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

Learn. Lead

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 2023-2024 and onwards)

Regulation and Syllabus for

M.Sc BIOCHEMISTRY

(With effect from the Academic Year 2023-24)

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 and 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

PREAMBLE

The Master of Science in Biochemistry program is designed to equip students with a profound understanding of the molecular mechanisms that underpin biological processes. This advanced curriculum fosters a deep comprehension of biochemical principles, integrating knowledge from chemistry, biology, and molecular sciences. Through rigorous coursework, cutting-edge laboratory techniques, and interdisciplinary research, students will develop the skills necessary to address complex biological questions and contribute to scientific advancements. The program emphasizes critical thinking, problem-solving, and innovation, preparing graduates for diverse careers in research, academia, industry, and healthcare. By cultivating a collaborative and intellectually stimulating environment, the M.Sc Biochemistry program aims to produce proficient biochemists who are capable of making significant contributions to scientific knowledge and societal well-being.

PROGRAMME LEARNING OUTCOME

NATURE AND EXTENT OF THE PROGRAMME

The M.Sc Biochemistry program offers an in-depth exploration of the chemical processes within and related to living organisms. It spans a broad spectrum of topics, including molecular biology, Pharmacology, enzymology, genetics, and metabolic pathways. The program combines theoretical knowledge with extensive practical experience, allowing students to engage in hands-on laboratory work and independent research projects. Through a multidisciplinary approach, students will acquire advanced analytical and technical skills, preparing them for careers in research, biotechnology, pharmaceuticals, and healthcare. The program also emphasizes the importance of ethical scientific practice and the impact of biochemistry on society and the environment.

AIM OF THE PROGRAMME

The aim of the M.Sc Biochemistry program is to provide students with a comprehensive and advanced understanding of biochemical processes at the molecular

and cellular levels. This program seeks to develop proficient scientists who can integrate chemical and biological principles to solve complex biological problems. Through a combination of theoretical knowledge, practical laboratory skills, and research experience, the program prepares students to excel in various scientific careers. Graduates will be equipped to conduct independent research, contribute to advancements in biochemistry, and apply their expertise in academic, industrial, and healthcare settings. The program strives to foster innovation, critical thinking, and ethical practices in the pursuit of scientific excellence and societal benefit.

GRADUATE ATTRIBUTES

- GA 1 Research Skill
- GA 2 Multicultural Competency
- GA 3 Critical Thinking
- GA 4 Problem Solving Skill
- GA 5 Disciplinary Knowledge
- GA 6 Moral and Ethical Reasoning
- GA 7 Self Directed Learning

Research-Related Skills:

a) Graduates will be skilled in designing and conducting independent research projects, employing advanced laboratory techniques, and utilizing modern analytical tools.
b) They will be capable of generating, analyzing, and interpreting scientific data accurately.
c) Graduates will have ability to plan and write a research paper

Multicultural Competence:

a) Graduates will understand the global context of biochemical research and its impact on health, environment, and industry.
b) They will be aware of the global challenges and opportunities in biochemistry and be prepared to engage in international scientific collaboration.

Critical Thinking:

a) Graduates will exhibit strong critical thinking abilities, including analytical evaluation, logical reasoning, and reflective skepticism.

b) They will be adept at solving complex problems, making informed decisions, and developing innovative solutions.

Problem Solving Skill:

a) Graduates will be able to apply their biochemical knowledge and skills to real-world problems in various settings, including academia, industry, healthcare, and biotechnology.

b) They will be prepared to contribute to scientific advancements and societal well-being.

Disciplinary Knowledge:

a) Graduates will have a thorough understanding of the molecular mechanisms of gene expression, regulation, and genetic engineering. They will be well-versed in DNA replication, transcription, translation, and gene editing technologies such as CRISPR.

b) Graduates will possess in-depth knowledge of enzyme structure, function, kinetics, and regulation. They will understand enzyme mechanisms and the role of cofactors and inhibitors in biochemical reactions.

c) Graduates will have a comprehensive understanding of metabolic pathways, including glycolysis, the citric acid cycle, oxidative phosphorylation, and lipid metabolism. They will be able to integrate these pathways to understand energy production and utilization in cells.

d) Graduates will be knowledgeable about the three-dimensional structures of biomolecules, including proteins, nucleic acids, and complex assemblies. They will understand techniques such as X-ray crystallography, NMR spectroscopy, and cryo-electron microscopy.

e) Graduates will understand the principles of cell signaling pathways, including signal transduction, receptor-ligand interactions, and intracellular signaling cascades. They will be familiar with key signaling molecules and their roles in cellular communication and regulation.

f) Graduates will be proficient in a wide range of biochemical techniques, including chromatography, electrophoresis, mass spectrometry, and spectrophotometry.

They will be capable of selecting and applying appropriate techniques for specific biochemical analyses.

g) Graduates will have a solid understanding of bioinformatics tools and databases used for analyzing biological data. They will be skilled in sequence alignment, structural modeling, and functional annotation of biomolecules.

h) Graduates will understand the physical principles underlying biochemical systems, including thermodynamics, kinetics, and molecular interactions. They will be able to apply these principles to study the behavior and properties of biomolecules.

i) Graduates will possess knowledge of the immune system, including the molecular and cellular basis of immune responses. They will understand the roles of antibodies, antigens, and immune cells in health and disease.

j) Graduates will have an understanding of how biochemical pathways are altered in various diseases, such as cancer, diabetes, and neurodegenerative disorders. They will be able to relate these changes to clinical symptoms and therapeutic approaches.

Moral and Ethical Reasoning:

a) Graduates will demonstrate a commitment to ethical principles and professional standards in scientific research and practice.

b) They will understand the importance of integrity, accountability, and responsible conduct in science.

Self-Directing Learning:

a) Graduates will recognize the importance of continuous learning and self-improvement.

b) They will be equipped to stay current with advancements in biochemistry and related fields through ongoing education and professional development.

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

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 acquire acumen to handle diverse contexts and function in domains of multiplicity

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

PO5 : Post graduates will learn ethical values and commit to Professional ethics.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1 : To acquire necessary knowledge and skills in core themes, principles and components of basic Biochemistry

PSO2 : To demonstrate the knowledge of biochemical processes from the cellular and molecular aspects

PSO3 : To Integrate and apply the techniques studied and to compare and contrast the depth of scientific knowledge in the broad range of fields

PSO4 : 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.

PSO5 : To provide students with the knowledge and skill base that would enable them to go for self-employment and entrepreneurship

REGULATIONS (2023-2024)

1. DURATION OF THE PROGRAME

1.1 Two years (Four semesters)

1.2 Each academic year shall be divided into two semesters. The odd semesters Shall consist of the period from June to November of each year and the even Semesters from December to May of each year.

1.3 There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION

2.1 A candidate who has passed B.Sc., degree in Biochemistry, Chemistry, Microbiology, Biotechnology, Botany, Zoology, Nutrition, Nutrition and Dietetics, Genetics or an Equivalent B.Sc. Examination in Bachelor in Medical/Clinical Laboratory Technology Course or some other B.Sc., board equivalence submitted by the respective University may be accepted by the syndicate as equivalent there to with Biochemistry shall be eligible for admission into M.Sc., course in Biochemistry.

3. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

3.1. A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in a College affiliated to the University for a period of not less than two academic years and passed the examinations of all the four Semesters prescribed earning a minimum of 91 credits as per the distribution given in Regulation fulfilled such other conditions as have been prescribed thereof.

4. COURSE OF STUDY, CREDITS AND SCHEME OF EXAMINATION

4.1 The Course Components and Credit Distribution shall consist of the following: (Minimum Number of Credits to be obtained)

S.No	Study Components	Credit Distribution
01	Core, Elective, EDC, and Project Courses	84
02	Internship	02
03	Human Rights	02
04	Professional Competency Skills	02
	Extension Activity	01
Total Credits		91

4.1.1 Extension Activity:

Students shall be awarded a maximum of 1 Credit for Compulsory Extension Service. All the Students shall have to enroll for clubs / NSO (Sports & Games) Retract / Youth Red Cross or any other Service Organizations in the College and shall have to put in compulsory minimum attendance of 40 hours which shall be duly certified by the Principal of the College before 31st March in a year. If a student lacks 40 hours attendance in the first year, he or she shall have to compensate the same during the subsequent years.

Those students who complete minimum attendance of 40 hours in one year will get 'half-a- credit and those who complete the attendance of 80 or more hours in Two Years will get 'one credit'. Literacy and Population Education and Field Work shall be compulsory components in the above extension service activities.

4.2 Inclusion of the Massive Open Online Courses (MOOCs) available on SWAYAM and NPTEL

4.2.1 Students can choose the MOOC Course Available on SWAYAM and NPTEL under Core, Elective or Soft skill category. He/ she will be awarded degree only after producing valid certificate of the MOOC course for credit Mobility

5. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

5.1 Eligibility: Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed by the Periyar University.

5.2. Attendance: All Students must earn 75% and above of attendance for appearing for the End Semester Examination.(Theory/Practical)

5.3. Condonation of shortage of attendance: If a Student fails to earn the minimum attendance (Percentage stipulated), the Principals shall condone the shortage of attendance up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after collecting the prescribed fee for Theory/Practical examination separately, towards the condonation of shortage of attendance. Such fees collected and should be remitted to the University.

5.4. Non-eligibility for condonation of shortage of attendance: Students who have secured less than 65% but more than 50% of attendance are NOT ELIGIBLE for condonation of shortage of attendance and such Students will not be permitted to appear for the regular examination, but will be allowed to proceed to the next year/next semester of the program and they may be permitted to take next University examination by paying the prescribed condonation fee

5.5. Detained students for want of attendance: Students who have earned less than 50% of attendance shall not be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the College from time to time.

5.6. Condonation of shortage of attendance for married women students: In respect of married women students undergoing PG programs, the minimum attendance for condonation (Theory/Practical) shall be relaxed and prescribed as 55% instead of 65% if they conceive during their academic career. Medical certificate from the Doctor (D.G.O) from the Government Hospital and the prescribed fee along with attendance details shall be forwarded to the college to consider the condonation of attendance mentioning the category

5.7. Zero Percent (0%) Attendance: The Students, who have earned 0% of attendance, have to repeat the program (by rejoining) without proceeding to succeeding semester and they have to obtain prior permission from the College/University immediately to rejoin the program.

5.8. Transfer of Students and Credits: The strength of the credits system is that it permits inter Institutional transfer of students. By providing mobility, it enables individual students to develop their capabilities fully by permitting them to move from one Institution to another in accordance with their aptitude and abilities by obtaining necessary permission from the university.

5.8.1. Transfer of Students is permitted from one Institution to another Institution for the same program with same nomenclature.

Provided, there is a vacancy in the respective program of Study in the Institution where the transfer is requested.

Provided the Student should have passed all the courses in the Institution from where the transfer is requested.

5.8.2 The marks obtained in the courses will be converted and grades will be assigned as per the College norms.

5.8.3 The transfer students are eligible for classification.

5.8.4 The transfer students are not eligible for Ranking, Prizes and Medals.

5.8.5 Students who want to go to foreign Universities up to two semesters or Project Work with the prior approval of the Departmental/College Committee are allowed to get transfer of credits and marks which will be converted in to Grades as per the University norms and are eligible to get CGPA and Classification; they are not eligible for Ranking, Prizes and Medals.

5.9. Students are exempted from attendance requirements for online courses of the College and MOOC's.

6. EXAMINATION AND EVALUATION

6.1. Register for all subjects: Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination. For this purpose, Students shall register for all the arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

6.2. Marks for Internal and End Semester Examinations

Category	Theory	Practical
Internal Assessment	25	**40**
End semester Examination	**75**	**60**

6.3 Procedure for Awarding Internal Marks Internal Examination Marks – Theory

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

6.4. Awarding Marks for Attendance (out of 5)

Percentage of Attendance	Marks
Below 60%	0 marks
60% to 75%	3 marks
75% to 90%	4 marks
Above 90%	5 marks

6.5. Components for Practical CIA.

Components	Marks
CIA -I	15
CIA - II	15
Observation Note	05
Attendance	5
Total	40

6.6. Components for Practical ESE.

Components	Marks
Completion of Experiments	50
Record	05
Viva voce	05
Total	60

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

Internship/Industrial Training		Project Work		
	Marks	Components		Marks
CIA*1		CIA		
Work Diary	25	a) Attendance	20 Marks	50
Report	50	b) Review / Work Diary*1	30 Marks	
Viva-voce	25			
Examination				
Total	100	ESE*2		
		a) Final Report	120 Marks	150
		b) Viva-voce	30 Marks	
		Total		200

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

6.8. Guidelines for Professional Competency Skill- 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.

6.9 Components for Human Rights Course (CIA Only)

The Course Human Rights is to be treated as 100% C I A 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

QUESTION PAPER PATTERN FOR CIA I, II AND ESE	
(3 HOURS)	MAXIMUM:75Marks
SECTION-A (Objective Type) Answer ALL Questions **ALL Questions Carry EQUAL Marks**	**(10 x1=10 marks)**
SECTION-B (Analytical Type) Answer any THREE Questions out of FIVE Questions **ALL Questions Carry EQUAL Marks**	**(3 x 5 = 15 marks)**
SECTION-C (Either or Type) Answer ALL Questions **ALL Questions Carry EQUAL Marks**	**(5 x 10 = 50 marks)**

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

6.10 PASSING MINIMUM

6.10.1 There shall be no passing minimum for Internal.

6.10.2 For external examination, passing minimum shall be 50% [Fifty Percentage] of the maximum marks prescribed for the course for each Course/Practical/Project and Viva-Voce.

6.10.3 In the aggregate [External/Internal] the passing minimum shall be of 50%.

6.10.4 He / She shall be declared to have passed the whole examination, if he/she passes in all the Courses and Practical wherever prescribed as per the scheme of the examinations by earning 90 CREDITS. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 credit to qualify for the Degree.

6.11 SUPPLIMENTARY EXAMINATION:

Supplementary Examinations is conducted for the students who appeared in the final semester examinations. Eligible criteria for appearing in the Supplementary Examinations are as follows:

6.11.1 Eligibility: A Student who is having arrear of only one theory course in any of the semester or two theory course in the Final semester of the PG degree programme alone is eligible for Supplementary Examinations.

