculardisorders, Diabetes mellitus-Type I, II, GI Tract Disorders, Liver and gall bladder, Pancreatic disorders, renal disorder, gout, cancer, Musculo-skeletal disorders (Rheumatoid Arthritis, Osteoarthritis, Osteoporosis), Respiratory problems, hyper metabolic conditions- Burns, Sepsis, Surgery.

UnitIV **(12Hours)**

Pro and prebiotics: Probiotics: Taxonomy and important features of probiotic microorganisms. Health effects of probiotics with mechanism of action. Probiotics in various foods: fermented milk products, non-milk products etc. **Prebiotics**: Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases. perspective for food applications for the-Non-digestible carbohydrates/oligosaccharides, Dietary fibre, Resistant starch, Gums. Palliative diet and nutritional care.

UnitV **(12Hours)**

Food- Drug Interaction: Effect of Food on Drug Therapy. Effect of Drug on Food and Nutrition. Modification of Drug Action by Food and Nutrition. Effect of Drug on Nutritional Status.Excipients and Food-Drug Interaction.***Medical nutritional therapy**.

Teaching Methods

Smart classroom/Power point presentation/Seminar/Quiz/Discussion/ Assignment/flipped class

Text Books

1. Mahan, L.K. and Escott-Stump, S. (2008). Krause's Food Nutrition and Diet-Therapy. 12thedition, W-13 Saunders Ltd.,Canada.

2. Garrrow J.S, James W. P.T, Ralph A. (2000). Human Nutrition and Dietetics. 10th edition, Churchill Livingston, London.

Reference Books

4. AntiaF.P. And Philip Abraham. (2001). Clinical Nutrition and Dietetics. Oxford Publishing Company, NewDelhi.

5. Williams, S.R. (2003). Nutrition and Diet Therapy. 7th edition, Times Mirror/Mosby CollegePublishing

6. Esther A. Winter feldt, Margret L. Bogle, Lea L. Ebro. (2011). Dietetics: Practice &FutureTrends.3rdedition,JonesandBarletPublishers.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	S	S
CO2	M	S	S	M	M
CO3	S	H	M	S	H
CO4	M	S	H	H	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub code: **24PBCOD1**

Programme Code: 07	**Programme Title:** M.Sc Biochemistry			
Title of the paper ALC – Forensic Science				
Batch 2024-2026	Hours / Week NA	Total Hours NA	Credits 2	Employability

Course Objectives

1. To deals with the forensic aspects like legal procedures and types of trauma.
2. To prop up and develops regulation in forensic science
3. To give students with a sound basis in forensic science

Course Outcomes (CO)

K1 TO K5	CO1	Define the basic concepts of forensic science
	CO2	Understand the identification procedures employed under forensics Science
	CO3	Apply the fingerprint analysis and interpretations in research fields
	CO4	Examine and analyze the results involved in fingerprinting technique
	CO5	Evaluate the physical analysis and injuries.

Unit I

Crime scene management and investigation: Collection, preservation, packing and forwarding of physical and trace evidences for analysis. Legal and court procedure related to expert testimony. Consumer Protection Act: rights and liabilities of doctors, medical indemnity insurance; human rights and violation; duties of medical practitioners to victims of torture; Human organ transplantation Act.

Unit II

Identification of the living and the dead: Forensic hematology; death; causes of death; mechanism and manner of death; changes after death; artifacts; medico legal Death in vestigation; exhumation. Examination and identification of hair, semen, saliva, urine, faecal matter and milk. DNA fingerprinting and HLA typing.

Unit III

Physical analysis: Soil, glass, paints, lacquers, cement, inks, paper, tool and tyremarks shoeprints. Forensic examination of vehicles in cases of accident.Identification of

individualization from foot prints andteeth.

Unit IV

Injuries: Mechanical injuries; injuries due to electricity, lightning and radiation; train and road traffic accidents; firearm and explosion injuries; medico legal aspects of wounds. General aspects; patho-physiology and classification; mechanical asphyxia; hanging; strangulation; drowning; smothering, choking, garroting, burking, yoking.

