

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE

(An Autonomous College)

Affiliated to Periyar University, Salem | Accredited by NAAC with 'A' Grade

Recognized by UGC under Section 2(f) & 12 (B)



ESTD-1994

**MUTHAYAMMAL
COLLEGE OF ARTS
AND SCIENCE**

(Autonomous)

A UNIT OF VANETRA GROUP

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DEGREE OF MASTER OF SCIENCE

Learning Outcomes - Based Curriculum Framework

- Choice Based Credit System

Syllabus for M.Sc., Biochemistry (Semester Pattern)

(For Candidates admitted from the academic year
2021 -2022 and onwards)

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

RASIPURAM - 637408

VISION

- ❖ To redefine the scope of higher education by infusing into each of our pursuits, initiatives that will encourage intellectual, emotional, social and spiritual growth, thereby nurturing a generation of committed, Knowledgeable and socially responsible citizens.

MISSION

- ❖ To Ensure State of the world learning experience
- ❖ To espouse value based Education
- ❖ To empower rural education
- ❖ To instill the sprite of entrepreneurship and enterprise
- ❖ To create a resource pool of socially responsible world citizens

QUALITY POLICY

To seek – To strive – To achieve greater heights in Arts & Science, Engineering, Technological and Management Education without compromising on the quality of education.

DEPARTMENT OF BIOCHEMISTRY

VISION

- ❖ To ensure state of the world learning experience in science

MISSION

- ❖ To expose the scientific education to empower science in rural peoples Vision

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Post Graduates will be able to promote learning environment to meet the industry expectation.

PEO2: Post Graduates will be incorporated the critical thinking with good Communication and Leadership skills to become a self-employed

PEO3: Post Graduates will be upholding the human values and environmental sustenance for the betterment of the society.

GRADUATE ATTRIBUTES

The Graduate Attributes of M.Sc., Medical Biochemistry are

GA1: Research skills

GA2: Multicultural competence

GA3: Critical thinking

GA4: Problem solving

GA5: Disciplinary knowledge

GA6: Moral and Ethical awareness

GA7: Self directed learning

PROGRAMME OUTCOMES (POs)

PO1: Post graduates will attain profound proficiency and expertise

PO2: Post graduates will be ensured with corporative self – directed learning

PO3: Post graduates will acquires acumen to handle diverse contexts and function in domains of multiplicity;

PO4: Post graduates will exercise intelligence in research Investigations and Introducing innovations.

P05: Post graduates will learn ethical values and commit to Professional ethics

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PS01: To acquire necessary knowledge and skills in core themes, principles and components of basic Biochemistry

PS02: To demonstrate the knowledge of biochemical processes from the cellular and molecular aspects

PS03: To Integrate and apply the techniques studied and to compare and contrast the depth of scientific knowledge in the broad range of fields

PS04: To be able to understand, analyze and apply the studied basic and concepts in wide variety of applications including diagnostics, biochemical pathway regulation and drug development and use this knowledge and apply the same for multitude of laboratory applications.

PS05: To provide students with the knowledge and skill base that would enable them to go for self-employment and entrepreneurship.

SEM	COURSE_CODE	TITLE OF THE COURSE	Hrs. /W		CREDIT POINTS	MAX.MARKS		
			Lect.	Lab.		CIA	ESE	TOTAL
I	21M1PBCC01	BIOMOLECULES	5		5	25	75	100
I	21M1PBCC02	BIOCHEMICAL AND BIOPHYSICAL TECHNIQUES	5	-	4	25	75	100
I	21M1PBCC03	ENZYMES AND ENZYME TECHNOLOGY	4		4	25	75	100
I	21M1PBCP01	PRACTICAL : BIOMOLECULES	-	6	3	40	60	100
I	21M1PBCP02	PRACTICAL : ENZYME TECHNOLOGY		6	3	40	60	100
I	21M1PBCE01	CELLULAR BIOCHEMISTRY	4		4	25	75	100
I		TOTAL	18	12	23	180	420	600
II	21M2PBCC04	BIOENERGETICS AND INTERMEDIARY METABOLISM	4	-	4	25	75	100
II	21M2PBCC05	MOLECULAR BIOLOGY AND GENETIC ENGINEERING	4	-	4	25	75	100
II	21M2PBCC06	IMMUNOCHEMISTRY	4		4	25	75	100
II	21M2PBCE03	PLANT BIOCHEMISTRY	4		4	25	75	100
II	21M2PHUR01	HUMAN RIGHTS	2	-	2	100		
II	21M1PBCP03	PRACTICAL : MOLECULAR BIOLOGY		6	3	40	60	100
II	21M1PBCP04	PRACTICAL : IMMUNOLOGY		6	3	40	60	100
II		TOTAL	18	12	24	280	420	600
III	21M3PBCC07	PHARMACOLOGY AND TOXICOLOGY	5	-	4	25	75	100
III	21M3PBCC08	ADVANCED CLINICAL BIOCHEMISTRY	5	-	4	25	75	100
III	21M3PBCC09	BIOSTATISTICS & RESEARCH METHDOLOGY	4		4	25	75	100
III		EDC	4		4	25	75	100
III	21M3PBCP05	PRACTICAL : LAB COURSE - V		6	3	40	60	100
III	21M3PBCP06	PRACTICAL : LAB COURSE - VI	-	6	3	40	60	100
III	21M3PBCIS1	INTERNSHIP	-		2	100		
III		TOTAL	18	12	24	280	420	600

IV	21M4PBCC10	BIOMEDICAL INSTRUMENTATION	5	-	4	25	75	100
IV		ELECTIVE - III	5		4	25	75	100
IV		ELECTIVE - IV	5		4	25	75	100
IV	21M4PBCPR1	PROJECT WORK	-		5	50	150	200
IV	21M4PBCOE1	BIOCHEMISTRY FOR COMPETITIVE EXAMINATIONS	-	-	2	100		
IV		TOTAL	15	0	19	225	375	500
IV		OVERALL TOTAL	69	36	90	965	1635	2300
IV	21M4PBCEC1	MOOC Courses offered in SWAYAM / NPTEL	-	-	2	-	-	-

List of Elective Subjects Details for M.Sc. Biochemistry
SYLLABUS - CBCS PATTERN
EFFECTIVE FROM THE ACADEMIC YEAR 2021-2022 Onwards

S.No.	SEM	SUBJECT_CODE	TITLE OF THE SUBJECT
1	I	21M1PBCE01	Cellular Biochemistry
2	I	21M1PBCE02	Medical Microbiology
3	II	21M2PBCE03	Plant Biochemistry
4	II	21M2PBCE04	Human anatomy and Physiology
5	IV	21M4PBCE05	Cancer Biology
6	IV	21M4PBCE06	Biotechnology and Nanotechnology
7	IV	21M4PBCE07	Biomedical Instrumentation
8	IV	21M4PBCE08	Molecular Biology and Biotechnology

List of Extra Disciplinary Course (GEC) Details
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2021-2022 Onwards

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	II	21M2PBCED1	Biochemistry in Health
2	II	21M2PBCED2	Clinical Lab technology
3	II	21M2PBCED3	Principles of Nutrition
4	II	21M2PBCED4	Human Physiology and Coding

PG - REGULATIONS

1. Internal Examination Marks - Theory

Components	Marks
CIA I & II	10
Attendance	5
Assignment	5
Seminar	5
Total	25

Attendance Percentage	Marks
96 %to 100%	5
91%to 95%	4
86%to 90%	3
81%to 85%	2
75%to 80%	1
Below 75%	0

2. Question Paper Pattern for CIAI,II AND ESE (for 75Marks) (3hours)

Section-A (10Marks) (Objective Type)

Answer ALL Questions

ALL questions carry EQUAL Marks

10 x 1 = 10 Marks

Section-B(15Marks)(Analytical Type)

Answer any THREE Questions out of FIVE questions

ALL questions carry EQUAL Marks

3 x 5 = 15 Marks

SECTION-C (50 Marks)

Answer ALL the Questions

Either or Type.

