

**KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)**

COIMBATORE – 641029



**SCHEME AND SYLLABUS FOR
DEPARTMENT OF BIOCHEMISTRY (PG)
CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)
(2022 - 2023 and onwards)**

PBC 1

Semester	Subject code	Title of the paper	Instruction hours/cycle	Exam Marks			Duration of Exam (Hrs)	Credits	
				CIA	ESE	Total			
I	22PBC101	C.P.1 Biomolecules	5	50	50	100	3	4	
	22PBC102	C.P.2 Bioanalytical Techniques	5	50	50	100	3	4	
	22PBC103	C.P.3 Enzymes and Enzyme Technology	5	50	50	100	3	4	
	22PBC104	C.P.4 Cellular Biochemistry	5	50	50	100	3	4	
	22PBC1CL	C.Pr.1 Lab in Biomolecules, Bioinstrumentation, Enzymology and Cell Biology	5	50	50	100	6	4	
	22PBC1E1	E.P.1 Major Elective- I	5	50	50	100	3	5	
Total Hours			30	300	300	600		25	
II	22PBC205	C.P.5 Plant Biochemistry and Biotechnology	5	50	50	100	3	4	
	22PBC206	C.P.6 Metabolism and Metabolic Regulation	5	50	50	100	3	4	
	22PBC207	C.P.7 Genetics and Molecular Biology	5	50	50	100	3	4	
	22PBC208	C.P.8 Drug Biochemistry	5	50	50	100	3	4	
	22PBC2CM	C.Pr.2 Lab in Plant Biochemistry, Genetics and Molecular Biology	5	50	50	100	5	4	
		22PBC2E2	E.P.2 Major Elective- II	5	50	50	100	3	5
Total Hours			30	300	300	600		25	
III	22PBC309	C.P.9 Immunology	6	50	50	100	3	5	
	22PBC310	C.P.10 Genetic Engineering	7	50	50	100	3	4	
	22PBC311	C.P.11 Clinical Biochemistry	7	50	50	100	3	4	
	22PBC3CN	C.Pr.3 Lab in Immunology, Genetic Engineering and Clinical Biochemistry	5	50	50	100	5	4	
		22PBC3N1	E.P.1 Non-major Elective –I (On-line)	3	50	50	100	3	4
		22PBC3ST	Summer training*	-	-	-	-	-	-
	22PBC3X1	EDC-Nutritional Biochemistry	2	50	50	100	3	2	

Total Hours			30	300	300	600		23
IV	22PBC412	C.P.12 Hormonal Biochemistry	5	50	50	100	3	4
	22PBC413	C.P.13 Biostatistics and Research Methodology	5	50	50	100	3	4
	22PBC4N2	E.P.2 Non-major Elective –II (On-line) - SM	5	50	50	100	3	4
	22PBC4Z1	Project and Viva-voce	15	50	50	100	-	3
		SWAYAM – MOOC	-	-	-	-	-	2
Total Hours			30	200	200	400		17
GRAND TOTAL			120	110	110	220		90
				0	0	0		
*Project record 120 marks + Viva-voce examination 40 marks								

PBC 2**Note:**

- CBCS – Choice Based Credit system
- CIA – Continuous Internal Assessment
- ESE – End of Semester Examinations

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) :

22PBC3X1 – EDC Paper 1 - Nutritional Biochemistry

Tally Table:

Subject	No. of Subjects	Total Marks	Credits
Core – Theory / Practical / Project	17	1700	68
SWAYAM – MOOC	-	-	2
Major Elective Papers	2	200	10
EDC Paper	1	100	2
Non Major Elective Paper	2	200	8
Grand Total	22	2200	90

- 50 % CIA is applicable to all subjects except EDC, JOC, COP and SWAYAM courses which are considered as extra credit courses.
- The students should complete a **SWAYAM-MOOC** before the completion of the 3rd semester and the course completed certificate should be submitted through the HOD to the Controller of Examinations. Two credits will be given to the candidates who have successfully completed. In case the students have completed more than one online course, the appropriate 2 extra credits shall be awarded to such candidates upon the submission of certificate through the HOD to the Controller of Examinations.
- A **Field Trip** preferably relevant to the course should be undertaken every year.

Components of Continuous Internal Assessment (50 Marks)

Components		Marks	Total
Theory			
CIA I	75	(75+75)	50
CIA II	75	converted to 30	
Problem based Assignment**		10	
Attendance		5	
Others*		5	
Practical			
CIA Practical		50 (Converted to 30)	50
Observation Notebook		15	
Attendance		5	
Project			
Review		45	50
Regularity		05	

Components of Continuous Internal Assessment (30 Marks & 25 Marks)

Components		Marks	Total
Theory			
CIA I	45	(45+45)	30
CIA II	45	converted to 15	
Problem based Assignment**		5	
Attendance		5	
Others*		5	
Practical			
CIA Practical		(25) converted to 10	25
Observation Notebook		10	
Attendance		5	

* Class Participation, Case Studies Presentation, Field Work, Field Survey, Group Discussion, Term Paper, Workshop/Conference Participation. Presentation of Papers in Conferences, Quiz, Report/Content writing. Etc.

** Two Assignments to be given. (Each 5 marks).

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 – K2 Q1 to 20	A (Answer all)	20 x 1 = 20	MCQ-10/ Fill ups-5/ One word-5	75**
K2 – K5 Q21 to 28	B (5 out of 8)	5 x 5 = 25	Short Answers	
K2 – K5 Q29 to 33	C (3 out of 5)	3 x 10 = 30	Descriptive / Detailed	

**For ESE 75 marks converted to 50 marks.

i) CIA I & II and ESE: 45 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 10	A (Answer all)	10 x 0.5 = 5	MCQ	45
K2 – K5 Q11 to 15	B (either or type)	5 x 3 = 15	Short Answers	
K2 – K5 Q16 to 20	C (either or type)	5 x 5 = 25	Descriptive / Detailed	

ESE Practical Examination:

Option 1 :

Knowledge Level	Section	Marks	Total
K3	Experiments Record Work	45	50
K4		05	
K5			

Knowledge Level	Section	Marks	Total
K3	Experiments Record Work	20	25
K4		05	
K5			

ESE Project Viva Voce:**Option 1:**

Knowledge Level	Section	Marks	Total
K3	Project Report	35	50
K4		Viva voce	
K5			

ESE Practical Examination:**Option 2 :**

Knowledge Level	Section	Marks	Total
K3	Experiments	40	50
K4		Record Work	
K5			

Knowledge Level	Section	Marks	Total
K3	Experiments	20	25
K4		Record Work	
K5			

ESE Project Viva Voce:**Option 2:**

Knowledge Level	Section	Marks	Total
K3	Project Report	30	50
K4		Viva voce	
K5			

ADVANCED LEARNERS COURSE UNDER SELF STUDY SCHEME (Optional)

22PBCOD1	Forensic Sciences
22PBCOD2	Nutraceuticals and Functional foods
22PBCOD3	Stem Cell Biology

JOB ORIENTED COURSE

22PBCOJ1	Bio entrepreneurship
22PBCOJ2	Food safety and Qualitycontrol
22PBCOJ3	Clinical and therapeutic nutrition

CERTIFICATE COURSE IN MEDICAL LABORATORY TECHNOLOGY

22PBC0F1	Paper I: Biochemistry
22PBC0F2	Paper II: Clinical Pathology andMicrobiology-I
22PBC0F3	Practical I
22PBC0F4	On the Job training

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

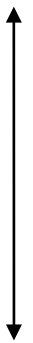
22PBC0F5	Paper I: Anatomy, Physiology and Laboratorysafety
22PBC0F6	Paper II: Clinical Pathology and Medical Microbiology II
22PBC0F7	Practical II
22PBC0F8	On the Job training

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper: Core Paper 1 – Biomolecules			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

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	Corelate 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.
		CO3	Able to know about execute of biomolecules in human health
		CO4	analyse and study the chemical and biochemical properties of biomolecule. They will be able to enter into drug design and pharmacogenetics field
	K5	CO5	Apply the structural studies to biological processes like replication, transcription and translation.

Unit I**(15Hours)**

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.

UnitII**(15Hours)**

Amino acids: Classification, structure and physical and chemical properties of amino acids (Ionization), Amphoteric molecule, Zwitterion, pK values; Isoelectric point, Functions of amino acids, Physical properties of amino acids: acid-base and UV-light absorption. Non-protein amino acids. Amino acid derivatives.

UnitIII**(15Hours)**

Proteins: Structural organization of protein: Primary structure. Determination of protein structure: Ramachandran plot. Polypeptide synthesis. Secondary structures – α -helix, β -sheet and β -turns, Pauling and Corey model for fibrous proteins, Reverse turns and super secondary 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 haemoglobin.

UnitIV**(15Hours)**

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, thromboxanes and leucotrienes. Steroids: structure and functions of cholesterol. Lipoproteins- classification and composition. Amphipathic lipids-emulsions and liposomes.

UnitV**(15Hours)**

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 procedures – 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 supercoiling and linking number. Chemical synthesis of DNA. Structure and biological functions of major forms of RNA: mRNA, rRNA and tRNA.

* denotes Self study

Teaching Methods

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

Text Books

1. Nelson, David L. and Cox. (2017). Lehninger Principles of Biochemistry. 7th edition, W.H. Freeman and 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. Garret R.H and Grisham, C. M. (2013). Principles of Biochemistry. 5th edition, Saunders college publishers.
3. Eric E. Conn, P.K. Stumpf, 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

CO \ PSO	PSO				
	PSO 1	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

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper Core Paper 2 – Bioanalytical Techniques			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	4

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 ↑ ↓ K5	CO1	recall the principle and applications of bioinstrumentation
	CO2	The students will discern the principle, Instrumentation of different types of bioanalytical techniques
	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.
	CO5	Appreciate the principle, instrumentation and difference between various spectroscopic methods.

Unit I

(15Hours)

Chromatography: Principle, technique and applications of TLC, HPTLC, column, ion-exchange, affinity, gel-filtration chromatography. Principle, instrumentation and applications of GLC and HPLC. Principle and applications of GC-MS, HPLC-MS, LC-MS/MS, Reverse phase chromatography and FPTLC.