Unit V

Medico legal aspects: Medico legal aspects of wounds. Post mortem examination and changes, asphyxia death, sexual offences, infanticide, forensic psychiatry and lye detection. History, classification, search, lifting and examination of fingerprints.Various methods for the development of latent fingerprints, ***Crime records and computerization.**

Text Books

1. NarayanareddyK. S. (2007). The Essentials of Forensic Medicine &Toxicology. 26th edition, K. SuganaDevi publishers,Hyderabad.

2. Basu, R. (2009). Fundamentals of forensic medicine and toxicology. 2ndEdition, Books and Allied (P) Ltd.Kolkata.

Reference Books

1. PillayV.V. (2009). Text book of Forensic Medicine, ParasPublication. Hyderabad.

2. JB Mukherjee's. (2007). Forensic Medicine and Toxicology-Volume I and II (combined)-edited by Karmakar, 3rdedition.

3. R.Saferstein.(2004).Criminalistics.8thedition,PrenticeHall,NewJersey.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	M	S
CO2	S	H	M	S	H
CO3	H	S	S	M	H
CO4	M	S	H	M	M
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub code: **24PBCOD2**

Programme Code: 07	**Programme Title:** M.Sc Biochemistry			
Title of the paper ALC – Nutraceuticals and Functional Foods				
Batch 2024-2026	Hours / Week NA	Total Hours NA	Credits 2	Employability

Course Objectives

1. To learn the concept of nutraceuticals and functional foods
2. To know the available biochemical compounds in our system
3. To prepare functional foods from nutraceutical compounds

Course Outcomes (CO)

K1	CO1	Remember the complete history of nutraceuticals
TO	CO2	Classify the different nutraceuticals
	CO3	Illustrate the formulation methods of functional foods
	CO4	Distinguish the role of functional foods in disease prevention and management
K5	CO5	Employ the role of nutraceuticals in various disorders.

Unit I

Introduction to Nutraceuticals as Science: Nutraceutical- Definition, Classification - Dietary supplements, Functional foods, Historical perspective, scope &future prospects. Applied aspects of the Nutraceutical Science.Sources of Nutraceuticals. Relation of NutraceuticalScience with other Sciences: Medicine, Human physiology, genetics, food technology, ***chemistry and nutrition (brief description).**

Unit II

Classification, Properties and structure of various Nutraceuticals: Alkaloids, Terpenoids,Glycosides, Natural phenols, Isoprenoidderivaties, Glucosamine, Octacosanol, flavonoids, carotenoids, polyunsaturated fatty acids, lecithin, choline and spingolipids, Lycopene, Carnitine, Melatonin and Ornithine alphaketoglutarate

asneutraceuticals. Use of proanthocyanidins, grape products, flaxseed oil as

Nutraceuticals.

Unit III

Nutraceuticals of plant and animal origin: Plant metabolites - Functions, sources - Alkaloids, phenols, Terpenoids. Applications with specific examples with reference to skin, hair, eye, bone, muscle, heart, brain, liver, kidney, general health and stimulants. Concept of cosmoceuticalsand aquaceuticals.Animal metabolites – Functions, Sources - chitin, chitosan, glucosamine, chondroitin sulphateand other polysaccharides of animal origin.Uses and applications in preventive medicine and treatment.

Unit IV

Functional Foods: Definition. Applications of herbs to functional foods.Concept of free radicals and antioxidants; Nutritive and Non-nutritive food components with potential health effects.Soy proteins and soy isoflavonesin human health; Role of nutsin cardiovascular disease prevention. Functional foods from wheat and rice and their health effects. Role of Dietary fibers in disease prevention.Vegetables, Cereals, milk and dairy products as Functional foods. Health effects of common beans, Capsicumannum,mustards,Ginseng,garlic,citrusfruits,fishoils,andseafoods.

Unit V

Foodas remedies: Nutraceuticals bridging thegapbetween foodand drug, Nutraceuticalsin treatment forcognitive decline, Nutraceuticalremediesfor common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceuticalrich supplements e.g. Bee pollen, Caffeine, Greentea,Lecithin,Mushroomextract,Chlorophyll,KelpandSpirulinaetc.