ALL Questions Carry EQUAL Marks

5 x 10 = 50 Marks

Total

75 Marks

(Syllabus for CIA-I 2.5 Unit , Syllabus for CIA-II All 5 Unit)

2.a)Components for Practical CIA.

Components	Marks
CIA -I	15
CIA - II	15
Observation Note	5
Attendance	5
Total	40

2.b) Components for Practical ESE.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	60

3. Internship/Industrial Training, Mini and Major Project Work

Internship/ Field Work Industrial Training		Project Work	
Components	Marks	Components	Marks
CIA*1		CIA	
Work Diary	25	a) Attendance Marks	20
Report	50	b) Review Marks	30
Viva-voce Examination	25		50
Total	100		
		ESE*1	
		a) Final Report Marks	120
		b) Viva-voce Marks	30
		Total	150
			200

*1Evaluation of report and conduct of viva- voce will be done jointly by Internal and External Examiners

4. Components for Human Rights Course(CIA Only)

- The Course Human Rights is to be treated as 100% CIA course which is offered in II Semester for I year PG students.
- Total Marks for the Course = 100

Components	Marks
Two Tests	75
Assignments	25
Total	100

- In case the candidate fails to secure 50 marks, which is the passing minimum, he/she may have to reappear for the same in the subsequent semesters.

5. Guidelines for Competitive Exams- Online Mode- Online Exam 3 hours

Components	Marks
100 Objective Type Questions 100*1=100 Marks	100

Objective type Questions from Question Bank

- The passing minimum for this paper is 50%
In case, the candidate fails to secure 50% passing minimum, he/she may have to reappear for the same in the subsequent semesters.

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Se m	Hour s	L	T	P	C
21M1PBCC01	BIOMOLECULES	DSC THEORY - I	I	5	5			5
Objective	To study the structure and functions of macromolecules							
Unit	Course Content						Knowled ge Levels	Session s
I	Carbohydrates Classification, Structure, functions, physical and chemical properties of Monosaccharides, Disaccharides; N-linked, O-linked and GPI linked oligosaccharides, glycoproteins structure, function and recognition, Polysaccharides; Homo & hetero polysaccharides, Bacterial Cell wall Polysaccharides. Structure, location and biological role of Proteoglycans (Glycosaminoglycans).						K1-K3	12
II	Lipids Classification, structure, function, physical and chemical properties of lipids. Fatty acids, saturated, unsaturated and hydroxy fatty acids. Amphipathic lipids- micelles, emulsion & liposomes. Lipids in cell membrane, Diversity of biological membranes. Sterols – Structure, Properties and functions of cholesterol. Eicosanoids - Structure and biological role of Prostaglandins, Leukotrienes, Prostacyclins, Thromboxanes and lipoxins. Lipoproteins - classification and functions.						K1-K3	12
III	Amino acids and Proteins Amino acids: Classification, structure, properties (physical and chemical) of amino acids and proteins. Ramachandran plot, linkage in Peptide bond. Protein sequencing (Sanger's method & Edmand reaction), Dansyl chloride protein degradation and evolution. Proteins: Primary structure, secondary structure: α - helix, β sheets & reverse turns, Keratin: Coil, Collagen-Triple helix, fibrous protein secondary structure, Tertiary structure: Super secondary structures; $\beta \alpha \beta$ motifs, - heparin, $\alpha\alpha$ motif, Greek Key motif. Quaternary Structure: Structure and functions of Hb, actin, myosin, elastin.						K1-K3	15

IV	<p>Nucleic Acids DNA: Physical (Buoyant density, viscosity) and chemical properties (renaturation and denaturation). Structure of nitrogenous bases, nucleosides, nucleotides, DNA Double helix -Watson & Crick model of DNA, Other forms; A, B and Z DNA, Triple helix, Palindromes, Inverse repeats, cruciform and hairpins & quadruple structures, Cot value. Histone proteins, chromatin and non-histone proteins. Miscellaneous alternative confirmation of DNA - slipped mispaired DNA, parallel stranded DNA and anisomorphic DNA. RNA Classes; mRNA, tRNA and rRNA, hnRNA, SnRNA, miRNA structure and functions.</p>				K1-K3	12
V	<p>Vitamins and Minerals Classification, structure and function of fat soluble and water-soluble vitamins (including antioxidant properties). Minerals of biological significance: Na, K, Ca, Mg, Mn, P, Fe, Cu, I, Zn, Se, Co.</p>				K1-K3	9
Course Outcome	CO1: To explain about the structure, properties and functions of polysaccharides				K2	
	CO2: Illustrate on structure, properties and functions of lipids, interactions of lipids in biological membrane				K3	
	CO3: Determine the classification, properties and significance of proteins				K3	
	CO4: Explain about the DNA properties and functions, biological importance of histone proteins				K3	
	CO5: To determine the significance of vitamins and its antioxidant activity, minerals of biological significance				K3	
Learning Resources						
Text Books	<ol style="list-style-type: none"> 1. Lehninger Principles of Biochemistry, Nelson, David L. and Cox, 2008.5th edition. W.H.Freeman and Co., New York. 2. Fundamentals of Biochemistry, Donald Voet, Judith G.Voet and Charlotte W 2008, 3rd edition Pratt, John Wiley & Sons. 3. Outlines of Biochemistry Eric E.Conn, P.K. Stumpf, G.Brueins and Ray H.Do, John 2005. 5th edition. Wiley and sons, Singapore. 					
Reference Books	<ol style="list-style-type: none"> 1. Stryer, I., 1988. Biochemistry (2nd Edition), W.H. Freeman & Co., New York. 2. White, A. et al., 1959. Principles of Biochemistry, McGraw Hill Book Co., New York. 3. Donald Voet and Judith, G. Voet. 2011. Biochemistry. (4th Edition). John Wiley and Sons, New York. 					
Website Link	<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/104103121 2. https://archive.nptel.ac.in/courses/104/103/104103121/ 3. https://onlinecourses.nptel.ac.in/noc22_cy03/preview 					
	L-Lecture	T-Tutorial	P-Practical		C-Credit	

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PBCC01	BIOMOLECULES	DSC THEORY - I	I	5	5			5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	M	S	S	S	S	M
CO2	S	S	M	S	M	S	M	M	S	S
CO3	S	S	S	S	S	S	M	S	M	S
CO4	S	M	S	M	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M	S	M	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG
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Tutorial Schedule

Teaching and Learning Methods

Chalk and talk method, PPT Classes, Smart classroom

Assesment Methods

Assignment, Class test, Unit test, Internal exams, Seminars, Attendance



Designed By	Verified By	Approved By
<i>[Signature]</i> 06/10/22	<i>[Signature]</i>	<i>[Signature]</i>
Dr. G. Krishnamoorthy (M. Shobana Begum)		