Unit II

(15Hours)

Electrophoresis: Principle, technique and applications of paper, Agarose gel, SDS-PAGE, 2D-PAGE electrophoresis, Immunoelectrophoresis. Isoelectric focusing

technique and application. Principle, instrumentation, technique and applications of capillary electrophoresis and pulse-field gel electrophoresis.

Unit III (15 Hours)

Spectroscopy: Principle, technique, instrumentation and applications of UV-Visible, FTIR spectroscopy, spectro-fluorimetry, flame photometry, molecular luminescence, atomic absorption spectrophotometry, Electron spin resonance (ESR), Nuclear Magnetic Resonance (NMR), Mass Spectrometry - Matrix assisted LASER desorption/ionization time of flight-mass spectroscopy (MALDI-TOF MS), LC MS. X-ray crystallography, XRD.

Unit IV (15 Hours)

Centrifugation: Types of rotors- swing bucket, fixed angle, vertical. Types of centrifuge: Micro centrifuge, High speed and Ultracentrifuges Principle, technique, instrumentation and applications of ultracentrifuge: preparative and analytical centrifugation, differential centrifugation, density gradient centrifugation, Rate zonal and isopycnic centrifugation. Methods of disrupting cells and tissues—homogenization and Fractionation.

Unit V (15 Hours)

Microscopy and Radioactivity: Principles, instrumentation and applications of microscopy: Bright field, phase-contrast, fluorescence and confocal microscopy. Electron microscope – SEM and TEM. Radioactivity: nature, types of Radioactive decay, Units of radioactivity (Curie, Rutherford and Becquerel), detection and measurement of radioactivity by GM and scintillation counter. Autoradiography and its applications. Therapeutic application of radioisotopes and its safety measures.

***Radio Immuno Assay.**

*** denotes Self study**

Teaching Methods

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

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, 5th edition, Cambridge University Press, New York.

Reference Books

1. D.J. Homie and H. Peck. (2003). Analytical Biochemistry. 1st edition, Rastogic CBS Publisher.
2. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch. (2008). Fundamentals of Analytical Chemistry. 4th edition, Barkha Nath Printers, India.
3. Keith Wilson and John Walker. (2011). Principles and Techniques of Biochemistry and Molecular Biology. 7th edition, Cambridge University Press, New York.
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	

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper Core Paper 3 – Enzymes and Enzyme Technology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	4

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
	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.

Unit I**(15Hours)**

Enzymes: Introduction, nomenclature and ***classification of enzymes**, Factors affecting enzyme activity. Unit of enzyme: Katal and IU. Measurement of enzyme activity: Active site- Definition, investigations of 3D structure of active site. Mechanism of enzyme action-Lock and key, induced fit model enzyme modification by treatment with proteases, Isoenzymes-LDH, CPK and ALP.

Unit II**(15Hours)**

Enzyme catalysis and regulation: Acid base catalysis, covalent catalysis, Mechanisms of reaction catalyzed by enzyme, pancreatic amylase, alcohol dehydrogenase, Lipase, chymotrypsin, carboxy peptidase A and ribonuclease. Metal

activated enzymes and metallo enzyme. Enzyme regulation: feed forward stimulation, feedback inhibition and its types. Covalent modification of enzyme activities. Multienzyme complex and reactions: Structure and mechanism of action and regulation of pyruvate dehydrogenase complex.

Unit III**(15Hours)**

Enzyme kinetics and Inhibition: Kinetics of single substrate catalyzed reaction- MM equation and turnover number, LB plot, Eadie-Hofstee plot and Hanes plot. Importance of K_m and V_{max} . Allosteric enzymes- Cooperativity, Hill plot, K & V series of Enzyme. Bisubstrate reaction. Enzyme inhibition: Reversible inhibition - competitive, uncompetitive, noncompetitive, mixed, substrate and allosteric inhibition. Suicide inhibition. Inhibitory kinetics.

Unit IV**(15Hours)**

Co-enzymes: Prosthetic group and cofactors. Structure, functions and mode of action of TPP in oxidative decarboxylation, FMN, FAD, NAD, NADP in redox reactions, PALP and PAMP in transamination, Co A in acetylation reactions, biotin in carboxylation, THF in one carbon transfer, cobalamin coenzymes- cyano, hydroxyl, methyl and deoxyadenosyl cobalamin- role in methyl group transfer and mutase reactions. Co-enzymic functions of vitamin C, lipoic acid and Co Q in metabolic reactions.

Unit V**(15Hours)**

Enzymes application: Industrial application of enzymes: Enzymes as analytical reagents, Enzymes in Textile, Food and detergent industry. Enzymes used in diagnosis and various diseases- Alkaline phosphatase, Lactate Dehydrogenase, Lipase and Aspartate transaminase. Immobilization techniques and applications: Adsorption, microencapsulation, entrapment, covalent and ionic bonding. Biosensors: Calorimetric, Potentiometric, Amperometric, immunosensors and optical biosensors. Ribozyme, abzyme. Purification of protein.

* denotes Self study

Teaching Methods

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

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. E.E. Conn and P.K. Stumpf, G. Bruening and R.Y. 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. 2nd edition, John Wiley and Sons Ltd.
5. David L Nelson, Michael M Cox. (2013). Lehninger's Principles of Biochemistry, 6th edition, Replika Press (P) Ltd, India.
6. Julio Polaina and 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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper Core Paper 4 – Cellular Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

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

Unit I

(15Hours)

Membrane structure and function: Membrane bilayer Models, Fluidmosaic model- composition and functions. Membrane lipids- fluidity, Asymmetry phase transition, Liposome experiments. Membrane proteins - Types, Orientation, Mobility Experiments, flippases, proteins of RBC membrane, Bacteriorhodopsin, Porins- aquaporin. RBC ghosts, solubilisation of proteins, lipid anchored proteins. Cell surface carbohydrates- Lectins, selectins.. Extracellular matrix- Integrin and Hyaluronic acid.

Unit II

(15Hours)

Endoplasmic reticulum: history, occurrence, morphology, components, types, enzymes associated, functions and biogenesis. **Ribosomes:** history, occurrence, location,

Ultrastructure, chemical composition, biogenesis. Association and dissociation of ribosomal subunits, functions of ribosomes. **Golgi bodies:** history, origin, occurrence, morphology, polarity, compartmentalization, chemical composition and functions. **Centriole:** origin, occurrence, ultrastructure and functions. Protein transportation into golgi apparatus.

Unit III**(15Hours)**

Nucleus: occurrence, structure: nuclear envelope (nuclear transport, disassembly & reassembly, nuclear pores, pore complex, nucleocytoplasmic transport), nucleoplasm, nucleolus, nuclear reticulum (euchromatin, heterochromatin and functions) and its functions. Cell cycle, cell division, amitosis, mitosis, meiosis, salient features of meiosis, mechanism of crossing over.

Unit IV**(15Hours)**

Mitochondria: history, ultrastructure, electron transport chain, mt DNA, mtRNA, ribosomes and protein synthesis in mitochondria. Semi-autonomous nature of mitochondria (symbiont hypothesis). Biogenesis, degeneration and functions of mitochondria. **Membrane transport:** Overview, Passive transport: osmosis, simple diffusion and facilitated diffusion; active transport: Ca^{2+} ATPase, Na^+K^+ ATPase, Gastric H^+K^+ ATPase. Ion concentration gradients. Bulk transport: exocytosis, phagocytosis and Receptor mediated endocytosis.

Unit V**(15Hours)**

Cytoskeleton: Microfilaments–Actin-Structures, Assembly, Myosin. Microtubules-Organization and dynamics, Kinesin and dynein. Striated muscle -structure, excitation-contraction. **Cell signaling:** Cell-Cell signaling-Signaling molecules and their receptors: functions of cell surface receptors, pathways of intracellular signal transduction, second messengers-G-protein coupled receptors, neurotransmitters, receptor tyrosine kinases, Ras, MAP kinases. Signal transduction: cAMP, cGMP, phosphatidyl inositol, Ca^{2+} .

* denotes Self study

Teaching Methods

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

Text Books

1. Dr.VeerBalaRastogi (2018).A Textbook of Cell Biology and Genetics. KNRN Publishers.Meerut.
2. P.S. Vermaand V.K. Agarwal. (2014). Cell Biology, Genetics, Molecular biology,EvolutionandEcology,S.ChandandCompany,NewDelhi.

Reference Books

1. Harvey Lodish, Arnold Berket *al.*, (2007). Molecular CellBiology.6thedition, W H Freeman and Company, NewYork.
2. GarretteR.H and Grisham, C. M. (2013). Principles of Biochemistry. 5thedition, Saunders CollegePublishers.
3. Albertset 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, NewDelhi.
5. G. Karp. (2001). Cell and Molecular Biology. 3rdedition, John Wiley & Sons publisher.
6. Geoffrey M.Cooperand Robert E. Hausman. (2009). TheCell: A Molecular Approach. 5thedition, ASM Press, WashingtonD.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

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title : Core Practical 1 – Lab in Biomolecules, Bioinstrumentation, Enzymology and CellBiology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	4

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 ↑ ↓ K5	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
	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
	CO5	Be competent to perform various biochemical analysis.

Biomolecules

1. Estimation of Starch in potato
2. Estimation of Fructose in Fruits
3. Estimation of Glycogen in liver

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
8. Separation of amino acids 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

Demonstration/Video lectures/Laboratory visits/Institutional visits

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper: Core Paper 5–Plant Biochemistry and Biotechnology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

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 ↑ ↓ K5	CO1	Recall the biosynthesis of primary and secondary metabolites, nitrogen metabolism involved in plants
	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
	CO5	Evaluate various gene transfer techniques

Unit I

(15Hours)

Photo synthesis: Overview, Pigments and factors affecting photosynthesis. Light reactions: Red drop and Emerson's enhancement effect, Hill's reaction, Arnon's work, pigment systems I and II, photo oxidation of water, production of assimilatory powers, electron transport chain, cyclic and non-cyclic photophosphorylation. Dark reactions: C₃, C₄ and CAM pathway. Photorespiration.

UnitII**(15Hours)**

Nitrogen metabolism: Role of micro and macronutrients .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.