Text Books:

1. SwaminathanM.(2014).EssentialsofFoodandNutrition.2nd edition.Bappco.
2. C. Gopalan, B. V. Rama Sastri& S.C. Balasubramanian, (Reprinted 2007, 2011) Nutritive Value Of Indian Foods(NVIF),

Reference Books:

1. Todd and others. Clinical Diagnosis and Management. 17th edition, W.B.Saunders, Philadelphia.
2. Clinicaldieteticsandnutrition20014thEdition,OxfordUnivPress.
3. Sizer, F. &Whitney, E. (2000). Nutrition-Concepts &Controversies. 8thedition, Wadsworth ThomsonLearning.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	S	S
CO2	M	S	S	M	M
CO3	S	H	M	S	H
CO4	M	S	H	H	S
CO5	M	S	M	H	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code: **24PBCOD3**

Programme Code: 07		**Programme Title:** M.Sc Biochemistry		
Title of the paper ALC –Stem Cell Biology				
Batch 2024-2026	Hours / Week NA	Total Hours NA	Credits 2	Employability

Course Objectives

1. To learn about the technology of stem cells preparation
2. To learn the properties of stem cells
3. To prepare stem cells for gene therapy

Course Outcomes (CO)

K1	CO1	Recall the different types of stem cells and its applications
TO	CO2	Explain the importance of gene therapy in various diseases
	CO3	Interpret implement the stem cell in therapies
K5	CO4	Examine the molecular concepts of stem cell
	CO5	Appraise the role of stem cells in various disorders.

Unit I

Introduction and Scope of stem cells: Definitions, Concepts of stem cells, differentiation, maturation, proliferation, pluripotency, self maintenance and selfrenewal, significations in measuring stemcells, preservation and storage protocols

Unit II

Types of stem cells: Intestinal stem cells, Mammary stem cells, Skeletal muscle stem cell,keratinocytestem cells of cornea, skin and hair follicles, tumor stem cells. Factors influencing proliferation and differentiation of stem cells. Role of hormone in differentiation.

Unit III

Embryonic stem cells: Blastocyst, inner cell mass, Culturing of ES cells in lab, laboratory tests to identify ES cells, stimulation ES cells for differentiation, properties of ES cells, human ES cells, Monkey and Mouse ES cells.

Unit IV

Application of stem cell: Identification, Manipulating differentiation pathways, stem cell therapy

vs cell protection, stem cell in cellular assays for screening, stem cellbased drug discovery platforms, drug screening and toxicology, stemcell banking.

Unit V

Gene therapy: Genetically engineered stem cells, stem cells and animal cloning, transgenic animals and stem cells, Therapeutic applications, Parkinson's disease, Neurological disorder, limb amputation, heart disease, spinal cord injuries, diabetes, burns. Matching the stem cell with transplant recipient, HLA typing Alzheimer's disease, spinal cord injuries tissue engineering application, production of complete organ, kidney, eyes, heart, and brain. ***Stem cell case study.**

Text Books

1. Kursadand Turksen. (2002).Embryonic Stem cells, Humana Press.

Reference Books

1. Stem cell and future of regenerative medicine. By committee on the Biological and Biomedical applications of Stem cell Research. (2002). National Academic press.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	S
CO2	S	S	M	H	S
CO3	M	H	S	M	H
CO4	H	S	S	M	M
CO5	H	S	H	M	S

S–Strong **H**–High **M**–Medium **L** –Low

Question paper pattern

(External only)

1. THEORY Max Marks = 75

Time = 3.00 hrs

SECTION - A (1 x 10=10 marks)

SECTION – B (5 x 5=25 marks)

Short answer questions

Q.No. 11-15: Either (a) or (b) short note type (One question 'a' or 'b' from each unit)

SECTION - C (8 x 5=40 marks)

Essay type of questions:

Q.No. 16-20: Either (a) or (b) essay type (One question 'a' or 'b' from each unit)

2. PRACTICALS – Question Pattern & Break-up of marks

END OF SEMESTER PRACTICAL EXAMINATION

Max. Marks: 60

Duration: 3hrs

I.	**Major**	(One question)	(1 x 20 = 20)
II.	**Minor**	(One question)	(1 x 10 = 15)
III.	**Spotters**		(3 x 5 = 15)

Examine, identify and critically comment on the spotters A, B, C, D and E.

V.	**Record / Observation***	(10)

**Record for ESE; Observation for CIA exam.*