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PBCC02	BIOCHEMICAL AND BIOPHYSICAL TECHNIQUES	DSC THEORY - II	I	5	5			4
Objective	This course focus on the biochemical techniques includes spectrophotometry, centrifugation, electrophoresis, radioactivity etc. Learning these techniques will be very useful for operating instruments and become the basic knowledge in their future.							
Unit	Course Content						Knowledge Levels	Sessions
I	Principles of electrochemical techniques – measurement of pH by glass electrode and hydrogen electrode. Oxygen electrode – principles, operation of a Clarke electrode and its applications. Principle - Beer & Lambert, s law Spectroscopic techniques : colorimetry, spectrophotometry – UV & visible, Extinction coefficient. Principle, instrumentation and applications of FT – IR spectroscopy and spectro- fluorimetry, luminometry, Atomic Absorption spectroscopy, Flame and flameless spectrophotometry. Basic principles of NMR, ESR and mass spectrometry and their biological applications.						K1-K3	12
II	Centrifugation - Cell disruption, homogenization and extraction of membrane bound proteins- cell disruption methods- organ and tissue slice techniques, dialysis. Basic principles of sedimentation. Different types of rotors. Low speed and high speed centrifuges. Ultracentrifuge: analytical and preparative ultracentrifuge- instrumentation and applications. Molecular weight determination by centrifugation. Sub cellular fractionation by differential centrifugation. Density – gradient centrifugation- rate zonal and isopycnic.						K1-K3	12
III	Chromatographic Techniques - Principles and Applications of Paper, TLC, Adsorption, Ion exchanges, Gel filtration, Affinity, GLC, Chromato focusing, HPLC, FPLC. Basic principles and applications, autoradiography. Principle and application Microscopy- Basic principles, components and applications of light, bright field, phase contrast and fluorescence microscopy. Electron microscopy- Principle, preparation of specimens for TEM and SEM and applications. Confocal microscopy. Microtomy. Fixation and staining.						K1-K3	12

IV	Electrophoretic Techniques: Polyacrylamide gel electrophoresis, SDS-PAGE, 2D – PAGE, Isoelectric focusing, Isotachopheresis, Agarose gel Electrophoresis, pulse field electrophoresis, high voltage electrophoresis, Capillary Electrophoresis, Blotting techniques and its applications– Western, Northern & Southern.	K1-K3	10					
V	Isolation of nucleic acids, restriction endonucleases, restriction mapping – nucleic acid probes – Clones probes, oligonucleotide probes and labeling nucleic acid probes. Restriction fragment length polymorphism (RFLP), FISH. - polymerase chain reaction - RTPCR, Digital PCR	K1-K3	12					
Course Outcome	CO1: The students will be able to understand the principle and working of different chromatography and different centrifugation techniques.	K2						
	CO2: The students will get the theoretical knowledge of various instruments and their practical applications	K2						
	CO3: Learn fundamental principles behind electrophoresis and apply them practically.	K3						
	CO4: Capable to choose and apply suitable separation techniques to identify different biomolecules	K3						
	CO5: Understand the intersection of life and information sciences, using SDS-PAGE, southern and northern blots and applying them at genome level	K3						
Learning Resources								
Text Books	1. Wilson and Walker (2000). A biologist's guide to principles and techniques of practical biochemistry. 5th ed. Cambridge University Press 2000. 2. Upadhyay, Upadhyay and Nath (1997). Biophysical Chemistry Principles and Techniques. Himalaya Publ.							
Reference Books	1. Analytical Biochemistry (1998) – DJ Holine & HAZEL Peck, Longman Group. 2. Quantitative problems in Biochemistry (1983) – Edwin a Dawes Longman Group. 3. Friefelder and Friefelder (1994). Physical Biochemistry – Applications to Biochemistry and Molecular Biology. WH Freeman & Co.							
Website Link	1. https://www.ncbi.nlm.nih.gov/pmc/articles 2. https://www.vedantu.com/chemistry/							
	L-Lecture	T-Tutorial	P-Practical		C-Credit			

M.Sc.-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards							
Course Code	Course Title	Course Type	Sem	Hours	L	T	C
21M1PBCC02	BIOCHEMICAL AND BIOPHYSICAL TECHNIQUES	DSC THEORY - II	I	5	5		4

CO-PO Mapping										
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	M	M	S	M	M	M	M	S	S
CO2	M	S	M	S	M	M	S	M	S	M
CO3	L	M	M	S	S	M	M	S	S	S
CO4	M	S	M	S	M	M	S	M	S	M
CO5	M	M	S	S	M	M	M	S	S	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
T. Femba	M. Shabane Begum	A. h. Suresh



M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PBCC03	ENZYMES AND ENZYME TECHNOLOGY	DSC THEORY - III	I	4	4			4
Objective	This paper aims to provide a basic understanding of biological catalysis, Mechanism of action of enzymes, structure and functional relationship and Understands the enzyme kinetics and role of coenzymes/co-factors and an overview of Industrial application of enzymes.							
Unit	Course Content						Knowledge Levels	Sessions
I	Introduction of enzymes: Holoenzyme, Apoenzyme, coenzymes and cofactors, free energy, activation energy and transition state theory. Active site- Fisher and Koshland models. Enzyme classification- Enzyme Nomenclature and IUB system of enzyme classification, Investigation of sub-cellular compartmentation of enzymes and marker enzymes. Introduction of co-enzymes: Structure and functions –Thiamine pyrophosphate and flavin nucleotides, NAD/ NADP, coenzyme A, Pyridoxal phosphate and Carries of one carbon group: tetrahydrofolate.						K1-K3	8
II	Enzyme kinetics –: Pre Steady state and Steady- State enzyme kinetics, MM equation and linear transformation of MM Equation. Eadie-Hofstee and Hanes-Wolf plots. Factors affecting rate of chemical reaction. Bi-Substrate reactions- Single displacement and double displacement reactions. Enzyme inhibition:Reversible and Irreversible inhibition - Competitive, Non-competitive and mixed inhibition. Feedback inhibition.						K1-K3	10
III	Enzymes Regulation: Allosteric control of enzyme activity. Concentrated model of Monod et al., and sequential model of Koshland et al .Allosteric kinetics (MWC and KNF models), cooperativity, symmetry and sequential models. Hill's equation. Regulation by covalent modification of enzymes with examples - Glycogen phosphorylase, Zymogen activation (Chymotrypsin).Isozymes- Lactate Dehydrogenase, Alkaline phosphatase. Active site determination -Lysozymes: A case study – structure, enzymatic activitymechanism of lysozyme action, the ionization states of side chains.						K1-K3	10
IV	Immobilized Enzymes-Principles and techniques of immobilization-commercial production of enzymes-amylases, proteases, cellulase, artificial enzymes, industrial applications, fermentation, enzyme modification, site directed mutagenesis. Immobilized enzymes in industrial processes.						K1-K3	8

V	Large scale extraction and purification of enzymes. Extraction by chemical and physical method, isolation and purification of enzymes -Measurement and expression of enzyme activity – enzyme assays, enzyme structure-chemical modification, enzyme purification by various chromatographic techniques. Industrial utilization of enzymes, food, detergents, energy, waste treatment, pharmaceuticals and medicine.	K1-K3	9					
Course Outcome	CO1: Identify the fundamentals of enzyme properties, nomenclatures, characteristics and Compare methods for production, purification, characterization of enzymes.	K1						
	CO2: Derive the equations of Enzyme kinetics. Discuss the factors affecting enzymatic reactions. Mechanism of enzyme catalysis and structure and functions of coenzymes	K2						
	CO3: Describe the concepts of co-operative behavior, enzyme inhibition and allosteric regulation.	K2						
	CO4: Compare methods for production, purification, characterization and immobilization of enzymes. Describe the multi enzyme complex with example. To know about the biosensors and its functions.	K3						
	CO5: Describe the major applications of enzymes in industry, understand the principles of enzyme immobilisation techniques and enzyme extraction procedures. Develop new ideas for the development of enzyme-based drugs. Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.	K3						
Learning Resources								
Text Books	1. Enzymes. Dixon , E.C Webb, CJR Thorne and K.F. Tipton, Longmans , London 2. Understanding Enzymes, Trevor Palmer, 1991. Third Edition Ellis Horwood Limited. 3. Principles of Biochemistry by Lehninger, Nelson and Cox(2005), W H Freeman and Company, New York, USA, 4th edition.							
Reference Books	1. Fundamentals of Enzymology, Nicholas C.Price, Lewis Stevans. 2 ed., (1998), Oxford University Press 2. R.M. Buitelaar, C. Bucke, J. Tramper, R.H. Wijffels 1996. Immobilized Cells: Basics and Applications: Elsevier Science 3. Douglas S. Clark, Harvey W. Blanch 1995. Biochemical Engineering ,CRC Press. 4. Dr. S. Shanmugam, T. Sathish Kumar 2009. Enzyme Technology, K. International Pvt Ltd.							
Website Link	1. https://www.khanacademy.org/science/ 2. https://www.creative-enzymes.com/ 3. https://www.nature.com/subjects/immobilized-enzymes 4. https://conductscience.com/enzyme-purification/							
	L-Lecture	T-Tutorial	P-Practical	C-Credit				

M. Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards									
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C	
21M1PBCC03	ENZYMES AND ENZYME TECHNOLOGY	DSC THEORY - III	I	4	4			4	

CO-PO Mapping										
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M	M	M	M	M	M
CO2	S	M	M	M	S	S	M	S	M	S
CO3	S	M	M	S	S	M	M	S	M	M
CO4	S	S	S	M	M	M	M	S	S	M
CO5	S	M	M	S	S	M	M	M	S	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
Dr. Anshika S. Anbika	M. Shekhar Begun.	A. h. b. e. e. e.