UnitIII**(15Hours)**

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

UnitIV**(15Hours)**

Secondary metabolites and plant tissue culture: Biosynthesis and functions of msand terpenoids. Functions of alkaloids, anthocyanins, Tanninsandlignin. 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.**

UnitV**(15Hours)**

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

* denotes Self study

Teaching Methods

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

Text Books

1. V.K. Jain. (2016). Fundamentals of Plant Physiology, 18th edition, S.Chandand Company Pvt.Ltd, NewDelhi.

2. S.K.Verma and Mohit Verma. (2008). A Textbook of Plant Physiology, Biochemistry and Biotechnology. 2nd edition. 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 Wiley and sons Publishers, UK.
4. William G. Hopkins. (2008). Introduction to Plant Physiology, 2nd edition, John Wiley and sons Publishers, UK.
5. Razdan M.K. (2003). An introduction to Plant Tissue culture. 2nd edition, 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

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper: Core Paper 6 – Metabolism and Metabolic Regulation			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	4

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

Unit I

(15Hours)

Carbohydrate Metabolism and regulation: An overview, energetics and regulation of glycolysis and gluconeogenesis. TCA cycle: steps: amphibolic nature of the Citric acid cycle- Anaplerotic mechanism. Electron transport chain and ATP production. Glycogen metabolism and its regulation. HMP shunt, Cori's cycle.

Unit II

(15Hours)

Lipid metabolism and regulation: An overview of fatty acid metabolism. Oxidation of fatty acid: alpha, beta and omega. Biosynthesis of fatty acid. Regulation of fatty acid metabolism. Metabolism of Ketone bodies - Formation, Utilization, Excretion and significance. Metabolism of triacylglycerol and phospholipids. Biosynthesis of cholesterol and its regulation. Metabolism of lipoproteins.

Unit III**(15Hours)**

Amino acid metabolism and regulation: Amino acid degradation: transamination, oxidative and non-oxidative deamination, decarboxylation. An overview on γ -glutamyl cycle. An overview: Methionine as methyl donor (SAM pathway). Urea cycle and its regulation. Catabolism of asparagine, glutamine, proline, cysteine and cysteine. Conversion of amino acids to Histamine, Serotonin, epinephrine and nor- epinephrine: Metabolism and function. Synthesis and regulation of pyruvate family, 3-Phosphoglycerate family and aspartate family of amino acids. Allosteric regulation of glutamine synthetase.

Unit IV**(15Hours)**

Nucleic acid metabolism and regulation: *Fate of dietary nucleic acids, Purines and pyrimidines biosynthesis (both de novo and salvage pathways) and degradation. Regulation of purine biosynthesis: PRPP aminotransferases. Regulation of pyrimidine biosynthesis: Aspartate carbamoyl transferase. Regulation of deoxyribonucleotides by activators and inhibitors.

Unit V**(15Hours)**

Integration of metabolism: Interconversion of food stuffs. Metabolic profile of the liver, adipose tissue and brain. Altered metabolism in starvation. Compartmentalization of metabolic pathway in the cell. Metabolic fuels: definition. Caloric value of metabolic fuels, metabolic relationship of tissues in various nutritional and hormonal states.

*denotes Self study Teaching

Methods

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

Text Books

1. Satyanarayana, U and Chakrapani, U. (2013). Biochemistry. 4th edition, Books and Allied Pvt. Ltd, Kolkata, 700010.
2. Robert K. Murray, Daryl K. Granner and Victor W. Rodwell. (2008), Harper's Illustrated Biochemistry. 29th edition, McGraw Hill Companies, Inc. New Delhi.

Reference Books

1. Voet, D., Voet, J.G. and Pratt, C.W. (2013). Fundamentals of Biochemistry, Life at the Molecular Level. 4th edition, John Wiley & Sons, New Delhi, 110002
2. Garret 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 Kannan Vaidyanathan (2011). Text Book of Biochemistry for Medical Students, 6th ed., JAYPEE Brothers Medical Publishers Pvt. 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-High

M-Medium

L-Low

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper: Core Paper 7 –Genetics and Molecular Biology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	4

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 ↑ ↓ K5	CO1	Able to define the basic concepts of gene
	CO2	Recognize the different processes involved in replication, transcription and Translation
	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
	CO5	Appraise the various concepts of regulation of genes.

Unit I

(15Hours)

Concept of gene: Molecular structure of gene and chromosomes. Mendelian Principles: Mono and dihybrid cross. Incomplete Dominance, Overdominance, 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.

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, hnRNA proteins, 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.Chand and Company, New Delhi.
2. Lodish, D. *et al.*, (2007). Molecular Cell Biology. 6th edition, Scientific American Books, Inc.

Reference Books

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

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper: Core Paper 8–Drug Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

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 ↑ ↓ K5	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.
	CO4	Examine the treatment of various disorders using drug molecules
	CO5	Contribute in understanding the mode of action of antibiotics.

Unit I

(15Hours)

Pharmacology: Classification of drugs, sources and preparation; natural source, synthetic drugs, drug preparation: crude drug, pure drug compounds, pharmaceutical preparations. Routes of drug administration: sublingual, buccal, oral, rectal, intravenous, intramuscular, subcutaneous, transdermal, inhalational and topical administration. Pharmacokinetics: Overview, drug absorption, drug distribution, drug biotransformation (role, formation and phases), drug excretion: quantitative pharmacokinetics, drug-plasma concentration curve, bioavailability, volume of distribution, drug clearance. Single dose pharmacokinetics, continuous and multiple dose kinetics, dosage calculations.

UnitII**(15Hours)**

Pharmacodynamics: Definition. Drug receptors: Types, classification, drug-receptor interaction (binding and affinity, signal transduction, efficacy, receptor regulation and drug tolerance). Dose-response relationships (gradual and quantal). Drug development and safety: Drug discovery and characterization, preclinical studies, clinical trials, drug safety and efficacy laws, drug abuse prevention laws, adverse effects of drugs, Factors affecting drug safety and efficacy. Antidepressant drugs: Overview and mechanism. Mechanism of action, therapeutic uses, kinetics and adverse effects of tricyclic antidepressants and monoamine oxidase inhibitors.

UnitIII**(15Hours)**

Pharmacokinetics: Mechanism of action, therapeutic uses, pharmacokinetics and adverse effects of Anti-inflammatory drugs - aspirin and colchicine, Anti-peptic ulcer drugs - H_2 receptor antagonists and inhibitors of H^+K^+ ATP-ase pump. Antihypertensive drugs: Overview, mechanism of controlling blood pressure, treatment strategies. Action, therapeutic uses, kinetics, adverse effects of β -adrenoceptor-blocking agents and ACE inhibitors. Anticoronary drugs.

UnitIV**(15Hours)**

Treatment of neurodegenerative diseases: Overview, neurotransmission in CNS, synaptic potentials, overview and drugs used for Alzheimer disease and Parkinson disease. Mechanism of action, therapeutic uses, kinetics and adverse effects of Hypnotic drug (barbiturates). Anesthetics: patient factors in selection of anesthesia, induction, maintenance and recovery from anesthesia, features, potency, uptake, distribution, action and adverse effects of inhalation anesthetics. *Intravenous and local anesthetics.

UnitV**(15Hours)**

Anticancer drugs: overview and principles of chemotherapy, treatment strategies, treatment regimens and scheduling, limitations of chemotherapy. Mechanism of action, therapeutic uses, pharmacokinetics and adverse effects of antimetabolites (Methotrexate and 5-fluorouracil), antibiotics (Dactinomycin and Bleomycin), alkylating agents (Cyclophosphamide), microtubule inhibitor (Vincristine and Vinblastine), steroid hormones and their antagonist (Tamoxifen), monoclonal antibody (Rituximab) and interferons.

* denotes Self study

Teaching Methods

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

Text books:

1. Richard.D.Howland, Mary. J.Mycek. Lippincott William and Wilkins. (2006). Lippincott's illustrated reviews: pharmacology. 3rdedition, WoltersKluwer health (India) Pvt. Ltd., NewDelhi.
2. R.S.Satoskar, NirmalaN. Reje, S. D.Bhandarkar. (2011). Pharmacologyand Pharmacotherapeutics. 22ndedition, Popular PrakashanPvt.Ltd.

Reference Books:

1. H L Sharma and K KSharma. (2011). Principles of Pharmacology 2ndedn. Paras Medical Publisher,India.
2. George M.Brunner, Craig W. Stevans. (2011). Pharmacology. 3rdedition, Saunders, an imprint of ElsevierInc.
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

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper: Core Practical 2 – Lab in Plant Biochemistry, Microbiology, Genetics and Molecular Biology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	4

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 ↑ ↓ K5	CO1	Corelate the principles of plant biochemistry, microbes, molecular biology and genetic techniques
	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
	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.

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
11. Isolation of Genomic DNA from onion and Agarose gel electrophoresis*
12. Isolation of Plasmid DNA from bacteria*
13. Extraction of total RNA*
14. Estimation of DNA by Diphenylamine method
15. Estimation of RNA by Orcinol method
16. SDS-PAGE*
17. Blotting techniques (anyone)*
18. Animal housekeeping, care, feed preparation and breeding of common laboratory animal-mice
19. 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

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper: Core Paper 9 – Immunology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	6	75	4

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 their resultant reaction responses
	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.

Unit I

(15Hours)

Cells of the immune system: Macrophages, B and T lymphocytes, Dendritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. Organs of the immune system: Thymus, Bone marrow, Spleen, lymph nodes, MALT, GALT. Haemopoiesis and differentiation, lymphocyte trafficking. Antigen-biology, structure and functions of different classes of Immunoglobulin. Biology of Superantigens.

Unit II

(15Hours)

Antigen and antibody: Antibody types and structural properties, characteristics of antigen. ***Antigen antibody reactions**, Applications of Immunological techniques, genetic control of immune response, effector mechanisms, MHC, antigen

recognition and presentation, activation of B and T lymphocytes.

Unit III**(15Hours)**

Humoral and cell mediated immunity: Cell mediated Cytotoxicity: 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, Biology of Complement system, Complement fixation test and assessment of immune complexes in tissues. Immune suppression and immune tolerance.