6.11.2 Non-eligibility for those completed the program: Students who have completed their Program duration but having arrears are not eligible to appear for Supplementary Examinations.

6.12. RETOTALLING, REVALUATION AND PHOTOCOPY OF THE ANSWER SCRIPTS:

6.12.1 Re-totaling: All UG Students who appeared for their Semester Examinations are eligible for applying for re-totaling of their answer scripts.

6.12.2Revaluation: All current batch Students who have appeared for their Semester Examinations are eligible for Revaluation of their answer scripts. Passed out candidates are not eligible for Revaluation.

6.12.3 Photo copy of the answer scripts: Students who have applied for revaluation can apply for the Photocopy of answer scripts by paying prescribed fee.

7. CLASSIFICATION OF SUCCESSFUL STUDENTS

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

7.1. Computation of Grade Point Average (GPA) in a Semester, Cumulative Grade Point Average(CGPA) and Classification

GPA for a Semester: = ∑iCiGi ,∑iCi

That is, GPA is the sum of the multiplication of grade points by the credits of the courses divided by the sum of the credits of the courses in a semester.

CGPA for the entire programme: = ∑n∑iCniGni ,∑n∑iCni That is, CGPA is the sum of the multiplication of grade points by the credits of the entire programme divided by the sum of the credits of the courses of the entire programme

Where,

Ci= Credits earned for course I in any semester,

Gi=GradePointsobtainedforcourseiinanysemestern=Semesterinwhichsuchcourseswere credited.

7.2 Letter Grade and Classification

CGPA	GRAD E	CLASSIFICATION OF FINAL RESULT
9.5-10.0	O+	First Class -Exemplary*
9.0 and above but below9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction*
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
0.0 and above but below 5.0	**U**	Re-appear

*The Students who have passed in the first appearance and within the prescribed semester of the PG Program are eligible.

8. RANKING

Students who pass all the examinations prescribed for the Program in the FIRST APPEARANCE ITSELF ALONE are eligible for Ranking I, II and III.

9. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAM TO QUALIFY FOR A DEGREE

9.1. A Student who for whatever reasons is not able to complete the program within the normal period (N) or the Minimum duration prescribed for the programme, may be allowed two years period beyond the normal period to clear the backlog to be qualified for the degree. (Time Span =N+2years for the completion of programme)

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M.Sc.,-BIOCHEMISTRY Abstract under LOCF-CBCS Pattern with effect from 2023-2024 Onwards

Structure of Credit Distribution as per the TANSCHE / UGC Guidelines

S.No.	Study Components	Sem I		Sem II		Sem III		Sem IV		No. of Paper	Total Credit
		No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit		
1	DISCIPLINE SPECIFIC CORESES(DSC)- THEORY	3	12	3	12	3	12	2	8	11	44
2	DSC-PRACTICAL			2	6	1	4			3	10
3	DISCIPLINE SPECIFIC ELECTIVE COURSES(DSE)	2	6	2	6	2	6	1	3	7	21
4	SOFT SKILL	1	2								2
5	PROJECT WORK							1	4	1	4
6	INTERNSHIP					1	2			1	2
7	GENERIC ELECTIVE COURSES(GEC)-EDC									0	0
8	HUMAN RIGHTS			1	1					1	1
9	NONMAJOR ELECTIVE (NMEC)			1	2	1	2				4
10	ONLINE - COMPETITIVE EXAMINATION							1	2	1	2
11	EXTENSION ACTIVITY							1	1		1
	Cumulative Credits	6	20	9	27	8	26	6	19	29	91

Total No. of Subjects	29
Marks	**2900**

Total Credit	**91**
Extra Credit	4
Grand Total	**95**

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (Autonomous) - Rasipuram - 637 408
Scheme of Examinations LOCF-CBCS Pattern
(for the Students Admitted from the Academic Year:2023-2024 Onwards)
Programme : M.Sc. BIOCHEMISTRY

S.No.	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX.MARKS		
				Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - I									
1	DSC THEORY - I	23M1PBCC01	BASICS OF BIOCHEMISTRY	6	-	4	25	75	100
2	DSC THEORY - II	23M1PBCC02	BIOCHEMICAL AND MOLECULAR BIOLOGY TECHNIQUES	5	-	4	25	75	100
3	DSC THEORY - III	23M1PBCC03	PHYSIOLOY AND CELL BIOLOGY	5	-	4	25	75	100
4	DSE THEORY - I	23M1PBCE02	ELECTIVE I : IMMUNOLOGY AND IMMUNOTECNOLOGY	5	-	3	25	75	100
5	DSE THEORY - II	23M1PBCE04	ELECTIVE II : CANCER BIOLOGY	5	-	3	25	75	100
6	SOFT SKILL	23M1PBCS01	TISSUE CULTURE TECHNIQUES	4	-	2	25	75	100
			TOTAL	**30**	**0**	**20**	**150**	**450**	**600**
SEMESTER - II									
1	DSC THEORY - IV	23M2PBCC04	ENZYMOLOGY	4	-	4	25	75	100
2	DSC THEORY - V	23M2PBCC05	CELLULAR METABOLISM	4	-	4	25	75	100
3	DSC THEORY - VI	23M2PBCC06	CLINICAL BIOCHEMISTRY	4		4	25	75	100
4	DSE THEORY - III	23M2PBCE05	ELECTIVE III: ENERGY AND DRUG METABOLISM	3		3	25	75	100
5	DSE THEORY - IV	23M2PBCE07	ELECTIVE IV: NUTRITIONAL BIOCHEMISTRY	3	-	3	25	75	100
6	DSC PRACTICAL - I	23M2PBCP01	PRACTICAL I : BIOMOLECULES AND BIOCHEMICAL TECHNIQUES	-	5	3	40	60	100
7	DSC PRACTICAL - II	23M2PBCP02	PRACTICAL II : ENZMOLOGY, MOLECULAR BIOLOGY AND CELL BIOLOGY	-	4	3	40	60	100
8	EDC - I		EDC	2	-	2	25	75	100
9	HUMAN RIGHTS	23M2PHR01	HUMAN RIGHTS	1	-	2	100		100
			TOTAL	**21**	**9**	**28**	**330**	**570**	**900**