M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PBCE01	CELLULAR BIOCHEMISTRY	DSE – I	I	4	4			4
Objective	To Know about tissue types, organization and classes of cell junctions and describe the role of cell adhesion molecules and ECM components and Understand what happens during the cell cycle and cell death and explain about membrane transports and checkpoints in the cell cycle.							
Unit	Course Content						Knowledge Levels	Sessions
I	Molecular organization: Freeze fracture and fluid mosaic model. Composition: Membrane lipids, membrane protein, membrane receptors, membrane carbohydrates. Properties: Membrane asymmetry: membrane fluidity and molecular mobility of proteins. Isolation and characterization of plasma membrane. Model Membrane Isolation: Techniques of making multi lamellar vesicle, bi layer reconstitution of proteins into vesicles, liposomes. Membrane fusion in fertilization, cell division, exocytosis, endocytosis and infection.						K1-K3	8
II	Membrane transport: Small molecules – Simple diffusion, Donnan Equilibrium, diffusion of changed and unchanged particles, Ficks law, facilitated transport (pores and channels, properties), carriers (specific ionphores). Transport proteins- periplasmic binding proteins, Active transport (Energy for active transport Na pump model). Mechanism (Ca ²⁺ pump), secondary active transport – Na ²⁺ dependent glucose transport, transport in excitable cells.						K1-K3	9
III	Structure of mitochondria, respiratory chain-enzyme complexes – inhibitors of respiratory chain- energy transfer oxidative phosphorylation – Various theories – proton gradient and ATP synthesis – F1 ATPase – Inhibitors –Microsomal electron transport.						K1-K3	8
IV	Cell surface, cell junctions: Desmosomes, tight junction, gap junctions, extra cellular matrix: collagen, chemistry and assembly, organization and role in cell adhesion: proteoglycans and glycosaminoglycans, elastin and aggregation: example – Nyxobacteria: Sponges, Communications: Chemical signaling between cells- Histamines, prostaglandins, hormones and neurotransmitters. Signal transduction: AMP, G- Protein Complex, Immunoprecipitation; Molecular aspects of cell division – Cell Cycle fusion, mitogens nucleocytoplasmic interaction.						K1-K3	10

V	Cancer Biology: Etiological factors, primary, secondary tumors benign and malignant tumors. Oncogene: proto oncogenes and viral oncogenes, oncogene activation, tumor suppressor genes, DNA tumorviruses, tumor specific antigens and tumor evasion. Metastasis: Molecular events in migration, extravasation, chemokines, role of ECM in metastasis. Angiogenesis: angiogenetic and antiangiogenetic factors, vasculogenesis. Types of cancer cells and morphological alterations.	K1-K3	10					
Course Outcome	CO1: Know about tissue types, organization and classes of cell junctions and describe the role of cell adhesion molecules and ECM components.	K1						
	CO2: Understand what happens during the cell cycle and cell death and explain about membrane transports and checkpoints in the cell cycle.	K2						
	CO3: Illustrate the basic structures, properties and organisation of eukaryotic and prokaryotic chromosomes.	K3						
	CO4: Pertain on Overview of cell cycle, cell growth, tumors, cancers and isolation techniques.	K3						
	CO5: Describe carcinogenesis.	K3						
Learning Resources								
Text Books	1. Cell & Molecular Biology, Gerald Karp, 1999 2. Genes – Benjamn Lewin, Latest Edition 3. Cellular & Molecular Biology Baltimore, Dainell & Lodish. 4. General Microbiology – Powar, Vol II 2nd Edition, 1999							
Reference Books	1. Biochemistry of lipids and membrane : VANCE AND VANCE. 2. Molecular biology of the cell – ALBERTS, BRAY, LAWIMS, RAFF. 3. Molecular cell biology – J. AVERS 4. Molecular biology of the gene – WATSON et al (4th edition)							
Website Link	1. https://www.ncbi.nlm.nih.gov/books/NBK26857/ 2. https://chem.libretexts.org/Bookshelves/Biological_Chemistry/ 3. https://www.verywellhealth.com/oncogenes-types-and-role-in-cancer-4178292							
	L-Lecture	T-Tutorial	P-Practical		C-Credit			

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards									
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C	
21M1PBCE01	CELLULAR BIOCHEMISTRY	DSE - I	I	4	4			4	

CO-PO Mapping										
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	M	M	M	S	M	S
CO2	S	S	M	M	M	S	S	M	M	M
CO3	S	M	M	M	S	M	M	S	S	M
CO4	S	M	S	M	M	S	S	M	M	S
CO5	S	S	M	M	M	M	M	M	S	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG							

Tutorial Schedule	
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment; Class test; Unit test; Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
R. Abirami	M. Shobana Begum	A. V. Sanyal



M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PBCP01	BIOMOLECULES	CORE PRACTICAL I	I	6				3
Objective	This course aims to bring the skills of performing basic biochemical techniques which are important in clinical investigations and it helps in learning all the basic biochemical estimations and aids in hands on training.							
S.No.	List of Experiments / Programmes						Knowledge Levels	Sessions
1	1. Isolation and Estimation of Glycogen by Colorimetric method 2. Determination of Maltose by DNSA method						K1- K3	10
2	3. Estimation of Total Protein by Lowry's method 4. Estimation of Total Protein by Biuret's method 5. Estimation of Albumin by Bromocresol green method						K1- K3	15
3	6. Determination of Acid number 7. Determination of Saponification number 8. Estimation of Iodine value						K1- K3	15
4	9. Estimation of Thiamine and riboflavin by Flourimetry 10. Estimation of Ascorbic Acid Vitamin C by 2,4-DNPH Method 11. Estimation of Total phenolics by modified Folin Ciocalteu method						K1- K3	15
5	12. Separation of Amino acids by paper chromatography 13. Separation of Sugars by Paper chromatography 14. Thin layer chromatographic separation of sugars and membrane lipids						K1- K4	15
Course Outcome	CO1: Learn how to standardize the biochemical tests.						K3	
	CO2: Carry out chromatographic techniques.						K3	
	CO3: Separate sugars and amino acids by Paper chromatography						K4	
	CO4: Perform titrations						K5	
	CO5: Isolate glycogen from tissues						K5	
Learning Resources								
Text Books	1. S. Sadhasivam, A. Manickam, Biochemical methods. New Age Publishers, 2009. 2. J. Jeyaraman, Laboratory/manual in Biochemistry. New age International Pvt. Ltd Publishers, 2011.							
Reference Books	1. S.K. Sawhney & Randir singh, Introductory Practical Biochemistry, 2014, Narosa Publications house. 2. Laboratory Handbook on Biochemistry By K. Shanmugam, S. Sathish Kumar, T. Panneer Selvam, 2019.							
Website Link	1. https://aquadocs.org/ 2. https://www.studocu.com/en-gb/							