Unit IV**(15Hours)**

Hyper sensitivity reactions: Autoimmune disorders – Systemic Lupus Erythematosus and Rheumatoid Arthritis, Transplantation immunology- MLR, HLA Typing, Bone marrow transplantation, Organ transplants. Immunity to Infectious agents - Bacteria, Viruses, Malaria, and Helminthes. Tumor immunology, Tumor antigens, immune response to tumors, cancer immunotherapy, Vaccines. AIDS and other immunodeficiencies, Structure of HIV, envelope glycoproteins, destruction of T cells: immunologic symptoms of AIDS, AIDS vaccine.

Unit V**(15Hours)**

Vaccine technology: recombinant vaccines, Identification of B and T epitopes for vaccine development. *In situ* characterization of cells from tissues, Immunoscreening of Recombinant library, Hybridoma – Monoclonal Antibody production and applications; MAbs in diagnosis and therapy.

* denotes Self study

Teaching Methods

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

Text Books

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

Reference Books

1. Ivan M. Roitt and Peter J. Delves (2001) Essential Immunology, Blackwell Science Ltd, Oxford.
2. Stefan E. Kaufmann, Alan Sher and Rafi Ahmed (2002) Immunology of Infectious diseases, ASM Press, USA.

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper : Core Paper 10 –Genetic Engineering			
Batch	Hours / Week	Total Hours	Credits
2022-2023	7	75	4

Course Objectives

- To enable the student to learn the principle and application of genetic engineering
- 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
	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.

Unit I

(15Hours)

Genetic engineering: Introduction and its applications. Properties and applications of Restriction enzymes (Type I, Type II, Type III, Type IV and Type V), DNases, Polymerases, Modifying enzymes and Ligases. Linkers, Adaptors and Homopolymertailing. Benefits of gene cloning. Isolation of nucleic acids, characterization and purification of plasmid, bacteriophage genomic DNA for cloning purpose

Unit II

(15Hours)

Cloning vectors: Plasmids (pBR322 and pUC18), Phages (λ 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.

Unit III**(15 Hours)**

cDNA libraries: Construction of genomic and cDNA libraries, selection and screening of recombinants, probes types, synthesis and uses of probes. Blotting techniques (Southern, Northern and Western), PCR types and applications. Chromosome walking, jumping, DNA finger printing and foot printing. Screening with antibodies, rescreening and subcloning.

Unit IV**(15 Hours)**

Gene transfer methods in animal cells: Microinjection, electroporation, particle bombardment gun, ultrasonication, liposome mediated and direct transfer. Restriction analysis of DNA, molecular markers: ***RFLP**, **RAPD**, **VNTR**, **SSR**, **AFLP**, **STS**, **SCAR**, **SNP**. Microarrays. Human genomic project and applications.

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, gene therapy for inherited diseases; familial hypercholesterolemia, hemophilia, ADA deficiency (SCID) and Cystic fibrosis.

* denotes Self study

Teaching Methods

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

Text Books

1. Twyman, B. Old and S. B. Primrose (2001). Principles of Gene Manipulation: An Introduction to Genetic Engineering, 6th ed., John Wiley and Sons Publishers, UK.
2. Primrose *et al.*, (2001). Principles of gene manipulation. 6th edition, Blackwell Scientific Publishers.

Reference Books

1. T.A. Brown (2015), Gene Cloning and DNA analysis, 7th ed., Blackwell publishing Ltd, UK.
2. Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th ed., ASM Press, USA
3. Winnacker, E.L. (2003). From Genes to Clones. Panima Publishing Corporation, New Delhi.
4. Old et al. (2001). Principles of Gene Manipulation, 6th Edition. Blackwell Science, London.

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper Core Paper11– ClinicalBiochemistry			
Batch 2022-2023	Hours / Week 2	Total Hours	Credits 2

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  K5	CO1	Correlate the important laboratory biochemical tests
	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	Criticize the diagnostic procedures for tumor development
	CO5	Evaluate the role of free radicals in various diseases.

Unit I

(15 Hours)

Specimen collection and processing: Collection of blood vein puncture, skin puncture, arterial puncture. **Collection of urine:** Timed urine specimens, urine preservatives. Clinical significance of urinary components with reference to sugars, proteins, ketone bodies, bilirubin and porphyrins. Microscopic examination of urine, Abnormal and normal constituents of urine. Body fluids-CSF, gastric juice, ascitic fluid, synovial fluid and amniotic fluid: Composition, collection and analysis. Quality control in clinical laboratory.

Unit II**(15Hours)**

Serology and hematology: Introduction. Anti serum, anti seraraising, chick andsnake venom antibody. Principle of agglutination and precipitation.C-reactive proteinand pregnancy test, Rhumatoid arthritis (RA) test. ESR, Coagulation test, prothrombintest.WIDAL test, ELISA, chemiluminescence, CMIA, ECLIA, flow cytometry.**Hemoglobin:** Normal and abnormal Hb, Separation of hemoglobin by electrophoresis. Hemoglobinopathiesand itstypes.GlycatedHb. Erythrocyte metabolic pathways, Disorder of erythrocyte metabolic pathways, Porphyrinsand porphyrias.

Unit III**(15Hours)**

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

Unit IV**(15Hours)**

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 pancreaticfunction test. Estimation of GFR and cystatinC in serum. Hyper and hypo lipoproteinemiasand diagnostic test for lipoprotein disorders. Diabetes mellitus.Fattyacid disorder – atherosclerosis.

Unit V**(15Hours)**

Free radicals in diseases: Introduction, *Types of free radicals. Free radical induced lipid peroxidation and antioxidants (Enzymic: SOD, Catalase, Glutathione Peroxidase, Glutathione Reductase; Non Enzymic: Vitamin A, Ascorbic acid, Tocopherol, ReducedGlutathione).

* denotes Self study

Teaching Methods

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

Text Books

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

Reference Books

1. Carl A. Burtis, Edward R. Ashwood, Norbert W. Tietz. (2012). Tietz Textbook of Clinical Chemistry and molecular diagnostics. 5th ed, Saunders college publishing, Harcourt Brace College Publishers, Philadelphia, Newyork, Tokyo.
2. Vasudevan D.M, Sreekumari S and Kannan Vaidyanathan, (2011), Text Book of Biochemistry for Medical Students, 6th ed., Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi, 110002.
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 medicine Vol. I and II. 14th edition, McGraw Hill Publishers

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper : EDC - Nutritional Biochemistry			
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 5

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
	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.
K5 ↓	CO4	Discriminate the diseases caused due to protein deficiency
	CO5	Employ the role of diet in various diseases.

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

UnitII (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.

UnitIII (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 proteinintake

UnitIV (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

UnitV (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

PowerPoint presentation/Seminar/Quiz/Discussion/Assignment, Model preparation

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.

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper Core Practical 3 – Lab in Immunology, Genetic Engineering and Clinical Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

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
		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.

Immunology

1. ELISA method
2. WIDAL test
3. Single radial immunodiffusion
4. Double immunodiffusion
5. Ouchterlony double diffusion
6. Immunoelectrophoresis
7. Rocket immunoelectrophoresis
8. Restriction digestion and ligation*

9. cDNAsynthesis*
10. Bacterialtransformation*

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper Core Paper 12 – Hormonal Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

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 ↑ ↓ K5	CO1	List the diverse group of hormones and their specific mechanism of action in the bodily metabolism
	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
	CO4	Differentiate the role of hormones in various biological organs
	CO5	Evaluate the biological action of different hormones .

Unit I**(15****Hours)**

Principles of endocrinology: Scope of Endocrinology, Nature of Hormones and its types, Receptor Families, Synthesis and Processing, Hormone Secretion, Transport, and Degradation. Hormone Action through Receptors – Membrane, Nuclear and Cytosolic Receptors. Functions of Hormones – Growth, Maintenance of Homeostasis and Reproduction. Hormonal Feedback Regulatory Systems-Paracrine and autocrine control, Hormonal Rhythms.

UnitII (15**Hours)**

Hypothalamus and pituitary hormones: Hypothalamic and pituitary axis hormones- Chemistry & biochemical functions; Hypothalamic releasing factors. Pituitary gland: hormones of the pituitary gland- Chemistry & biochemical functions - neurovascular hypothesis; pineal gland- hormones of the pineal gland- Chemistry & biochemical functions.

UnitIII (15**Hours)**

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

UnitIV (15**Hours)**

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.

UnitV (15**Hours)**

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

* denotes Self study

Teaching Methods

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

Text Books

1. MacE. Hadley (2009). Endocrinology. 4th edition. Prentice Hall International Inc

2. Harrison's Endocrinology, (2017). 4nd edition, Edited by J. Larry Jameson, The McGraw Hill Companies, Inc.USA.

Reference Books

1. A. Longstaff. (2002). Instant notes: Neuroscience. 1st Indian edition, BIOS Scientific Publishers Ltd, UK John E. Hall, Mario Vaz, AnuraKurpad, Tony Raj. (2016).
2. Guyton & Hall (2016). Textbook of Medical Physiology. 2nd South Asian edition, Elsevier publications.
3. Shlomo Melmed *et al.*, (2011). William's Textbook of endocrinology. 12th edition, Philadelphia: Elsevier/Saunders.

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

Programme C ode: 07		Programme Title: M.Sc Biochemistry	
Title of the paper: Core Paper Methodology13-Biostatistics and Research			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	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 soon

Course Outcomes (CO)

	K1	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
	K5	CO5	Contribute the research knowledge in report writing.

Unit I

(15Hours)

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.

UnitII**(15Hours)**

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 LocalControl).

UnitIII**(15Hours)**

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.

UnitIV**(15Hours)**

Classification and tabulation of data. Diagrammatic & graphic presentation of data. Problems involving arithmetic mean, median, mode, quartiles, deciles and percentiles. **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).

UnitV**(15Hours)**

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.

* denotes Self study

Teaching Methods

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

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, 28thedition, 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 Publisher.
3. S.P.Gupta. (2016). Fundamentals of Statistics. 6thedition, 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

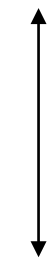
L –Low

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper Major Elective: Nanobiotechnology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 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
		CO4	Apply the knowledge of nanotechnology in biological research
	K5	CO5	Employ and apply the knowledge of nanotechnology in wastewater treatment, agriculture and diseases.