SEMESTER - III									
1	DSC THEORY - VII	23M3PBCC07	INDUSTRIAL MICROBIOLOGY	6	-	4	25	75	100
2	DSC THEORY - VIII	23M3PBCC08	MOLECULAR BIOLOGY	6	-	4	25	75	100
3	DSC THEORY - IX	23M3PBCC09	GENE EDITING, CELL AND GENE THERAPY	6		4	25	75	100
4	DSE THEORY- V	23M3PBCE09	ELECTIVE V: BIOSTATISTICS AND DATA SCIENCE	3	-	3	25	75	100
5	DSE THEORY- VI	23M3PBCE12	ELECTIVE VI: MOLECULAR BASIS OF DISEASES AND THERAPEUTIC STRATEGIES	3	-	3	25	75	100
6	DSC PRACTICAL - III	23M3PBCP03	PRACTICAL III : CLINICAL BIOCHEMISTRY	-	4	3	40	60	100
7	EDC - II		EDC	2	-	2	25	75	100
8	INTERNSHIP	23M3PBCIS1	INTERNSHIP	-	-	2	100	-	100
			TOTAL	**26**	**4**	**25**	**290**	**510**	**800**
SEMESTER - IV									
1	DSC THEORY - X	23M4PBCC10	PHARMACEUTICAL BIOCHEMISTRY	6	-	4	25	75	100
2	DSC THEORY - XI	23M4PBCC11	BIOCHEMICAL TOXICOLOGY	6		4	25	75	100
3	DSE THEORY- VII	23M4PBCE14	ELECTIVE VII: PLANT BIOCHEMISTRY	5		3	25	75	100
4	PROJECT WORK	23M4PBCPR1	PROJECT	-	13	4	50	150	200
5	ONLINE - COMPETITIVE EXAMINATION	23M4PBCOE1	BIOCHEMISTRY FOR COMPETITIVE EXAMINATION	-	-	2	100	-	100
6	EXTENSION ACTIVITY	23M4PEXA01	EXTENSION ACTIVITY	-	-	1	-	-	-
			TOTAL	**17**	**13**	**18**	**225**	**375**	**600**
			OVERALL TOTAL	**94**	**26**	**91**	**995**	**1905**	**2900**
	EXTRA CREDIT COURSE		MOOC COURSES OFFERED IN SWAYAM / NPTEL	-	-	2	-	-	-
	VALUE ADDED COURSE		VALUE ADDED COURSE	-	-	2	-	-	-

HOD MEMBER SECRETARY ACADEMIC COUNCIL PRINCIPAL

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCC01	**BASICS OF BIOCHEMISTRY**	**DSC THEORY – I**	**I**	**6**	**2**	**4**		**4**
Objective	Students will explore biomolecule structures, including carbohydrates, lipids, proteins, and nucleic acids, and their vital roles in biological processes							

Unit	Course Content	Knowledge Levels	Sessions
I	Carbohydrates- Classification, structure (configurations and conformations, anomeric forms), function and properties of monosaccharides, mutarotation, Disaccharides and oligosaccharides with suitable examples. Polysaccharides – Homopolysaccharides (starch, glycogen, cellulose, inulin, dextrin, agar, pectin, dextran). Heteropolysaccharides – Glycosaminoglycans– source, structure, functions of hyaluronic acid, chondroitin sulphates, heparin, Keratan sulphate, Glycoproteins – proteoglycans. O- Linked and N-linked glycoproteins. Biological significance of glycan. Bacterial cell wall (peptidoglycans, teichoic acid) and plant cell wall carbohydrates.	K3	12
II	Lipids – Classification of lipids, structure, properties and functions of fatty acids, triacylglycerols, phospholipids, glycolipids, sphingolipids and steroids – Biological importance. Eicosanoids- classification, structure and functions of prostaglandins, thromboxanes, leukotrienes. Lipoproteins – Classification, structure, transport (endogenous and exogenous Pathway) and their biological significance.	K3	13
III	Overview of Amino acids – classification, structure and properties of amino acids, biological role. Nonprotein amino acids and their biological significance. Proteins – classification based on composition, structure and functions. Primary, secondary, super secondary (motifs) (Helix-turn –helix, helix-loop-helix, Beta- alpha-beta motif, Rosemann Rossmann fold, Greek key), tertiary and quaternary structure of proteins. Structural characteristics of collagen and hemoglobin. Determination of amino acid sequence, Forces involved in stabilization of protein structure. Ramachandran plot	K4	13
IV	Membrane Proteins – Types and their significance. Cytoskeleton proteins – actin, tubulin , intermediate filaments . Biological role of cytoskeletal proteins. Membrane structure-fluid mosaic model	K4	12
V	Nucleic acids – types and forms (A, B, C and Z) of DNA. Watson-Crick model-Primary, secondary and tertiary structures of DNA. Triple helix and quadruplex DNA. Mitochondrial and chloroplast DNA. DNA supercoiling (calculation of Writhe, linking and twist number). Determination of nucleic acid sequences by Maxam Gilbert and Sanger's methods. Forces stabilizing nucleic acid structure. Properties of DNA and RNA. C-value, C-value paradox, Cot curve. Structure and role of nucleotides in cellular communications. Major and minor classes of RNA, their structure and biological functions.	K4	10
	CO1: Identify the chemical structure and functions of carbohydrates.	K3	
	CO2: Apply the knowledge of lipid structure and function, explain how it plays a role in Signaling pathways	K3	

Course Outcome	CO3: Develop the various levels of structural organization of proteins and the role of proteins in biological system	K4
	CO4: Analyze the knowledge of proteins in cell-cell interactions	K4
	CO5: Discover the knowledge of nucleic acid sequencing in research and diagnosis	K4
Learning Resources		
Text Books	1.DavidL.Nelsonand MichaelM.Cox(2012)Lehninger Principles of Biochemistry (6thed)W.H.Freeman. 2.Voet.D&Voet.J.G(2010)Biochemistry,(4thed),John Wiley & Sons, Inc. 3.Metzler D.E(2003).The chemical reactions of living cells (2nded),Academic Press.	
Reference Books	1. Zubay G.L(1999) Biochemistry, (4thed),McGrew-Hill. 2. Lubert Stryer (2010) Biochemistry,(7thed),W.H.Freeman	

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M1PBCC01	**BASICS OF BIOCHEMISTRY**	DSC THEORY – I	I	6	2	4		4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**L**	**M**	**S**	**M**	**M**	**M**	**S**	**M**	**M**
CO2	**S**	**M**	**L**	**S**	**M**	**M**	**M**	**S**	**M**	**M**
CO3	**S**	**M**	**M**	**S**	**S**	**M**	**L**	**S**	**M**	**M**
CO4	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**S**	**M**	**M**
CO5	**S**	**S**	**M**	**S**	**S**	**M**	**M**	**S**	**M**	**M**

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCC02	**Biochemical and Molecular Biology Techniques**	DSC THEORY - II	I	5	3	2		4
Objective	This course covers diverse topics, including biochemical investigation techniques, chromatography applications, electrophoresis, spectroscopy in biochemistry, and radio labelling alongside centrifugation methods.							