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards

Course Code	Course Title				Course Type	Sem	Hours	L	T	P	C	
21M1PBCP01	BIOMOLECULES				CORE PRACTICAL I	I	6				3	
CO-PO Mapping												
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5		
C01	M	S	M	M	S	M	M	M	M	S		
C02	M	M	M	M	M	S	M	S	M	M		
C03	M	M	S	S	M	M	M	M	S	M		
C04	M	M	M	M	S	M	M	M	M	S		
C05	M	M	M	S	M	S	M	M	S	M		
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG								
Tutorial Schedule												
Teaching and Learning Methods					Explanation of Practical procedure and Demonstration of experiments							
Assesment Methods					Observation, Performance, Attendance							
					Designed By		Verified By			Approved By		

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PBCP02	ENZYME TECHNOLOGY	CORE PRACTICAL II	I	6				3
Objective	This course aims to bring the skills of performing isolation, identification and purification of enzymes							
S.No.	List of Experiments / Programmes					Knowledge Levels		Sessions
1	I. Enzyme Isolation and Assay of Enzyme/Specific Activity a. Extraction and Purification of Enzyme and Specific Activity - Peroxidase/Urease b. Molecular Weight Determination of Enzymes- Peroxidase/Urease by Molecular Sieve chromatography method					K1- K3		10
2	Determination of Aspartate transaminase activity Determination of Alanine transaminase activity Determination of activity of Amylase Determination of specific activity of Lipase					K1- K3		20
3	II. Immobilisation Enzyme a. Immobilisation of peroxidase/Acid phosphatase by matrix entrapment, ionic and cross linking					K1- K34		10
4	III. Enzyme Kinetics a. Effect of pH, temperature, Substrate and enzyme concentration of Amylase.					K1- K4		15
5	III. Enzyme Kinetics a. Effect of pH, temperature, Substrate and enzyme concentration of Urease.					K1- K4		15
Course Outcome	CO1: Learn how to extract the enzymes from its sources					K3		
	CO2:Preparation of immobilised enzymes					K3		
	CO3:Determine the enzyme kinetics					K4		
	CO4: Isolation of enzymes from its sources					K4		
	CO5: Assay of enzymes					K5		
Learning Resources								
Text Books	1. Practical clinical biochemistry, volume I and II- Harold Varley, et al., 1980. Fifth Edition. CBS publishers, 2. Biochemical Methods. II Edition. Sadasivam. S and Manickam, A New Age International private Ltd Publishers. 3. A Text book of practical biochemistry. David Plummer							
Reference Books	1. Laboratory techniques in Biochemistry and Molecular biology, Copyright 2017. Ed. T.S. Work and E.Work., 1969. Vol I & II, Elsevier. 2. A Biologist's guide to principles and Techniques of Practical Biochemistry, Modern Experimental Biochemistry Boyer, R III Edition, Benjamin Cummings Publishers. 3. Enzymes Structure and Mechanism, Aln Fessht 1997.							
Website Link	1. https://laboratorytests.org/ 2. https://www.ncbi.nlm.nih.gov/pmc/articles/							

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards

Course Code	Course Title				Course Type	Sem	Hours	L	T	P	C
21M1PBCP02	ENZYME TECHNOLOGY				CORE PRACTICAL II	I	6				3
CO-PO Mapping											
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	S	S	M	M	S	M	M	M	M	S	
CO2	S	M	M	S	M	S	S	M	S	M	
CO3	S	S	S	M	M	M	M	S	S	S	
CO4	S	M	M	M	S	S	M	M	S	S	
CO5	S	S	M	M	M	M	M	S	M	S	
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG							
Tutorial Schedule											
Teaching and Learning Methods					Explanation of Practical procedure and Demonstration of experiments						
Assessment Methods					Observation, Performance, Attendance						
				Designed By			Verified By			Approved By	

M.Sc.,-Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCC04	BIOENERGETICS AND INTERMEDIARY METABOLISM	DSC THEORY - IV	II	4	4			4
Objective	To understand the principles of cellular energy metabolism, schematize the oxidative pathways of carbohydrates, Lipids, Proteins & Nucleic acids and to gain knowledge on mitochondrial Electron transport chain and Oxidative Phosphorylation							
Unit	Course Content						Knowledge Levels	Sessions
I	Bioenergetics - Principles of energy, energy transduction, membrane energy interconversions, high energy compounds, standard free energy of hydrolysis of ATP, transfer potential of phosphate groups, mitochondria - ultrastructure, electron transport chain, components and different complexes in detail. Mobile electron carriers. Proton transport during electron flow, inhibitors of electron transport chain. Mitochondrial electron transporters and shuttle systems. Microsomal electron transport chain. Functions of ATP, substrate level Phosphorylation, oxidative Phosphorylation - mechanisms - energy coupling, chemical and chemiosmotic, conformational coupling, inhibitors and uncouplers, control of oxidative Phosphorylation.						KI-K2	9
II	Metabolism of Carbohydrates - Overview of glycolysis, gluconeogenesis, citric acid cycle, galactose and fructose metabolism. Importance of pyruvate dehydrogenase. Significance of Cori and glyoxylate cycle. Pentose phosphate pathway- significance and regulation machinery. Biosynthesis and degradation of glycogen, starch and sucrose-role of UDP sugars in carbohydrate metabolism. Detailed study of hormonal regulation and role of secondary messengers in glycogen metabolism. Biosynthesis and biochemistry of mucopolysaccharides- hyaluronic acid, chondroitin sulfate, dermatan sulfate, heparin and keratin.						KI-K2	9
III	Metabolism of Lipids - Biological regulation and significance of fatty acid metabolism. Oxidation of fatty acids (α, β, ω). Metabolism of ketone bodies - Formation, utilization, excretion and clinical significance. Metabolism of triglycerides, phospholipids and sphingolipids. Fatty acid derivatives: eicosanoids, their function and metabolism. Lipoprotein metabolism and its regulation. Lipid peroxidation. Cholesterol - Biosynthesis, regulation, transport and excretion. HMG CoA reductase regulation.						K1-K3	9

IV	Metabolism of Amino acids - Overview of biosynthesis of nonessential amino acids. Catabolism of amino acid nitrogen - transamination, deamination, ammonia formation and the urea cycle. Catabolism of amino acid carbon skeleton. Common enzymatic reactions of amino acid degradation - degradation of individual amino acids - regulation of amino acid metabolism.	KI-K4	9
V	Metabolism of Nucleic acids - Nucleotide biosynthesis - de novo and salvage pathways for biosynthesis of purine and pyrimidine. Mechanism of feedback regulation. Biosynthesis of dNTPs. Mechanism of purine and pyrimidine catabolism, uric acid, xanthine oxidase inhibitors.	KI-K5	9
Course Outcome	CO1:Understand the basic principles of metabolic pathways	K1	
	CO2:Recognise carbohydrate metabolism and its regulation	K2	
	CO3:Implement the big picture about the biological oxidation process	K3	
	CO4:Select the concepts of lipid metabolism and amino acid metabolism and urea cycle	K4	
	CO5:Design the concepts of nucleotide metabolism nucleic acid metabolism	K5	
Learning Resources			
Text Books	1. Fundamentals of Biochemistry, J.L. Jain, S. Chand publications, 2004. 2. Biochemistry, Lubert Stryer, 4th edition, W.H. Freeman & Co, 1995. 3. Fundamentals of Biochemistry (1999) - Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.		
Reference Books	1. Lehninger's Principles of Biochemistry (2000) - Nelson, David I. and Cox, M.M. Macmillan / Worth, NY. 2. Harper's Biochemistry Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 24th edition, Prentice Hall International. Inc. 3. Principles of Biochemistry, Geoffrey L. Zubay, 3rd edition William W. Parson, Dennis E. Vance, W.C. Brown Publishers, 1995. 26 4. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4th edition, W.H. Freeman and company.		
Website Link	1. www.biosciencenotes.com 2. https://microbenotes.com/		