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, Intramolecular bonding, 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 - Cell Biochips - Nanoparticles for Bioimaging – Textile and pharma industries. Application in environment, agriculture and pesticide diagnosis. Nanorobotics. Military applications of Nanotechnology - Nanomaterials for food Applications. Diagnosis and nano Toxicity of Nanoparticles - Future Perspectives.

* **denotes Self study**

Teaching Methods

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

Text Books

1. T.Pradeep. (2008). Nano: The Essentials: Understanding Nanoscience and Nanotechnology. Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan. (2005). Nanoscale Science and Technology. John Wiley & Sons, Ltd., UK.

Reference Books

1. Guozhong Gao. (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	Programme Title: M.Sc Biochemistry		
Title of the paper Major Elective – Microbiology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	5

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.
	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 pathogenesis.

Unit I

(15Hours)

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

(15Hours)

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**(15Hours)**

Food Microbiology: Food poisoning – Food borne diseases- Bacterial and Non-Bacterial. Microbial quality and safety – Determining microorganisms in food culture, 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. Antibio gram. Bacteriology: Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of Gram positive 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 to laboratory diagnosis. Mycosis-Superficial, Subcutaneous and Systemic infections-*Candida albicans*. Parasitology: Pathogenicity and laboratory diagnosis of *Plasmodium vivax*.

* denotes Self study

Teaching Methods

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

Text Books

1. Prescott. (2003). Microbiology. 3rd edition, Magrawhill, Boston
2. Pelczar M.J., Ried, RD and Chan, ECS. (2000). Microbiology. 5th edition, McGrawHill

Reference Books

1. Ananthanarayanan and Jayaram Paniker. (2005). Text Book of Microbiology. 6th edition Orient Longman, Hyderabad.
2. Standby and Wittaker. (2008). Principles of Fermentation Technology. 2nd edition.
3. Davis *et al.*, (2001). Microbiology. 4th edition, Lippincott Williams and Wilkins.

MAPPING

CO \ PSO	PSO 1	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	Programme Title: M.Sc Biochemistry		
Title of the paper Major Elective: Bioinformatics			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	5

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

UnitI

(15Hours)

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.

UnitII

(15Hours)

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 itsadvantages.

UnitIII**(15Hours)**

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.

UnitIV**(15Hours)**

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.

UnitV**(15Hours)**

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 to progress.

* denotes Self study

Teaching Methods

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

Text Books

1. Prakash S. Lohar (2009). Bioinformatics. MJ Publishers.
2. Jean-Michel Claverie and Cedric Notredame. (2012) Bioinformatics-A beginner's guide. 1st edition, Wiley- Dream Tech India Pvt. Ltd.

Reference Books

1. David. W. Mount. (2001). Bioinformatics. CBS publishers and distributors.

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	Programme Title: M.Sc Biochemistry		
Title of the paper Major Elective - Bioethics, Biosafety and IPR			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	5

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 ↑ ↓ K5	CO1	Remember the ethical issues of scientific research
	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.

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 Department of Biochemistry, Kongunadu Arts and Science College, Coimbatore – 641029. Page No: 59

regulations (National and International) – operation of biosafety guidelines and regulations – types of biosafety containment.

UnitIV

(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).

UnitV

(15Hours)

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

*** denotes Self study**

Teaching Methods

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

Text Books

1. Jose Cibelli, Robert P. Ianza, 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. BCII, 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		Programme Title: M.Sc Biochemistry	
Title of the paper Non Major Elective – Environmental Management			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	5

Course Objectives

1. To learn the various issues pertaining to the environment
2. To combat the environmental issues with efficient strategies
3. To assess the various existing environmental risk issues

Course Outcomes (CO)

K1 ↑ ↓ K5	CO1	Recognize the subject of environmental management
	CO2	Demonstrate the issues concerned with environmental management
	CO3	Analyze the various issues of importance
	CO4	Criticize the right decision on combating upcoming environmental Issues
	CO5	Employ the role of assessment of risk in the management of environment.

Unit I

(15 Hours)

Concept and scope of Environmental Management: Environmental Management of Resources - Water, forest, biological, mineral and agricultural; Environmental management of chemical, mining and manufacturing industries –petroleum, coal, cement, paper, fertilizer. Analysis and prediction of Environmental issues: Environmental Planning, Establishment of Health and Environmental standards, measuring Sustainable Development, Life Cycle Assessment, Material Flow Analysis, Environmental Auditing and Environmental Management Systems and Accounting for Eco-efficiency.

UnitII**(15Hours)**

Principles of Risk Assessment: Human Health Risk Assessments, Ecological Risk Assessment, Probabilistic Risk Assessments, Determination of acceptable risk based limits for Environmental chemicals and development of riskbased remediation goals.

UnitIII**(15Hours)**

The role of Risk Assessment in Environmental Management decisions : Evaluation of Human Health Risks Associated with airborne exposures to asbestos, a diagnostic human health risk assessment for a contaminated site problem and a risk based strategy for developing a corrective action, Response plan for petroleum – contaminated sites, Risk Management and Risk Communication.

UnitIV**(15Hours)**

Basic concepts of Environmental Economics: International Trade and its Environmental Integrity, Ecolabelling, responsible care, design for the Environment and full-cost accounting for municipal solid waste management, Waste lands and their reclamation, Desertification and its control. Soil erosion, Formation and reclamation of user, alkaline and saline soil, Terra Preta [black carbon] soil in Amazon forests for sustainability in soil; Biochars for energy production and as mitigation measures for global warming and ***soil rejuvenation**.

UnitV**(15Hours)**

Environmental Education and Communication: Environmental Conflict Management, Sustainable development-concept, and growth of the idea, indicators of sustainability, Sustainability of Water Resources, Sustainable Management of Forests, Sustainability in Industry, Ecosystem Management: Coastal Environments, River and Inland Water Environments, Wetlands, Desert margins, Rural and Urban Environments. Current environmental issues in India – Case studies: Narmada Dam, Tehri Dam, Almetti Dam.

*** denotes Self study**

Teaching Methods

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

Text Books

1. Sally L. Benjamin and David, A. Bullock. (2001). Practical Guide to Understanding Management and Reviewing Environmental Risk Assessment Reports. Lewis Publishers, Washington D.C
2. Mary K. Theodore, Louis Theodore (2009). Introduction to Environmental Management. 1st Edition.

Reference Books

1. M.C. Dash (2019). Concepts of Environmental Management for Sustainable Development. Dreamtech Press.
2. Kart A, Frantzen. (2001). Risk based analysis for Environmental Managers. Lewis Publishers Washington D.C.

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	M	S
CO2	S	M	S	M	S
CO3	H	S	M	S	M
CO4	S	H	M	M	H
CO5	S	M	S	S	H
	S –Strong	H –High	M –Medium	L –Low	

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper Non Major Elective – Competitive Science			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	5

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

Unit I

(15Hours)

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

(15Hours)

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. Fundamental Processes: DNA

replication, repair and recombination - RNA synthesis and processing – Protein synthesis and processing - Control of gene expression at transcription and translation level.

Unit III**(15Hours)**

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**(15Hours)**

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 DNA methods - Histochemical and Immunotechniques- Biophysical Methods - Statistical Methods - Radiolabelling techniques - Microscopic techniques - Electrophysiological methods - Methods in fieldbiology.

Unit V**(15Hours)**

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.

* denotes Self study

Teaching Methods

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

Textbooks:

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

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		Programme Title: M.Sc Biochemistry		
Course Code: NA		Title of the paper Non Major Elective – Bioprocess Technology		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	NA	5	75	5

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

Unit I

(15Hours)

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

UNIT II

(15Hours)

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

(15Hours)

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. Inoculation development for Industrial fermentations. Scale up and scale down.

UNIT IV**(15Hours)**

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, DO₂, agitation and foam level. PID control and computer aided control.

UNIT V**(15Hours)**

Downstream processing: Overview. Primary separation - Cells, Solid matter and foam- precipitation, filtration, centrifugation, cell disruptions (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).

* denotes Self study

Teaching Methods

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

Textbooks:

1. El – Mans, E.M.T., and Bryce, C.F.A. (2002). Fermentation Microbiology and Biotechnology. Taylor & Francis group
2. Stanbury, P. F. & A. Whitaker. (2003). Principles of Fermentation Technology. Pergamann Press, Oxford.

Reference books:

1. M.L. Shuler and F. Kargi. (2003). Bioprocess engineering: Basic Concepts. Prentice Hall, Englewood Cliffs.
2. W. Cruger & A. Cruger. (2003). A Textbook of Industrial Microbiology. Panima Pub. Corp., New Delhi.
3. R.K. Rajput. (2003). Heat and Mass Transfer in SI units. S Chand and Co. Ltd., New Delhi.

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		Programme Title: M.Sc Biochemistry		
Title of the paper Non Major Elective – Cancer Biology				
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	NA	5	75	5

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 ↑ ↓	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
K5	CO5	Employ various strategies in the treatment of cancer

Unit I

(15Hours)

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

(15Hours)

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.

UnitIII**(15Hours)**

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.

UnitIV**(15Hours)**

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).

UnitV**(15Hours)**

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).

* denotes Self study

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/GoogleClassroom

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 University Press.
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 H Freeman and Company, New York.

MAPPING

CO \ PSO	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

**KONGUNADU ARTS AND SCIENCE COLLEGE
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Re-accredited by NAAC with 'A' Grade Status – 3.64CGPA out of 4 (3rdCycle)

College of Excellence (UGC)

COIMBATORE – 641029, TAMIL NADU, INDIA.

**QUESTION PAPER PATTERN FOR CIA & END OF SEMSTER
EXAMINATION**

M.Sc., BIOCHEMISTRY

1. THEORY

Max Marks =75

Time = 3.00hrs

SECTION-A

(10 x 1=10marks)

Choose the correct answer type.

Q.No. 1 to 10: Multiple choice type alone.

Questions with four alternative (distracter) answers each (Two questions from each unit).

Q.No. 11 to 15: Fill in the blanks alone.