Unit	Course Content	Knowledge Levels	Sessions
I	General approaches to biochemical investigation, cell culture techniques and microscopic techniques. Organ and tissue slice technique, tissue homogenization techniques, cell sorting, and cell counting, tissue Culture techniques. Cryopreservation, Biosensors- principle and applications. Principle, working and applications of light microscope, dark field, phase contrast and fluorecent microscope. Electron microscope- Principle, instrumentation of TEM and SEM, Specimen preparation and applications-shadow casting, negative staining and freeze fracturing.	K3	12
II	Chromatographic Techniques: Basic principles of chromatography- adsorption and partition techniques. Chiral Chromatography and counter current Chromatography. Adsorption Chromatography – Hydroxy apatite chromatography and hydrophobic interaction Chromatography. Affinity chromatography. Gas liquid chromatography-principle, instrumentation, column development, detectors and applications. Low pressure column chromatography – principle, instrumentation, column packing, detection, quantitation and column efficiency, High pressure liquid chromatography-principle, instrumentation, delivery pump, sample injection unit, column packing, development, detection and application. Reverse HPLC, capillary electro chromatography and perfusion chromatography.	K3	12
III	Electrophoretic Techniques: General principles of electrophoresis, supporting medium, factors affecting electrophoresis, Isoelectric focusing-principle, ampholyte, development of pH gradient and application. PAGE-gel casting- horizontal, vertical, slab gels, sample application, detection- staining using CBB, silver, fluorescent stains. SDS PAGE-principle and application in molecular weight determination principle of disc gel electrophoresis, 2D PAGE. Electrophoresis of nucleic acids- agarose gel electrophoresis of DNA, pulsed field gel electrophoresis- principle, apparatus, application. Electrophoresis of RNA, curve. Microchip electrophoresis and 2D electrophoresis, Capillary electrophoresis.	K4	13
IV	Spectroscopic techniques: Basic laws of light absorption- principle, instrumentation and applications of UV-Visible, IR, ESR, NMR, Mass spectroscopy, Turbidimetry and Nephelometry. Luminometry (Luciferase system, chemiluminescence). X - ray diffraction. Atomic absorption spectroscopy - principle and applications - Determination of trace elements	K4	13
V	Radiolabeling Techniques and Centrifugation: Nature of radioactivity-detection and measurement of radioactivity, methods based upon ionization (GM counter) and excitation (scintillation counter), autoradiography and applications of radioactive isotopes, biological hazards of radiation and safety measures in handling radioactive	K5	10

	isotopes. Basic principles of Centrifugation. Preparative ultracentrifugation - Differential centrifugation, Density gradient centrifugation. Analytical ultracentrifugation - Molecular weight determination.		
Course Outcome	CO1: Develop good knowledge in modern used in biochemical investigation and microscopy and apply the experimental protocols to plan and carry out simple investigations in biological research.	K3	
	CO2: Apply knowledge to implement the theoretical basis of chromatography in upcoming practical course work.	K3	
	CO3:Demonstrate knowledge to implement the theoretical basis of electrophoretic techniques in research work	K4	
	CO4: Categorized more advanced and specialized spectroscopic techniques that are pertinent to research.	K4	
	CO5: Examine more advanced and specialized radioisotope and centrifugation techniques that are pertinent to research work.	K5	

Learning Resources				
Text Books	1. Keith Wilson , John Walker (2010) Principles and Techniques of Biochemistry and Molecular Biology 2. David Sheehan (2009), Physical Biochemistry: Principles and Applications (2nd ed), Wiley- Blackwell 3. David M. Freifelder (1982) Physical Biochemistry: Applications to Biochemistry			
Reference Books	1. Rodney F.Boyer (2012), Biochemistry Laboratory: Modern Theory and techniques 2. Kaloch Rajan (2011), Analytical techniques in Biochemistry and Molecular Biology, Springer 3. Segel I.H (1976) Biochemical Calculations (2nd ed),John Wiley and Sons			
Website Link	https://www.kau.edu.sa/Files/0017514/Subjects/principals%20and%20techiniques%20of%20biochemistry%20and%20molecular%20biology%207th%20ed%			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards							
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCC02	**Biochemical and Molecular Biology Techniques**	DSC THEORY - II	I	5	3	2		4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	L	M	S	S	L	L	S	S	M
CO 2	S	M	M	S	M	L	M	S	S	L
CO 3	S	M	L	S	M	M	M	S	M	L
CO 4	S	S	L	S	S	M	M	S	M	M
CO 5	S	S	M	S	M	M	M	S	M	M

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Dr.M.Devi	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCC03	**PHYSIOLOGY AND CELL BIOLOGY**	DSC THEORY - III	I	5	3	2		4
Objective	To understand the functions and activities of organs, tissues or cells and of physical and chemical phenomena involved in the human body							

Unit	Course Content	Knowledge Levels	Sessions
I	Major classes of cell junctions- anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs)- cadherins, integrins. Types of tissues. Epithelium- organization and types. The basement membrane. Cell cycle- mitosis and meiosis, Cell cycle-phases and regulation. Cell death mechanisms- an overview-apoptosis, necrosis.	K3	8
II	Reproductive system- sexual differentiation and development; sperm transport, sperm capacitation, semen analyses and Acrosome reaction. Clinical relevance of female reproductive physiology- menstrual cycle, pregnancy and menopause. Fertilization and infertility issues.	K4	12
III	Digestive system- structure and functions of different components of digestive system, digestion and absorption of carbohydrates, lipids and proteins, role of bile salts in digestion and absorption, mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive system. Respiratory system-Gaseous transport and acid-base homeostasis. Mechanism of the movement of O2 and CO2 through lungs, arterial and venous circulation. Bohr effect, oxygen and carbon dioxide binding hemoglobin.	K4	12
IV	Sensory transduction, Nerve impulse transmission- nerve cells, synapses, reflex arc structure, resting membrane potential, Nernst equation, action potential, voltage gated ion-channels, impulse transmission, neurotransmission, neurotransmitter receptors, synaptosomes, rod and cone cells in the retina, changes in the visual cycle, photochemical reaction and regulation of rhodopsin, odour receptors, learning and memory. Chemistry of muscle contraction – actin and myosin filaments, theories involved in muscle contraction, mechanism of muscle contraction, energy sources for muscle contraction.	K5	12
V	Hormones – Classification, Biosynthesis, circulation in blood, modification and degradation. Mechanism of hormone action, Target cell concept. Hormones of Hypothalamus, pituitary, Pancreatic, thyroid & parathyroid, adrenal and gonadal hormones. Synthesis, secretion, physiological actions and feedback regulation of synthesis.	K5	11
	CO1: Describe and understand the biological and chemical processes within a human cell	K3	
	CO2: Analyze the role and significance of reproductive organs	K4	
	CO3: Inspect the defects in digestion, nutritional deficiencies and intolerances, and gastrointestinal pathologies	K4	
	CO4: Evaluate the general characteristics in individuals with imbalances of	K5	

	acid- base, fluid and electrolytes	
	CO5: Evaluate the process of the mechanism of the hormone synthesis and its regulation	K5

Learning Resources	
Text Books	1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6th ed). John Wiley & Sons.Inc. 2. Bruce Alberts and Dennis Bray (2013),Essential Cell Biology,(4th ed),Garland Science. 3. De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Cell and Molecular Biology.(8th ed). Lippincott Williams and Wilkins, Philadelphia
Reference Books	1. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. (5th ed). Sunderland, Mass. Sinauer Associates, Inc. 2. Wayne M. Baker (2008) the World of the Cell. (7th ed). Pearson Benjamin Cummings Publishing, San Francisco. Cell Biology 3. John E. Hall (2010). Guyton and Hall Textbook of Medical Physiology (12th ed), Saunders
Website Link	https://www.genome.gov/genetics-glossary/Cell-Cycle https://my.clevelandclinic.org/health/diseases/16083-infertility-causes https://www.webmd.com/heartburn-gerd/reflux-disease https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5760509/