L-Lecture T-Tutorial P-Practical C-Credit

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCC04	BIOENERGETICS AND INTERMEDIARY METABOLISM	DSC THEORY - IV	II	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	M	M	M	M	M	M	M
CO2	S	M	M	S	S	M	M	S	S	S
CO3	M	M	S	M	M	S	S	S	M	M
CO4	M	S	M	S	M	M	M	M	S	S
CO5	S	M	M	M	S	M	M	M	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
<i>M. De</i>	<i>MSP</i>	<i>A. h. Saran</i>



M.Sc.,-Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCC05	MOLECULAR BIOLOGY AND GENETIC ENGINEERING	DSC THEORY - V	II	4	4			4
Objective	To understand the fundamentals of DNA, and advanced aspects of molecular biology and also provide knowledge about genetic engineering aspects							
Unit	Course Content						Knowledge Levels	Sessions
I	DNA as the genetic material - Transformation, transduction, conjugation and recombination genetic code. Mutation: Types of mutations, mutagens, mutagenesis, mutational hot spots, reversion of mutation. DNA Replication- DNA polymerases: Binding proteins: DNA Ligases, topoisomerases and DNAases; Events in the replication fork; termination.						KI-K2	10
II	Transcription: Prokaryotic DNA dependent RNA polymerase- initiation, elongation and termination of transcription, Rho and sigma factors in transcription, Biosynthesis of mRNA; and tRNA- Maturation- post transcriptional processing. Control of transcription, antibiotics and transcription. Translation: structure and composition of prokaryotic protein synthesis - amino acid activation, initiation, elongation and termination, post translational modification, control of translation inhibitors of protein synthesis.						KI-K2	8
III	DNA repair - photo reactivation, exclusion repair and recombination repair. Genetic recombination: Types of recombination, breakage and rejoining to form hetero duplexes; exchange between homologous double stranded molecules; Holliday model for homologous recombination asymmetric strand. Transfer model transposable element: Type of bacterial transposition: Gene Regulation prokaryotes : The operon model; lac operon, Ala operon. Trp operon and His operon.						K1-K3	9
IV	Generation of DNA fragments for cloning restriction enzymes random shear, complementary DNA, synthetic DNA cloning, chromosome walking, Genomic library. Vector: Gene transfer vectors, expression vectors, Plasmid vectors - PBR 322 phages vectors - M13 filamentous phage, cosmids, yeast vector - YIP (simple integrative and autonomous vectors) changing genes - site directed mutagenesis - Ligation of sticky ends, blunt end ligation, homopolymer tailing.						K1- K4	9

V	Gene manipulation of plants: Gene transfer through Agrobacterium tumefaciens and R. Rizogenes: Protoplast fusion; Genetic manipulation in nitrogen fixation - common modulation genes, Bacillus thuringiensis; products delta endotoxin, production of herbicide resistant plants; virus resistant plant; pest resistant plants; biofertilizers; cellulose degradation. Transgenic plants: Experimental procedures of producing transgenic plants. Production of Novel Proteins: Human Insulin, somatostatin interferons, vaccines, blood proteins, lymphokines. Transgenic animals: Method of production, expression of foreign DNA in transgenic mice. Gene therapy : Treating Adenosine Deaminase deficiency (combined immune deficiency)	K1-K5	9
Course Outcome	CO1: Understand the basic concept of DNA, mutation, and replication	K1	
	CO2: Implement the basic concept of transcription and translation	K2	
	CO3: Interpret the principles and mechanisms of DNA repair and genetic recombination	K3	
	CO4: Select the structure and functions of DNA fragments, cloning and vectors	K4	
	CO5: Construct the mechanism of gene manipulation of plants and transgenic animals	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Molecular Biology Weaver R.F. Tata, 2005, 3rd edition, Mc Graw-hill companies, inc. India 2. Essential Molecular Biology A Practical approach Brown T.A 2007, 2nd edition. IRL Press, 3. Molecular Biology David Friefeld, 1987. 2nd edition. Friefeldernarosa Publishing house, New Delhi. 4. Cloning 1 and 2, Glover D.M. and Hames B.D. 1995. IRL Press. 		
Reference Books	<ol style="list-style-type: none"> 1. Alberts, Johnson, Lewis, Raff, Roberts and Walter, 2002.. Molecular Biology of the cell 4th edition., Garland Publication, NY. 2. Molecular Biology of the gene Watson, Baker, Bell, 2004. 5th edition. Dorling Kinderly (P) Ltd. 3. Molecular Biotechnology Glick B.R. and Pasternak J.J 2010. 4th edition. ASM Press, USA. 4. Recombinant DNA 2nd edition. Watson 1992, W.H, Freeman and Co., NY. 		
Website Link	<ol style="list-style-type: none"> 1. https://microbenotes.com/ 2. https://www.mayoclinic.org/ 		

L-Lecture T-Tutorial P-Practical C-Credit

M.Sc.,-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCC05	MOLECULAR BIOLOGY AND GENETIC ENGINEERING	DSC THEORY - V	II	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S	M	M	M	M	S
CO2	S	M	S	S	M	S	M	S	S	M
CO3	M	M	M	M	S	M	M	M	M	S
CO4	S	M	S	M	M	M	S	M	S	M
CO5	M	M	S	M	M	M	M	S	M	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
		



M.Sc.,-Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCC06	IMMUNOCHEMISTRY	DSC THEORY - VI	II	4	4			4
Objective	To study the immune responses of human body against antigen, immunological techniques and vaccine synthesis							
Unit	Course Content						Knowledge Levels	Sessions
I	Types of immunity - innate and acquired. Humoral and cell mediated immunity. Immunity to infection: Immunological and non immunological surface protective mechanisms, antibacterial resistance antiviral resistance, interfection, antibacterial antigens, self antigens, MHC, Foreign antigen: Essential features of antigenicity - Factors that govern immune response, cross reactivity , Haptens, Tumour antigens, Viral antigens, Bacterial antigens. Cells that trap foreign material myeloid system, mononuclear phagocytic system. Inflammation: Acute and Chronic inflammation.						K1-k2	10
II	Antibodies: Properties of antibody structure of IgG, isotopes, allotypes,, idiotype, classes, subclasses, Igs as antigens. Monoclonal antibodies (Hybridomas). Ag-Ab complex: chemical basis of Ag-Ab binding, affinity, valence, kinetics of Ag-Ab reactions. Theories of antibody formation; generation of antibody diversity; genetics. Complement system: components of complement activation and its biological consequences - classical, alternative and lectin pathways.						K1-k2	8
III	Lymphocytes: T and B cells, Lymphocyte, mitogens, response of B cells to antigens. Interaction between T and B cells. Macrophage co-operation, interleukins and other factors. Triggering of B cells, plasma cells, memory cell. Response of T cells to antigens - antigens that provide T cell response lymphokines, interleukins, cytotoxicity.						K1- K3	8
IV	Vaccination - passive and active immunization schedule, antibacterial, antitoxic and viral vaccines. Serology: precipitation, agglutination, immune-electrophoresis, fluorescent antibody techniques, RIA and ELISA. Allergy and hypersensitivity: type I, II, III and IV hypersensitivity unusual and adverse to drugs, drug discovery, drug intolerance.						K1-k4	9