(5 x 1=5marks)

Q.No. 16 to 20: one word answer alone.

(5 x 1=5marks)

SECTION-B

(5 x 5=25marks)

Short answer questions

Q.No. 21-28: Answer any 5 out of 8

SECTION-C

(3x 10=30marks)

Essay type of questions:

Q.No. 29-33: Answer any 3 out of 5

2. BREAK UP OF INTERNAL MARKS (25marks)

Internal marks (50) = CIA (out of 30) + problem based Assignment (out of 10) + Attendance (out of 5) + others(out of 5)

***CIA marks (out of 30 marks) = I CIA marks + II CIA marks / 150 X 15 PBC**

79

3. PRACTICALS–QuestionPattern&Break-upofmarks**END OF SEMESTER PRACTICAL EXAMINATION**

Max. Marks: 50

Duration: 3hrs

I. Major (Onequestion) (1 x 15= 15)

II. Minor (Onequestion) (1 x 10 = 10)

III. Spotters (3 x 5=15)

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

IV. Viva (05)

V. Record/Observation* (05)

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

INTERNAL - PRACTICAL MARKS

From Model Practical Examination	-	30
Observation	-	15
Attendance	-	5
Total	-	50

PRACTICALS – Question Pattern & Break-up of marks

END OF SEMESTER PRACTICAL EXAMINATION

Max. Marks: 50

Duration: 3hrs

- | | | |
|----------------------------------------------------------------------------|----------------|---------------|
| I. Major | (One question) | (1 x 15 = 15) |
| II. Minor | (One question) | (1 x 10 = 10) |
| III. Spotters | | (3 x 5 = 15) |
| Examine, identify and critically comment on the spotters A, B, C, D and E. | | |
| IV. Viva | | (05) |
| V. Record/Observation* | | (05) |

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

INTERNAL - PRACTICAL MARKS

From Model Practical Examination	-	30
Observation	-	15
Attendance	-	5
Total	-	50

PBC 81**PROJECT VIVA-VOCE EXAMINATION****Maximum marks: 100****Continuous Internal Assessment (CIA)**

Project review I&II	- 45 marks
Regularity	- 5marks
Total	-50marks

End of Semester Examination (ESE)

Projectreport	- 35marks
Viva-voce	- 15marks
Total	- 80marks

=====

CIA	- 50marks
ESE	- 50marks
Total	- 100marks

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper ALC – Forensic Science			
Batch 2022-2023	Hours / Week NA	Total Hours NA	Credits 4

Course Objectives

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

Course Outcomes (CO)

K1 ↑ ↓ K5	CO1	Define the basic concepts of forensic science
	CO2	Understand the identification procedures employed under forensic science
	CO3	Apply the fingerprint analysis and interpretations in research fields
	CO4	Examine and analyze the results involved in fingerprinting technique
K5	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 thanatology; death; causes of death; mechanism and manner of death; changes after death; artifacts; medico legal Death in investigation; 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 tyre marks shoeprints. Forensic examination of vehicles in cases of accident. Identification of individualization from foot prints and teeth.

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 lie detection. History, classification, search, lifting and examination of fingerprints. Various methods for the development of latent fingerprints, ***Crime records and computerization.**

*** denotes Self study**

Teaching Methods

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

Text Books

1. Narayanareddy K. S. (2007). The Essentials of Forensic Medicine & Toxicology. 26th edition, K. Sugana Devi publishers, Hyderabad.
2. Basu, R. (2009). Fundamentals of forensic medicine and toxicology. 2nd Edition, Books and Allied (P) Ltd. Kolkata.

Reference Books

1. Pillay V.V. (2009). Text book of Forensic Medicine, Paras Publication. Hyderabad.
2. JB Mukherjee's. (2007). Forensic Medicine and Toxicology-Volume I and II (combined)-edited by Karmakar, 3rd edition.
3. R. Saferstein. (2004). Criminalistics. 8th edition, Prentice Hall, New Jersey.

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: 22PBCOD2

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper ALC – Nutraceuticals and Functional Foods			
Batch	Hours / Week	Total Hours	Credits
2022-2023	NA	NA	4

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 ↑ ↓ K5	CO1	Remember the complete history of nutraceuticals
	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 Nutraceutical Science 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, Isoprenoid derivatives, Glucosamine, Octacosanol, flavonoids, carotenoids, polyunsaturated fatty acids, lecithin, choline and sphingolipids, Lycopene, Carnitine, Melatonin and Ornithine alpha-ketoglutarate

as nutraceuticals. 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 cosmoceuticals and aquaceuticals. Animal metabolites – Functions, Sources - chitin, chitosan, glucosamine, chondroitin sulphate and 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 isoflavones in human health; Role of nuts in 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, Capsicum annum, mustards, Ginseng, garlic, citrus fruits, fish oils, and seafoods.

Unit V

Food as remedies: Nutraceuticals bridging the gap between food and drug, Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.

* denotes Self study

Teaching Methods

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

Text Books:

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

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. Clinical dietetics and nutrition 2001 4th Edition, Oxford Univ Press.
- 3.Sizer, F. & Whitney, E. (2000). Nutrition-Concepts & Controversies. 8th edition, Wadsworth Thomson Learning.

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

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper ALC –Stem CellBiology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	NA	NA	4

Course Objectives

1. To learn about the technology of stem cellspreparation
2. To learn the properties of stemcells
3. To prepare stem cells for genetherapy

Course Outcomes (CO)

	K1	CO1	Recall the different types of stem cells and its applications
		CO2	Explain the importance of gene therapy in various diseases
		CO3	Interpret implement the stem cell in therapies
		CO4	Examine the molecular concepts of stem cell
	K5	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,keratinocytstem cells of cornea, skin and hair follicles, tumor stem cells. Factors influencing proliferation and differentiation of stem cells. Role of hormoneindifferentiation.

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 drugdiscovery 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.**

* denotes Self study

Teaching Methods

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

Text Books

1. KursadandTurksen.(2002).EmbryonicStemcells,HumanaPress.

Reference Books

1. Stem cell and future of regenerative medicine. By committeeon the Biologicaland Biomedical applications of Stem cell Research. (2002). NationalAcademic 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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper JOC –Bio-Entrepreneurship			
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 4

Course Objectives

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

Course Outcomes (CO)

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

Unit I

(6Hours)

Basics of Bioentrepreneurship Introduction to bioentrepreneurship– Biotechnology in a global scale, Scope in Bioentrepreneurship, Importance of entrepreneurship. Meaning of entrepreneur, function of an entrepreneur, types of entrepreneur, advantages of being entrepreneur. Innovation – types, out of box thinking, opportunities for Bioentrepreneurship. Entrepreneurship development programs of public and private agencies (MSME, DBT, BIRAC, Startup and Make in India). Patent landscape, IP protection and commercialization strategies.

Unit II

(6Hours)

Management, Accounting and Finance 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&L account,

double entry book keeping, estimation of income, expenditure and Income tax. Collaborations and partnerships, information technology for business administration and expansion.

Unit III**(6Hours)**

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)

Unit IV**(6Hours)**

Medium & Small Scale Industry Definition, characteristics, need and rationale, objectives, scope and advantages of small scale industries. Types of bioindustries— Pharma, Agri and Industry. Biofertilizers production - *Azospirillum, Azolla, Cyanobacteria and its applications. Biopesticides production- Bacterial, fungal, viral and plant insecticides. Sericulture. Apiculture. Dairy farming. Single Cell Protein Production and applications. Vermicomposting and its applications. Mushroom cultivation and its application. Ancillary and tiny industries

Unit V**(6Hours)**

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 and teamwork.

* denotes Self study

Teaching Methods

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

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper JOC - Food Safety and Quality Control			
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 4

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 ↑ ↓ K5	CO1	Repeat the various steps in the quality control of food items
	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
	CO5	Evaluate the methods in standardization of quality control of foods.

Unit I

(6Hours)

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.

Unit II

(6Hours)

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

Unit III

(6Hours)

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

UnitIV**(6Hours)**

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**(6Hours)**

Food safety, Risks and hazards: Food related hazards, Microbial consideration in food safety, HACCP-principles and structured approach. Chemical hazards associated 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. 2nd 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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper JOC –Clinical and Therapeutic Nutrition			
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 4

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 preparation 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
K5 ↓	CO3	Interpret the lifestyle and nutritional assessment techniques
	CO4	Analyze the main nutrients and its functions in the body
	CO5	Appraise the role of probiotics in diet.

Unit I

(6Hours)

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.

Unit II

(6Hours)

Dietician and Nutrition counselling: Role of dietician on hospitalized and outdoor patients and development of nutritional care plan. Specific functions of a therapeutic, administrative and consultant dietician. Team approach in patient care.

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

Unit III**(6Hours)**

Weight imbalances, anorexia nervosa and Bulimia nervosa, cardiovascular disorders, 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.

Unit IV**(6Hours)**

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.

Unit V**(6Hours)**

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.**

* denotes Self study

Teaching Methods

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

Text Books

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

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

Reference Books

1. Antia F.P. And Philip Abraham. (2001). Clinical Nutrition and Dietetics. Oxford Publishing Company, New Delhi.
2. Williams, S.R. (2003). Nutrition and Diet Therapy. 7th edition, Times Mirror/Mosby College Publishing
3. Esther A. Winterfeldt, Margret L. Bogle, Lea L. Ebro. (2011). Dietetics: Practice & Future Trends. 3rd edition, Jones and Barlet Publishers.

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

CERTIFICATE COURSE IN MEDICAL LABORATORY TECHNOLOGY

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

Re-accredited by NAAC with 'A' Grade Status – 3.64 CGPA out of 4 (3rd Cycle)

College of Excellence (UGC)

COIMBATORE – 641029, TAMIL NADU, INDIA.