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M1PBCC03	**PHYSIOLOGY AND CELL BIOLOGY**	DSC THEORY - III	I	5	3	2		4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**M**
CO 2	**S**	**S**	**S**	**S**	**S**	**L**	**S**	**S**	**S**	**M**
CO 3	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**M**
CO 4	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**M**
CO 5	**M**	**S**	**L**	**S**	**S**	**L**	**M**	**M**	**L**	**L**

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCC04	**ENZYMOLOGY**	DSC THEORY - IV	II	4	4	-	-	4
Objective	Students will explore enzymology theory and practice, covering catalysis mechanisms, kinetics, applications in medicine, research, and industry, and the role of enzyme regulation in metabolic pathways and cellular responses.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Introduction to enzymes and features of catalysis: History of Enzymes. Holoenzyme, apoenzyme, cofactors, coenzyme, prosthetic groups, Classification and Nomenclature, Specificity of enzyme action-group specificity, absolute specificity, substrate specificity, stereochemical specificity. Active site, Identification of amino acids at the active site-trapping of ES complex, identification using chemical modification of amino acid side chains and by site-directed mutagenesis. Mechanisms of enzyme catalysis: acid-base catalysis, covalent catalysis, electrostatic catalysis, metal ion catalysis, proximity and orientation effects, Low barrier H-bonds, Structural flexibility Mechanism of action of chymotrypsin	K2	10
II	Enzyme techniques: Isolation and purification of enzymes – Importance of enzyme purification, methods of purification- choice of source , extraction, fractionation methods-based on size or mass (centrifugation, gel filtration); based on polarity (ion-exchange chromatography, electrophoresis, isoelectric focusing, hydrophobic interaction chromatography); based on solubility (change in pH, change in ionic strength); based on specific binding sites (affinity chromatography) ,choice of methods, Criteria of purity of enzymes. Enzyme units – Katal, IU. Isoenzymes and their separation by electrophoresis with special reference to LDH	K3	12
III	Enzyme kinetics I: Thermodynamics of enzyme action, Activation energy, transition-state theory, steady-state kinetics & pre-steady- state kinetics. Single substrate enzyme catalyzed reactions – assumptions, Michaelis-Menten and Briggs-Haldane kinetics, derivation of Michaelis-Menten equation and its modifications(Lineweaver-Burk and Eadie –Hofstee) linear plots, their advantages and limitations. Analysis of kinetic data- determination of Km, Vmax, kcat, and their physiological significance, Importance of kcat/Km. Enzyme inhibition: Irreversible inhibition. Reversible inhibition- Competitive, uncompetitive,noncompetitive, mixed and substrate inhibition. Therapeutic use of enzyme inhibitors-Aspirin, statins (irreversible inhibitors), Methotrexate (competitive inhibitor), Etoposide (non-competitive inhibitor), camptothecin (uncompetitive inhibitor).	K3	15

IV	Enzyme kinetics II: Allosteric enzymes: Cooperativity, MWC and KNF models of allosteric enzymes, Sigmoidal kinetics taking ATCase as an example. Regulation of amount and catalytic activity by – extracellular signal, transcription, stability of mRNA, rate of translation and degradation, compartmentation, pH, temperature, substrate concentration, allosteric effectors, covalent modification. Regulation of glycogen synthase and glycogen phosphorylase. Feedback inhibition-sequential, concerted, cumulative, enzyme-multiplicity with examples Bi – Substrate reactions	K4	13
V	Enzyme technology: Immobilization of enzymes – methods – Reversible immobilization (Adsorption, Affinity binding), Irreversible immobilization (Covalent coupling, Entrapment and Microencapsulation, Crosslinking, Advantages and Disadvantages of each method, Properties of immobilized enzymes,. Designer enzymes- ribozymes and deoxyribozymes, abzymes, synzymes. Enzymes as therapeutic agents-therapeutic use of asparaginase and streptokinase. Application of enzymes in industry- Industrial application of rennin, lipases, lactases, invertase, pectinases, papain.	K5	10
Course Outcome	CO1: Understand the catalytic mechanisms employed by enzymes	K2	
	CO2: Choose and use the appropriate methods to isolate and purify enzymes and check the purity of the enzyme.	K3	
	CO3: Analyze enzyme kinetic data graphically, calculate kinetic parameters, determine the mechanism of inhibition by a drug/chemical and analyze options for applying enzymes and their inhibitors in medicine	K4	
	CO4: Categorize the allosterism and cooperativity and differentiate Michaelis-Menten kinetics from sigmoidal kinetics. The role played by enzymes in the regulation of vital cellular processes will be appreciated.	K4	
	CO5: Evaluate the use of enzymes in industries and biomedicine	K5	

Learning Resources

Text Books	1. Enzymes: Biochemistry, Biotechnology and Clinical chemistry, 2nd edition, 2007, Palmer T and Bonner P; Affiliated- East West press private Ltd, New Delhi 2. Fundamentals of Enzymology, 3rd edition, 2003, Price NC and Stevens L; Oxford University Press, New York 3. Voet's Biochemistry, Adapted ed, 2011,Voet,D and Voet JG; Wiley, India
Reference Books	1. Lehninger Principles of Biochemistry, 8th edition, 2021, .Nelson DL and Cox MM; WH Freeman & Co, New York 2. Biochemistry, Berg JM, Stryer L, Gatto,G, 8th ed, 2015;WH Freeman & Co., New York. 3. Enzyme Kinetics and Mechanism; Cook PF, Cleland W, ;2007; Garland Science, London
Website Link	https://ocw.mit.edu/high- school/biology/exam-prep/chemistry-of-life/enzymes/ https://onlinecourses.swayam2.ac.in/cec20_bt20/preview https://mooc.es/course/enzymology/ https://dth.ac.in/medical/courses/biochemistry/block-1/1/index.php

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCC04	**ENZYMOLOGY**	DSC THEORY IV	II	4	4	-	-	4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**M**	**S**	**L**	**M**	**S**	**L**	**S**	**S**	**M**
CO 2	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**S**	**S**	**S**
CO 3	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**S**	**S**	**S**
CO 4	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**S**	**S**	**S**
CO 5	**S**	**S**	**S**	**S**	**M**	**L**	**M**	**S**	**S**	**S**

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

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCC05	**CELLULAR METABOLISM**	DSC THEORY V	II	4	4	-	-	4
Objective	Discover blood glucose regulation, clinically relevant metabolic pathways, nucleotide metabolism, PLP role in amino acid processing, and clinical ties to heme and sulfur metabolism.							