V	Transplantation - graft rejection, transplantation antigens, HLA mechanism of graft rejection, prevention of graft rejection, immune suppressive agents immune surveillance. Acute intolerance (tachyphyrasis) Autoimmunity: mechanism of breakdown: rheumatoid arthritis; myasthenia gravis, immunity and aging, disorders of immunoglobulin synthesis.	K1-k5	10
Course Outcome	CO1: Understand the Humoral and cell mediated immunity	K1	
	CO2: Sketch the primary and secondary lymphoid organ.	K2	
	CO3: Differentiate the theories of antibody formation and factors influencing antibody production.	K3	
	CO4: Select the types of transplantation and understand how its malfunction is linked with autoimmune disease and hypersensitivity.	K4	
	CO5: Formulate the active and passive immunization and learn how to make recombinant vector vaccines. Get clear knowledge about the agglutination and precipitation techniques involved in research level.	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Immunology (2007) Kuby 6th edition 2. ROITT's Essential Immunology(2002) Wiley publication 12th edition. 3. Immunology - A introduction - Tizard 4. Immunology - Kannan. MJP Publishers Edition: 2013 		
Reference Books	<ol style="list-style-type: none"> 1. Biomedical Methods Hand Book-John M. Walkset Ralph Raplay. Humana Press, 2005. 2. George P. Patrinos, Wilhelm Ansorge, (2009). Molecular Diagnostics 3. Stress, immunity of ageing - L Cooper. Marcel Dekkar 4. Nucleic Acid Testing for Human Diseases. Ed. Attila Lorincz. Taylor and Francis Publishers(CRC, NY), 2006 		
Website Link	<ol style="list-style-type: none"> 1. https://ameripharmaspecialty.com/ 2. https://www.britannica.com 3. https://pathology.jhu.edu/ 		

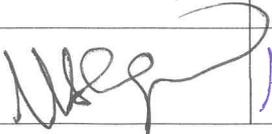
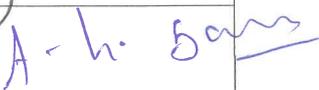
L-Lecture T-Tutorial P-Practical C-Credit

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCC06	IMMUNOCHEMISTRY	DSC THEORY - VI	II	4	4			4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	M	S	M	S	M	M
CO2	M	M	S	M	S	M	S	S	M	M
CO3	S	M	S	M	S	M	M	M	M	S
CO4	S	M	S	M	M	S	S	M	S	S
CO5	S	M	S	S	M	S	S	V	S	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
		



M.Sc.,- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCE0 ③ 2	PLANT BIOCHEMISTRY	DSE - II	II	4	4			4
Objective	This paper aims to provide a basic understanding of structure and functions of cell, photosynthesis, nitrogen fixation, and phytohormones, provide the knowledge about secondary metabolites and gene transfer methods and to understand the basic knowledge of mechanism of water transport and Photosynthesis							
Unit	Course Content						Knowledge Levels	Sessions
I	Plant Cell: Structure, Composition and functions of plant cell organelles, including cell wall and cell membranes. Biosynthesis of cell wall. Plant cell and tissue culture. Transport mechanisms: water movement, ascent of sap, mechanisms for movement of solutes. Translocation in xylem and phloem.						KI-K2	8
II	Plant Nutrition: Essential nutrients - inorganic nutrients, their functions, deficient and toxicity symptoms. Nitrogen fixation; Biochemistry of nitrate assimilation - Structural features of Nitrate reductase, nitrite reductase and regulation - sulphur metabolism, sulphur activation and assimilation. Circadian rhythms.						KI-K2	8
III	Photosynthesis: Structure and composition of photosynthetic apparatus - light and dark reactions- Cyclic and Non Cyclic Photophosphorylations; Carbon dioxide fixation - C3, C4 and CAM pathways. Biosynthesis of sucrose and starch, Factors affecting the rate of photosynthesis. Photorespiration- Photosynthesis and plant productivity.						KI-K3	9
IV	Growth Regulators : Auxins, Gibberellins, cytokinins, ABA-Ethylene Metabolism, function and mechanism of action. Plant growth inhibitors, Plant Stress, Plant responses to abiotic and biotic stresses Phytochemistry : Plant chemicals and their significance storage carbohydrates, proteins and fats. Secondary plant products and their economic importance - waxes; essential oils, phenolic glycosides, flavonoids, anthocyanins and alkaloids. Biosynthesis of alkaloids, terpenoids, phenolics and pigments (general treatment only).						KI-K4	10
V	Biochemistry of plant diseases : Plant pathogenesis, initial stages of pathogenesis, mechanisms of pathogenesis - Mechanism of attack. Responses of plants to pathogens - pathological effects of respiration, photosynthesis, cell wall enzymes and water uptake. Disease-resistance mechanisms; phytoalexins.						KI-K4	10

To check

Course Outcome	CO1:Describe the nitrogen fixation mechanisms in plants and interrelationship between photosynthesis and nitrogen metabolism.	K1
	CO2:Get the Knowledge about the Biosynthesis, transport, distribution, mechanism of action and physiological effects of plant hormones	K2
	CO3:Relate the plant hormones and secondary metabolites to plant growth and development and also its significance in human nutrition and health	K3
	CO4: Defend the biochemical events associated with growth regulators.	K4
	CO5:Select the role of secondary metabolites in drug development	K4
Learning Resources		
Text Books	1. A Textbook of Plant Physiology, Biochemistry and Biotechnology by S K Verma & Mohit Verma. 2. Plant Biochemistry, by Hans-Walter Heldt, Birgit Piechulla in cooperation with Fiona Heldt. Academic Press. 3. Plant Biochemistry, P.M. Dey & J.B. Harborne(2000) Hart Court Asia Pte Ltd.	
Reference Books	1. Principles of Gene Manipulation, by R.W. Old, S.B. Primrose, Wiley-Blackwell Publications 2. Photosynthesis, D.O. Hall and K. K. Rao, (1999), 6th Edn. Cambridge University Press. 3. Plant Biochemistry and Molecular Biology Peter J. Lea Richard. C. Lee good, 1999 2nd edition. John Wiley & Sons, NY. 4. Plant pathology by Pandey B.P, S. 2009 Chand & Co.	
Website Link	1. https://biologydictionary.net/ 2. https://www.nature.com/ 3. https://www.britannica.com/science/	

L-Lecture T-Tutorial P-Practical C-Credit

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCE03	PLANT BIOCHEMISTRY	DSE - II	II	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S	S	S	S	S	S
CO2	S	S	M	M	S	S	M	M	M	S
CO3	M	M	M	S	M	M	S	M	M	M
CO4	M	S	M	S	M	S	M	M	M	S
CO5	S	S	M	M	S	S	M	M	S	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
<i>S. Anitha</i>	<i>WSP</i>	<i>A-h-b</i>



M.Sc.,- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCPO 3	MOLECULAR BIOLOGY	DSC PRACTICAL - III	II	6			6	3
Objective	To study the basic concepts of techniques in isolation, identification and estimation of nucleic acids							
S.NO 1.Group discussion 2.Flash cards 3.Listening skills 4.Roll play No.	List of Experiments / Programmes						Knowledge Levels	Sessions
1	1. Estimation of DNA a) Diphenylamine method b) UV method 2. Estimation of RNA a) Orcinol method b) UV method						KI-K3	15
2	3. Comet Assay 4. Agarose Gel Electrophoresis						KI-K3	12
3	5. Isolation of plasmid DNA 6. Isolation of Genomic DNA 7. Isolation of RNA						KI-K4	18
4	8. Restriction digestion of DNA 9. Preparation of competent cell and Transformation						KI-K4	15
5	10. PCR - Demonstration 11. Southern Blotting -Demonstration						KI-K5	10
Course Outcome	CO1: Learn how to estimate DNA & RNA						K3	
	CO2:Isolation of DNA and RNA						K3	
	CO3:Learn about how to analyze DNA damage by Comet assya and process of DNA electrophoresis using agarose gels						K3	
	CO4: The students can read a plasmid map to determine restriction sites and fragment sizes and Compare gel electrophoresis bands to determine DNA sizes						K4	
	CO5:Learn about the basic steps involved in PCR and they can identify specific DNA sequence in DNA samples by southern blotting						K5	
Learning Resources								