Course Name: M.Sc. Biochemistry Curriculum

and Scheme of Examination under CBCS

(Applicable for the Students Admitted during the Academic Year

2022-2023 onwards)

Subject code/ Question paper code	Title of the paper	Instructions hours/cycle	Exam Marks			Duration of Exam (Hrs)	Credits
			CIA	ESE	Total		
22PBC0F1	Paper I: Biochemistry	2	-	100	100	3	4
22PBC0F2	Paper II: Clinical Pathology and Microbiology-I	2	-	100	100	3	4
22PBC0F3	Practical I	2	-	100	100	3	4
22PBC0F4	On the Job training and Viva voce	2	-	100	100	3	8

Sub Code:22PBC0F1

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper Paper I-Biochemistry			
Batch	Hours / Week	Total Hours	Credits
2022-2023	2	60	4

Course Objectives

1. To acquire the knowledge on laboratory safety and measures
2. To know the techniques of biochemistry and clinical chemistry
3. To obtain information about various enzymes analysis and analytical techniques

Course Outcomes (CO)

K1 ↑ ↓	CO1	Commemorate the basics of laboratory practices
	CO2	Explain the relation between colorimetric and titrimetric techniques
	CO3	Interpret various clinical laboratory techniques
K5	CO4	Analyze the basic concepts in automation.
	CO5	Appraise the mechanism of management of laboratory.

Unit I**(12Hours)**

Laboratory safety and Specimen processing: General approach to medical laboratory sciences. Safety in laboratory. General laboratory instruments and equipments. Basic chemistry and laboratory chemicals. Specimen processing for biochemical analysis: blood, urine, CSF.

Unit II**(12Hours)**

Biochemical techniques: Principles of analytical techniques. Basic concepts in analytical chemistry, colorimetry, spectrophotometry, titrimetry, flame photometry, chromatography, electrophoresis, PCR, Real time PRR. Immunochemistry: ELISA, RIA, CLIA, flow cytometry and biochips.

Unit III**(12Hours)**

Clinical chemistry: Biochemical tests: glucose, protein, albumin, urea, creatinine, uric acid, bilirubin and cholesterol. Enzymes: *SGOT, SGPT, ALP, ACP, LDH, creatinine kinase, lipase, amylase, choline esterase. Hormones: Insulin, T3, T4, TSH, cortisol, FSH, progesterone and estrogen. Electrolytes and blood gases. Biochemical profile test: liver function test, renal function test, gastric function test, pancreatic function test and endocrine function test.

Unit IV**(12Hours)**

Automation in clinical laboratory: Basic concepts, automation of the analytical processes, steps of automation in biochemical analysis, computers in the clinical laboratory, types of automated analysers, commonly used analysers of biochemical

laboratories. Statistical procedures: Arithmetic mean, median, standard deviation, coefficient of correlation, t test and ANOVA

Unit V**(12Hours)**

Laboratory management: Clinical laboratory informatics, computer systems, laboratory information systems. Laboratory management: Basic concepts, financial management, quality management-fundamentals, total quality management of clinical laboratory.

Reference Books

1. Ochei J and Klohatkar A. (2000). Medical Laboratory Science-Theory and Practice. Tata McGraw Hill Publishing Company Limited.
2. Chatterjee M N and Shinde R. (2002). Text book of Medical Biochemistry. 5th edition. Jaypee Brothers Medical Publishers.

MAPPING

CO \ PSO	PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	S	S	S
CO2	M	S	S	M	M	M
CO3	S	H	M	S	H	H
CO4	M	S	H	H	S	S
CO5	S	M	H	S	M	M

S-Strong

H-High

M-Medium

L-Low

Sub Code:22PBC0F2

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper Paper II-Clinical Pathology and Microbiology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	2	60	4

Course Objectives

1. To acquire the knowledge on microbial techniques
2. To know the techniques of serological procedures
3. To obtain information on hematological processing

Course Outcomes (CO)

K1 ↑ ↓	CO1	Recall the basics of microbiology.
	CO2	Explain the relation between various infectious agents
	CO3	Interpret sero diagnostic techniques
K5	CO4	Analyze the basic concepts in clinical pathology
	CO5	Evaluate the mechanisms in hematology

Unit I**(12Hours)**

Microbiology: Introduction to diagnostic microbiology and microbiological techniques. Role of microbiology in laboratory, specimen handling, laboratory records maintenance, safety regulations, basic procedures of diagnostic microbiology, culture environment of microbes and quality control in microbiology.

Unit II**(12Hours)**

Diagnostic Bacteriology: Systemic grouping of pathogenic bacteria, laboratory identification of infectious agents, diagnosis of anaerobic infection, identifying characteristics of common pathogenic bacteria. Anti microbial susceptibility test.

Diagnostic of mycotic infection: Introduction to fungi, parasitic fungi, specimen collection, laboratory diagnosis of mycotic infection, diagnostic mycology.

Unit III**(12Hours)**

Serology: Serology and serodiagnostic procedures: Principles of immunological reactions, serodiagnosis. Laboratory procedures in serology: Collection and preparation of specimen. CRP test, RA test, ASO test, HIV, immunologic test for pregnancy.

UnitIV**(12Hours)**

Clinical Pathology: Clinical pathology and urine analysis: Urine analysis, routing examination of urine, rapid chemical test of urine. Laboratory examination of miscellaneous body fluids: CSF, serous fluids, synovial fluids and gastric juices. Semen analysis: Clinical examination, specimen collection, laboratory investigation. Stool examination: Clinical significance, collection of faecal specimen and laboratory investigations.

UnitV**(12Hours)**

Hematology: Components of blood and their function, specimen collection. Routine haematological test: RBC, WBC, DC, TC, platelet, *Hb, EST, PCV. Bleeding disorders: Bleeding time, clotting time, routine coagulation test. Blood banking: Human blood grouping system, transfusion reactions, collection and processing of blood for transfusion.

Reference Books

1. OcheiJ and KlohatkarA. (2000). Medical Laboratory Science-Theory and Practice. Tata McGraw Hill Publishing Company Limited.
2. ChatterjeeMN and ShindeR. (2002). Text book of Medical Biochemistry. 5th edition. Jaypee Brothers Medical Publishers.
3. VarleyS. (1988). Practical Clinical Biochemistry. 6th edition, CBS Publishers and Distributors.

MAPPING

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

S–Strong

H–High

M–Medium

L –Low

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper : Practical I			
Batch	Hours / Week	Total Hours	Credits
2022-2023	2	60	4

Course Objectives

1. To attain the knowledge on serum and urine analysis
2. To know the principles and techniques of microbiology
3. To acquire knowledge on pathological techniques

Course Outcomes (CO)

K1 ↑ ↓ K5	CO1	Recall the basics of biological samples
	CO2	Explain the experiments in Biochemistry
	CO3	Interpret various clinical laboratory techniques
	CO4	Analyze the pathogens used in microbiology..
	CO5	Be competent enough to handle various clinical pathology experiments.

Biochemistry:

1. Analysis in serum:
Glucose, creatinine, uric acid, cholesterol, urea, bilirubin, total protein, albumin, total lipids, triglycerides, HDL
2. Analysis in urine:
Glucose, creatinine, uric acid, urea
3. Analysis in CSF: Sugar and protein
4. Enzymes: SGOT, ALP, LDH, CK, lipase, amylase and choline esterase
5. Hormones: Insulin, TSH, estrogen
6. Electrolytes in serum and urine: Sodium, potassium, chlorides, calcium
7. Routine complete urine analysis

Microbiology:

8. Sterilization and media preparation

9. Staining procedures: Simple, differential, negative and acid fast staining
10. Identification of pathological organism
11. Biochemical analysis of microbial strains
12. Processing of clinical specimens: Urine, pus, blood and other body fluids

Clinical Pathology:

13. CRP
14. ASO
15. RA
16. HIV
17. VDRL
18. WIDAL
19. Blood banking: Sample collection and storage

Reference Books

1. Mukherjee KL. (1988). Medical Laboratory Technology-A procedure manual for routine diagnostic tests, Vol I, II, III. Tata McGraw Hill Publishing Company Limited.
2. Burtis CA, Ashwood ER. (1999). Tetz Textbook of Clinical Chemistry. 3rd edition, WB Saunders Company.
3. Varley S. (1988). Practical Clinical Biochemistry. 6th edition, CBS Publishers and Distributors.

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

Question paper pattern

(External only)

1. THEORY

Max Marks =100

Time = 3.00hrs

SECTION-A

(5 x 5=25marks)

Short answer questions

Q.No. 1-5: Either (a) or (b) short note type (One question 'a' or 'b' from each unit)

SECTION-B

(5 x 15=75marks)

Essay type of questions:

Q.No. 6-10: 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: 100

Duration: 3hrs

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

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

IV. Viva (05)

V. Record/Observation* (10)

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

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

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College of Excellence (UGC)

COIMBATORE – 641029, TAMIL NADU, INDIA.

Course Name: M.Sc. Biochemistry Curriculum

and Scheme of Examination under CBCS

(Applicable for the Students Admitted during the Academic Year 2022-2023)

Subject code/ Question paper code	Title of the paper	Instructions hours/cycle	Exam Marks			Duration of Exam (Hrs)	Credits
			CIA	ESE	Total		
22PBC0F5	Paper I: Anatomy, Physiology and Laboratory safety	2	-	100	100	3	4
22PBC0F6	Paper II: Clinical Pathology and Medical Microbiology II	2	-	100	100	3	4
22PBC0F7	Practical II	2	-	100	100	3	4
22PBC0F8	On the job training and Viva voce	2	-	100	100	3	8

Programme Code: 07		Programme Title: M.Sc Biochemistry	
Title of the paper Paper I-Anatomy, Physiology and Laboratory safety			
Batch	Hours / Week	Total Hours	Credits
2022-2023	2	60	4

Course Objectives

1. To learn the anatomy of different organs in humanbody
2. To know the structure and functions oforgans
3. To acquire the knowledge on laboratory safety andmeasures

Course Outcomes (CO)

K1 ↑	CO1	Commemorate the basics of anatomy of the body
	CO2	Understand the relation between various organs and its functions.
↓ K5	CO3	Distinguish different organs and its functions.
	CO4	Analyze the functions of respiratory system
	CO5	Evaluate the methods of management of laboratory.

UnitI**(12Hours)**

Gross Anatomy: Introduction to Anatomy and its Nomenclature-Different systems of Human body, Cell- Structure and function; Body Tissue – their functions, Common anatomical terms(Anterior/Ventral, lateral, medial,median, posterior/dorsal etc.), Anatomical Position &Planes (Supine, prone, recumbent, lithotomy) planes- coronal,sagittal.