Unit	Course Content	Knowledge Levels	Sessions
I	Glycolysis – aerobic and anaerobic, inhibitors, and regulation. Feeder pathway- entry of hexoses into glycolysis, Galactosemia, fructosuria, Pyruvate dehydrogenase complex-mechanism and regulation. Glyoxalate cycle and its regulation. Gluconeogenesis – source, key enzymes, reaction sequence and its regulation. Blood glucose homeostasis and the role of hormones. Pentose phosphate pathway- significance and its regulation. Metabolism of glycogen and its regulation. Biosynthesis of N-linked and O-linked glycoproteins and mucopolysaccharides.	K2	10
II	Oxidation of fatty acids-oxidation of saturated and unsaturated fatty acids (α, β & ω oxidation) Oxidation of fatty acids with odd and even numbered carbon atoms. Regulation of β oxidation. Ketogenesis and its regulation. Biosynthesis of fatty acid–saturated and unsaturated, chain elongation, regulation. Biosynthesis of prostaglandins, thromboxanes and leukotrienes and hydroxyl eicosanoic acids. Biosynthesis and degradation of triacylglycerol, phosphoglycero lipids-lecithin, cephalin, plasmalogens and phosphatidyl inositol, Sphingolipid-sphingomyelin, cerebrosides, sulfatides, and gangliosides. Cholesterol biosynthesis and its regulation. Lipoprotein metabolism-chylomicrons, VLDL, HDLand LDL	K3	12
III	Metabolism of nucleotides- *De novo* synthesis and salvage pathways of purine and pyrimidine nucleotides. Regulation and inhibitors of nucleotide biosynthesis. Role of ribonucleotide reductase and its regulation. Degradation of purine and pyrimidine nucleotides	K4	15
IV	Biosynthesis of non- essential amino acids.- Role and biological significance of glutamate dehydrogenase, glutamine and 37mphibian37s synthetase, lysine, proline and phenylalanine hydroxylase. Interconversion of amino acids – proline to glutamate, methionine to cysteine, serine to glycine. Biosynthesis of spermine and spermidine. Degradation of amino acids – glucogenic and ketogenic amino acids. Formation of acetate from leucine and aromatic amino acid, pyruvate from cysteine, threonine and 37mphibia proline, α-keto glutarate from histidine and proline, succinate from methionine, threonine, valine and isoleucine, Oxaloacetate from aspartate, glycine and serine.	K4	13

V	Biosynthesis and degradation of heme. Jaundice-classification, pathology and Differential diagnosis Oxidation and reduction of inorganic sulphur compounds by microbes and plants. Sulpho transferases and their biological role-rhodanases, sulphatases, 3- mercapto pyruvate sulphur transferases. Mucopolysaccharidoses – Hunter syndrome, Sanfilippo syndrome and Maroteaux-Lamy syndrome. Oxidation of cysteine to sulphate and inter conversion of sulphur compounds.	K5	10
Course Outcome	CO1: Explain the modes of synthesis and degradation of glucose and will be able to justify the pros and cons of maintain the blood sugar level	K2	
	CO2: Develop the knowledge on polysaccharide metabolism and glycogen storage disease	K3	
	CO3: Apprise with the making and braking of nucleotides	K4	
	CO4: Differentiate the diverse reaction a particular amino acid can experience	K4	
	CO5: Correlate the disturbance of metabolic reactions to clinical manifestations with reference to heme and sulphur metabolism	K5	

Learning Resources

Text Books	1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman 2. Voet.D and Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc. 3. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
Reference Books	1. Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill. 2. Textbook of Biochemistry with Clinical Correlations, 7th Edition,Thomas M. Devlin (Editor), Wiley 3. Human Biochemistry – James M.Orten&Otto.W.Neuhan- 10th edn- The C.V.Mosby Company
Website Link	1. https://www.embopress.org/doi/full/10.1038/msb.2013.19 2. https://people.wou.edu/~guralnl/450Glycogen%20metabolism.pdf 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3243375/ 4. https://www.researchgate.net/publication/334458898_Urea_Cycle

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M2PBCC05	**CELLULAR METABOLISM**	DSC THEORY V	II	4	4	-	-	4	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**M**
CO 2	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**M**
CO 3	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 4	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**M**
CO 5	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

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

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Dr.M.Devi	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCC06	**CLINICAL BIOCHEMISTRY**	DSC THEORY VI	II	4	4	-	-	4
Objective	The students can gain knowledge about biological sample collection methods, metabolic/hormonal disorders, diagnostics, serum enzymes, inherited genes, electrolyte, hormonal imbalances, and tests.							

Unit	Course Content	Knowledge Levels	Sessions
I	Biochemical investigations in diagnosis, prognosis, monitoring, screening: Specimen collection – blood, (primary /Secondary specimen)., urine and CSF. Preservation of biological specimens – blood, urine, CSF and amniotic fluid. ; . Biological reference ranges; Disorders of blood cells: Hemolytic, iron deficiency and aplasticanemia and diagnosis, sickle cell anaemia, thalassemia HBA1C variants. Porphyrias, Thrombocytopenia, Causes of leucopenia, leukemia and leucocytosis. Disorders of blood clotting mechanism – Von willebrand's disease, Hemophilia A, B and C, diagnostic test for clotting disorders, D-dimer and its clinical significance	K2	10
II	Diabetes mellitus: pathology and complications: Acute changes; Chronic complications: Diabetic nephropathy, neuropathy, retinopathy and Diabetic foot ulcers, Random/Fasting/PP glucose testing, Impaired glucose tolerance (IGT), Impaired fasting glucose (IFT), Diagnosis-by GTT, Pre-diabetes, Gestational DM ,Glycosylated Haemoglobin (HBA1c) ; Glycated albumin., Hypoglycaemia and critical alert value for glucose. Markers of complications of Diabetes mellitus: Metabolic syndrome, Lipid profile & lipoproteinemia, Atherosclerosis, Diabetic nephropathy, Microalbuminuira, eGFR. Point of care testing for glucose (Glucometers) and continuous glucose monitoring (CGM) : principle and its use. Major groups of anti-diabetic drugs. Diet and life style modifications	K3	12
III	Diagnostic Enzymology: Clinically Important Enzymes and Isoezyme as diagnostic markers: Clinical significance of AST, ALT, ALP, ACP, CK, γ-GT, amylase, pseudocholinesterase and their pattern inMyocardial infarction; Liver disease, Bone disease, Muscle disease, Cancer (tumor markers), GI tract pancreatitis); Enzymes as therapeutic agents.Pre- and post-natal testing: Amniocentesis, prenatal detection of inborn errors of metabolism in developing fetus- Autosomal recessive mode of inheritance- cystic fibrosis, X linked recessive inheritance- Duchenne muscular dystrophy. New born screening (NBS) for In born errors of metabolism, Tandem mass spectrometry application in NBS	K4	15