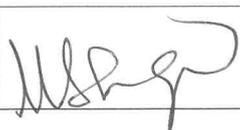
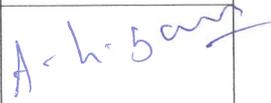
<p>Text Books</p>	<p>1. Plant biochemistry - Practical. C.C. Giri & Archana Giri. 2. Introductory practical Biochemistry. S.K. Sawhney, Randhir Singh. 3. Biochemical methods, S.Sadasivam and A.Manickam 1992. Willey Eastern Limited, New Delhi.</p>
<p>Reference Books</p>	<p>4. J. Sambroke, E.F. Fritsch & T.Maniatis. Molecular cloning - A laboratory manual. 5. James .J. Greene, Veningalla.B.Rao. Recombinant DNA principles and methodologies 6. D.M. Glover and B.D.Hames. DNA cloning - A practical approach.</p>
<p>Website Link</p>	<p>1. https://www.biotechnologynotes.com/ 2. https://www.mybiosource.com/learn/testing-procedures/</p>

M.Sc.,- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCP03	MOLECULAR BIOLOGY	DSC PRACTICAL - III	II	6			6	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M	S	S	M	M	S
CO2	M	M	M	S	M	M	M	S	S	M
CO3	S	M	M	M	S	M	S	M	M	S
CO4	M	M	S	S	S	M	M	S	M	S
CO5	S	S	M	M	S	S	M	M	S	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	UV Method learning and group discussion
Teaching and Learning Methods	Explanation of Practical procedure and Demonstration of experiments
Assessment Methods	Observation, Performance, Attendance

Designed By	Verified By	Approved By
		



M.Sc.,- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCP04	IMMUNOLOGY	DSC PRACTICAL - IV	II	6			6	3
Objective	To study the basic concepts of techniques in agglutination, precipitation, and immune responses							
S. No.	List of Experiments / Programmes						Knowledge Levels	Sessions
1	I. Agglutination 1. Blood Grouping and Rh Typing						KI-K3	10
2	2. RA test 3. CRP test 4. Pregnancy Test						KI-K3	15
3	II. Precipitation 1. Immunodiffusion - Mancini and Ouchterlony method 2. Immuno Electrophoresis 3. Rocket Immuno Electrophoresis 4. Counter Current Immuno Electrophoresis 5. Immunoprecipitation test						KI-K4	30
4	III. Enzyme immune assay 1. ELISA						KI-K4	5
5	IV. Hybridization Technique 1. Western Blotting						KI-K5	10
Course Outcome	CO1: Learn about how the agglutination reactions can be used to assess the presence of antibodies in a specimen						K3	
	CO2: Learn about the principles and procedures of immunological techniques						K3	
	CO3: Use of various immunoelectrophoresis techniques to separate and characterize a mixture of proteins and examine the specificity of the antigen-antibody interaction						K3	
	CO4: Demonstrate the power of an ELISA as a biomedical diagnostic tool and can perform the method of ELISA						K4	
	CO5: Determine the molecular weight of protein by western blotting						K5	
Learning Resources								

Text Books	<ol style="list-style-type: none">1. Practical immunology Frank L Hay and Olywn M R 4th Edn. Westwood2. Practical Manual of Biochemistry S.P. Singh, 2013. CBS publishers
Reference Books	<ol style="list-style-type: none">1. Laboratory techniques in Biochemistry and Molecular Biology, Work and Work.2. Bioinformatics - A Practical Guide to the analysis of gene and proteins
Website Link	<ol style="list-style-type: none">1. https://www.biotechnologynotes.com/2. https://www.mybiosource.com/learn/testing-procedures/3. https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual

M.Sc.,- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCP04	IMMUNOLOGY	DSC PRACTICAL - IV	II	6			6	3

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	S	M	S	S	S
CO2	M	S	S	M	M	S	M	M	S	M
CO3	M	S	M	S	M	S	M	S	M	S
CO4	S	M	S	M	M	M	S	M	M	S
CO5	S	M	S	M	S	S	M	S	S	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	Demonstration and group discussion
Teaching and Learning Methods	Explanation of Practical procedure and Demonstration of experiments
Assessment Methods	Observation, Performance, Attendance

Designed By	Verified By	Approved By
		



M.Sc.,- Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCED 1	BIOCHEMISTRY IN HEALTH	GEC - EDC - I	II	3	3			4
Objective	To understand the different types of bio molecules, common disorders of nutritional deficiency and to gain knowledge on the biological importance of micro nutrients.							
Unit	Course Content						Knowledge Levels	Sessions
I	Carbohydrate - Source of carbohydrates, significance of carbohydrates in cellular activities and organism life system. Mucopolysaccharidosis, Lactose and Fructose intolerance. Normal level of sugar, alterations; Diabetes mellitus, types and its complications. Control and Management of diabetes mellitus.						KI-K2	6
II	Protein -Sources of proteins and amino acids. Importance of proteins in living organisms. Normal level of protein in human. Protein deficiency disease- Kwashiorkor and marasmus Protein quality 'Inborn error of amino acid metabolism.						KI-K2	6
III	Fatty acids - source of fats and importance of fats and lipids in living organism and. Role of LDL, VLDL, HDL and chylomicrons in human body. Normal levels of cholesterol, hypercholesterolemia and role of cholesterol in Blood pressure. Atherosclerosis and Heart attack. Prevention and control of heart related diseases						KI-K3	6
IV	Water - biological importance. Vitamins- water soluble and fat soluble vitamins; Sources, chemical composition, Biological function and property, Deficiency diseases in human.						KI-K4	6
V	Minerals Source and deficiency disorders of Macro-minerals; Sodium, Potassium, Calcium, Magnesium, Micro-minerals: Copper, phosphorus, Iron, Iodine, Zinc and Selenium in human Prevention and control of Anaemia.						KI-K5	6
Course Outcome	CO1: Summarize the sources, importance of carbohydrates and gain awareness about Diabetes mellitus.						K2	
	CO2: Understand the importance of proteins in living organism with their deficiency disorders.						K2	
	CO3: Describe the sources and importance of lipids along with the disorders of lipid metabolism.						K3	

	CO4: Explain the sources, RDA, importance and deficiency disorders of vitamins.	K4	
	CO5: Describe about sources and biological importance of minerals.	K5	
Learning Resources			
Text Books	1. Text book of Medical Biochemistry 2002.M.N. Chatterjea and Rana Shinde, 5th Edn. JayPee Publications, New Delhi 2. Fundamentals of Biochemistry, Dr.A.C.Deb 2006, New Central Book Agency(P)Ltd. Kolkota. 3. Essentials of Biochemistry Sathyanarayanan.U. 2002, Books and allied (P) Ltd. 4. Essentials of Medical Physiology , K.Sembilingam and Prema Sembulingam, 2010. 5th Edn.Jaypee Bros, medical Publishers (P) Ltd. Chennai.		
Reference Books	1. Text book of Medical Physiology - A.C . Guyton, 8th Edn.1991, W.B.Saunders, Harcourt Brace Company, Bangalore. 2. Fundamentals of Biochemistry for Medical Students by Ambika shanmugam 2006.Published by author; West CIT Nagar, Chennai-35 3. Text Book of Biochemistry, S.Nagini, 2002. Scitech Publications (P) Ltd., Chennai		
Website Link	1. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview 2. https://onlinecourses.nptel.ac.in/noc22_cy06/preview 3. https://drvasantraopawarmedicalcollege.com/facilities/ict-enabled-t-l/		

L-Lecture T-Tutorial P-Practical C-Credit

M.Sc.,-Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PBCED1	BIOCHEMISTRY IN HEALTH	GEC - EDC - I	II	3	3			4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	M	S	M	M	M
CO2	M	M	S	M	M	M	S	M	M	M
CO3	S	S	S	M	M	S	M	M	S	M
CO4	M	M	M	S	M	M	M	M	M	S
CO5	S	M	M	S	M	M	M	S	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.flash cards 3.Listining skills 4.Role play
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By
<i>M. Sreejith</i>	<i>M. Sreejith</i>	<i>A. h. Sam</i>