UnitII**(12Hours)**

Cardiovascular and Respiratory system: Structure of Heart &its coverings, Major Blood vessels- arteries and veins, Pulmonarycirculation-portal and systemic circulation. Cardiovascular diseases-hypertension, Cardiac Failure, Ischemic heart disease.Respiratory system: Respiratory tract structure, Lungs structure, Mechanism of respiration. Introduction to Respiratory Diseases like Tuberculosis, Pneumonia, Asthma, ARDS, Respiratory failure,***carcinoma**.

UnitIII**(12Hours)**

Digestive and Central Nervous system: Structure of Digestive system- physiology of digestion. Introduction to bowel diseases like -Gastric ulcer, Carcinoma, Inflammatory Bowel disease, Liver – Cirrhosis, Cholelithiasis and Pancreatitis.

Brain – Central and

peripheral nervous system. Introduction to central nervous system diseases - Stroke, Alzheimer's disease, Epilepsy, Myasthenia Gravis, Parkinson's disease.

Unit IV: (12Hours)

Urinary, Reproductive and Endocrine system: Structure and functions of kidney- Mechanism of urine formation, Introduction to common kidney diseases like Urolithiasis and Renal failure. Reproductive system: Structure of male and female reproductive system. Testis- Vas deferens, prostate, Seminal vesicles; Ovaries, uterus, vagina Diseases- Menopause, carcinoma. Hormones: Classification – Mechanism of action – Hypothalamic hormones – Pituitary – Anterior, posterior – Thyroid, Adrenal cortex, Adrenal medulla – Gonadal hormones-GI hormones.

Unit V: (12Hours)

Laboratory safety: General principles of safety programmes: First aid and safety measures for Mechanical, Electrical, Chemical, Radioactive and Biological hazards; Universal safety precautions. General Principles: Care and Cleaning of Glassware, Care of equipment and apparatus, Laboratory chemicals-Proper use, care, storage and labeling, Specimen handling, Appropriate container, Method of collection, Method of transportation, Method of preservation and disposal of laboratory waste.

***Designing of laboratory sections.**

*** denotes Self study**

Teaching Methods

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

Text Books

1. Standring S. (2016). Gray's Anatomy: The Anatomical Basis of Clinical Practice. Elsevier, pp.1584.
2. Ranganathan TS. (2000). A Textbook of Human Anatomy. 5th edition, S Chand & Co Ltd.

Reference Books Guyton AC and Hall JE. (2000). Text Book of Medical Physiology, 10th edition, Saunders Publishers.

1. Greishcimer EM. Physiology and Anatomy with practical considerations. JP Lippincott, Philadelphia.
2. Chaurasia BD and Garg K. (2012) Human Anatomy Regional and Applied. CBS Publications: New Delhi.
3. Fattana. (1991). Human anatomy (Description and applied). Saunders & C P Prism Publishers, Bangalore.
4. Solomon EA. (2008). Introduction to Human Anatomy and Physiology. 3rd edition, Saunders: St Louis.

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

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper Paper II-Clinical Pathology and Medical Microbiology			
Batch	Hours / Week	Total Hours	Credits
2022-2023	2	30	4

Course Objectives

1. To learn the principles and applications of hematological techniques
2. To acquire a knowledge on antigen-antibody reactions
3. To know the microbial techniques and how to establish the laboratory

Course Outcomes (CO)

K1 ↑	CO1	Recall the basics of clinical pathology
	CO2	Understand the various tests in hematology.
K5 ↓	CO3	Able to distinguish different blood groups.
	CO4	Analyze the mechanism of antigen antibody reaction
	CO5	Evaluate the methods of management of laboratory.

Unit I

Clinical Pathology: Routine analysis and examination of urine, body fluids, semen and stool. Mantoux test: Blood coagulation test-BT, CT, PT, PTT. Histopathology: Reception of specimen-cytology, fluid cytology, FNAC, PAP smear and histopathological examination preparation and processing, fixing, dehydration, impregnation with paraffin wax, embedding, block making, section cutting, mounting and staining, documentation, slide filling, wax block preservation.

Unit II

Haematology: Introduction, haemopoietic system of body, specimen collection, routine haematological test: special tests, estimation of foetal Hb, screening for sickle cell anemia, Heinz body preparation, lupus erythematosus preparation, preparation of bone marrow smear, cytochemical test. Blood banking: Preparation for blood collection, laboratory preparation in blood bank, ABO blood grouping, Rh typing, anti-human globulin

(AHG) or coomb's test, compatibility test/cross matching, blood transfusion process and transfusion reactions.

Unit III

Immunology: Immunity-Definition, classification, mechanism of innate and acquired immunity vaccines. Antigen: Definition, properties and types. Antibodies: Definition, structure, classification and functions. Complement system. Antigen- antibody reaction, different types of reaction, principle and application of antigen - antibody reactions.

Unit IV:

Medical Microbiology: Introduction to Medical Microbiology-Common methods of sterilization and disinfection-Common media and culturing methods used for bacterial growth. Antimicrobial susceptibility test. Virology: Morphology, pathogenicity and laboratory diagnosis of Hepatitis, AIDS and oncogenic viruses. Mycology: Morphology and laboratory diagnosis of superficial mycosis and deep Mycosis. Parasitology: Morphology, Life-cycle, Pathogenicity and Laboratory diagnosis of *E. histolytica*, *Giardia*, *Trichomonas*, *Toxoplasma*, *Plasmodia* and *Leishmania*.

Unit V:

Laboratory establishment and management: Space, ventilation, light, water, working benches, arrangement of rooms, laboratory safety, maintenance of records, students code, personal care. Computer laboratory information systems. Laboratory management: Balance sheet, profit loss statement, equity and cashflow, cost accounting. Total quality management of clinical laboratory. Laboratory statistics.

* denotes Self study

Teaching Methods

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

Text Books

1. Sood Ramnik. (2009). Textbook of Medical Laboratory Technology, 6th Ed, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
2. Orchard G and Nation B. (2018). Histopathology. 2nd edition. Oxford University Press, Oxford, United Kingdom.

Reference Books

1. Shirley Mitchell Lewis, Barbara J. Bain, Imelda Bates (2006) Dacie and Lewis Practical Haematology, 10th Ed, Churchill Livingstone/Elsevier.
2. Carson FL and Cappellano CH. (2015). Histotechnology: A Self-Instructional Text. 4th edition. American Society of Clinical Pathologists Press, Chicago, United States
3. Saunders WB. (2014). Cytology :Diagnostic Principles and Clinical Correlates. 4th edition. Elsevier Health Sciences, W B Saunders Co Ltd, London, United Kingdom
4. Teitz, Clinical Chemistry. W.B. Saunders Company Harcourt (India) Private Limited New Delhi.
5. Ananthanarayanan and Jayaram Paniker. (2005). Text Book of Microbiology. 6th edition Orient Longman, Hyderabad.

MAPPING

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

S–Strong

H–High

M–Medium

L –Low

Programme Code: 07	Programme Title: M.Sc Biochemistry		
Title of the paper: Practical II			
Batch 2022-2023	Hours / Week 2	Total Hours 60	Credits 4

Course Objectives

1. To accomplish the information on routine analysis of blood and urine
2. To know the techniques of microbiology and immunology
3. To acquire knowledge on pathological techniques

Course Outcomes (CO)

K1 ↑ ↓	CO1	Commemorate the basics of blood and urine.
	CO2	Understand the techniques of clinical pathology and microbiology
	CO3	Demonstrate various estimation procedures.
K5	CO4	Analyze the immunological techniques
	CO5	Be competent to handle the biological samples and pathogens.

Clinical pathology, Immunology and Microbiology:

1. Haemoglobin Estimation – Sahli's and Drabkin's method
2. Total RBC and WBC Count
3. Differential Count
4. E.S.R. determination by Westergren's method
5. Platelet Count
6. Prothrombin time / Partial Thromboplastin time
7. Lupus Erythematosus (L.E) Cell Preparation
8. ABO Grouping: Slide technique
9. Crossmatching
10. Rh typing – Slide/tube test
11. Coombs test: Direct and Indirect coombs test
12. Routine examination of urine

13. Routine examination of stool
14. Routine examination of sputum
15. Fixation, Processing, Embedding, Section cutting and preparation of slides
16. Sharpening of Knives
Preparation of fixative and decalcifying fluid
17. Principles and working of laboratory instruments (Demonstration)
18. Preparation of buffer solutions and measurement of their pH
19. Estimation of Blood glucose – GOD-POD method
20. Estimation of Urea- DAM method
21. Estimation of Plasma protein – Biuret method
22. Estimation of serum Bilirubin- Diazot method, Uric acid, Creatinine, Cholesterol,
HDL Cholesterol
23. Estimation of serum Chloride
24. Estimation of serum Sodium and Potassium (by flame photometer)
25. Estimation of SGOT
26. Estimation of serum Amylase
27. Estimation of serum ALP
28. Hanging drop technique for motility
29. Biochemical tests for identification of pathogens
30. Demonstration of malarial parasites

MAPPING

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

S–Strong

H–High

M–Medium

L –Low

Question paper pattern

(External only)

1. THEORY

Max Marks =100

Time = 3.00hrs

SECTION-A

(5 x 5=25marks)

Short answer questions

Q.No. 1-5: Either (a) or (b) short note type (One question 'a' or 'b' from each unit)

SECTION-B

(5 x 15=75marks)

Essay type of questions:

Q.No. 6-10: Either (a) or (b) essay type (One question 'a' or 'b' from each unit)

2. PRACTICALS–QuestionPattern&Break-upofmarks**END OF SEMESTER PRACTICAL EXAMINATION**

Max. Marks: 100

Duration: 3hrs

- | | |
|----------------------------------------------------------------------------|---------------|
| I. Major (Onequestion) | (1 x 20 = 20) |
| II. Minor (Onequestion) | (1 x 10 = 10) |
| III. Spotters | (3 x 5 =15) |
| Examine, identify and critically comment on the spotters A, B, C, D and E. | |
| IV. Viva | (05) |
| V. Record/Observation* | (10) |

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