IV	Liver function tests: Liver function test panel, Fatty liver. Plasma protein changes in liver diseases. Hepatitis A, Band C. Cirrhosis and fibrosis. Portal hypertension and hepatic coma. Acute phase proteins –CRP, Haptoglobins, α-fetoprotein, ferritin and 40mphibian40si and their clinical significance, Interpreting serum protein electrophoresis. Inflammatory markers (cytokines such as TNF-alpha IL6 and others)	K4	13
V	Renal function tests – tests for glomerular and tubular function-Acute and chronic renal failure-Glomerulonephritis, Nephrotic syndrome, uraemia-urinary calculi-Nephrocalcinosis and Nephrolithiasis-causes, pathology and symptoms. Chronic kidney disease. Dialysis- Hemodialysis and peritoneal dialysis. Electrolyte disorder : calcium: hypercalcemia and hypocalcemia; Calcium homoestasis in Blood;phosphate: hyperphosphatemia or hypophosphatemia; Clinical significance: Potassium: hyperkalaemia and hypokalaemia, Sodium: hypernatremia and hyponatremia; Chloride: hyperchloremia, hyporchloremia Hormonal disorders and diagnostics: T3,T4 and TSH in the diagnosis of thyroid disorders; Diagnostic methods for disorders associated with adrenal, pituitary and sex hormones – Addison's disease, Cushing's syndrome, pituitary tumour, Hypopituitarism, Hypogonadism	K5	10
Course Outcome	CO1: Identify the importance of sample collection and diagnostic tests for non-communicable diseases, gaining awareness of their significance in understanding biochemical parameters and blood cell disorders.	K2	
	CO2: Comprehend the causes of metabolic diseases (e.g., diabetes, atherosclerosis), prevent lifestyle disorders through healthy eating, and link symptoms to underlying pathology using diagnostic and prognostic markers.	K3	
	CO3: Discover the diagnostic application of serum/plasma enzymes to correlate their levels with the organ pathologies associated with specific diseases.	K4	
	CO4: Analyze the role of pre and post-natal diagnosis leading to healthy progeny	K4	
	CO5: Evaluate the transmission of signals from cell surface to the nucleus through different pathways, comparing and contrasting them, and evaluate the resulting biological outcomes.	K5	
Learning Resources			
Text Books	1. ThomasM.Devlin (2014) Textbook of Biochemistry with Clinical Correlations (7th ed). John Wiley & Sons 2. Montgomery R, Conway TW, Spector AA (1996),Biochemistry: A Case-Oriented Approach (6th ed), Mosby Publishers, USA. 3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (2018) (8th ed),Saunders		
Reference Books	1. Dinesh Puri, (2020) Text book of Biochemistry: A clinically oriented approach – 4th Edition, Elsevier. 2. M.N.Chatterjee and RanaShinde (2012).Textbook of Medical Biochemistry (8th ed), Jaypee Brothers Medical Publishers. 3. Clinical Case Discussion In Biochemistry A Book On Early Clinical Exposure (ECE), Poonam Agrawal , 2021, CBS Publishers & distributors pvt. Ltd		

Website Link	1.https://www.aacc.org/science-and-research/clinical-chemistry-trainee-council/trainee-council-in-english/pearls-of-laboratory-medicine/2018/utility-of-hil-in-clinical-chemistry 2. DOI: 10.7860/NJLM/2016/22587:2173 https://doi.org/10.2147/JMDH.S286679 3. https://diabetesjournals.org/clinical/article/40/1/10/139035/Standards-of-Medical-Care-in-Diabetes-2022			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M2PBCC06	**CLINICAL BIOCHEMISTRY**	DSC THEORY VI	II	4	4	-	-	4	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	M	S	S	S	S	M	M	S
CO 2	S	M	S	M	S	S	S	M	M	M
CO 3	S	S	S	S	S	M	S	S	M	M
CO 4	S	M	M	M	S	M	S	S	S	M
CO 5	S	M	S	M	S	S	S	S	S	S

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Dr.M.Devi	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCP01	**LAB COURSE ON BIOMOLECULES AND BIOCHEMICAL TECHNIQUES**	DSC PRACTICAL I	II	5	-	-	5	3
Objective	The course aims to enhance students' understanding of biomolecule principles, teach techniques for macromolecule isolation, purification, quantification, colorimetric estimation, subcellular fractionation, marker identification, and phytochemical screening							

Unit	Course Content	Knowledge Levels	Sessions
I	Biochemical studies and estimation of macromolecules 1. Isolation and estimation of glycogen from liver. 2. Isolation and estimation of DNA from animal tissue. 3. Isolation and estimation of RNA from yeast. 4. Purification of Polysaccharides –Starch and assessment of its purity	K5	10
II	UV absorption 1. Denaturation of DNA and absorption studies at 260nm. 2. Denaturation of Protein and absorption studies at 280nm.	K5-K6	12
III	Colorimetric estimations 1. Estimation of Pyruvate 2. Estimation of tryptophan.	K6	10
IV	Estimation of minerals 1. Estimation of calcium 2. Estimation of iron	K6	8
V	Plant Biochemistry 1.Qualitative analysis Phytochemical screening 2.Estimation of Flavonoids –Quantitative analysis	K6	10
VI	Group Experiments 1.Fractionation of sub-cellular organelles by differential centrifugation - Mitochondria and nucleus 2. Identification of the separated sub-cellular fractions using marker enzymes (any one) 3.Separation of identification of lipids by TLC 4.Separation of plant pigments from leaves by column chromatography 5.Identification of Sugars by Paper Chromatography 6.6.Identification of Amino acids by Paper Chromatography	K6	10
Course Outcome	CO1: The student will be able to acquire knowledge and skill in the techniques used in the isolation, purification and estimation of different biomolecules that are widely employed in research	K5	
	CO2: The students will get acquainted with Principle, Instrumentation and method of Performing UV absorption studies of DNA, Protein and interpreting the alteration occurred during the process of denaturation	K6	
	CO3: The student will be fine-tune in handling the instruments like colorimeter, spectrophotometer and will be able to estimate the biomolecules and minerals from the given samples	K6	

	CO4: The student, in addition to acquiring skill in performing various biochemical techniques can also learn to detect presence of phytochemicals and quantify them in the plant sample.	K6
	CO5: The students can design the skills in analytical techniques	K6

Learning Resources	
Text Books	1. David Plummer (2001) An Introduction to Practical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd 2. Jayaraman, J (2011),laboratory Manual in Biochemistry, New age publishers 3. Varley H (2006) Practical Clinical Biochemistry (6th ed) , CBS Publishers
Reference Books	1. O. Debiyi and F. A. Sofowora, (1978)"Phytochemical screening of medical plants," Iloyidia, vol. 3, pp. 234–246, 2. Prof. Sarin A. Chavhan, Prof. Sushilkumar A. Shinde (2019) A Guide to Chromatography Techniques Edition:1 3. Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer(2011)
Website Link	1. https://www.researchgate.net/publication/313745155_Practical_Biochemistry_A_Student_Companion 2. https://doi.org/10.1186/s13020-018-0177-x 3.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5368116/

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M2PBCP01	**LAB COURSE ON BIOMOLECULES AND BIOCHEMICAL TECHNIQUES**	DSC PRACTICAL I	II	5	-	-	5	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	M	S	L	S	M	S
CO 2	S	S	S	S	M	S	L	S	M	S
CO 3	S	S	S	S	M	S	M	S	M	S
CO 4	S	S	S	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	S	S	S	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 Member Secretary
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCP02	**LAB COURSE IN ENZYMOLOGY, MICROBIOLOGY AND CELL BIOLOGY**	DSC PRACTICAL II	II	4	-	-	4	3
Objective	The role involves teaching student's enzyme assay skills, conducting experiments, providing training, teaching microbiology techniques, conducting blood grouping and cell studies, and organizing industry visits for real-world insights.							

Unit	Course Content	Knowledge Levels	Sessions
I	Enzymology Alkaline Phosphatase a. Isolation of Alkaline Phophatase from goat kidney. b. Purification of alkaline phosphatase c. Checking the purity using SDS-PAGE d. Determination of optimum pH and temperature of alkaline phosphatase. e. Determination of specific activity and Km of alkaline phosphatase. f. Effect of activators and inhibitors on the activity of alkaline phosphatase. Assay of enzymes a. Salivary Amylase b. Acid Phosphatase	K6	10
II	Microbiology a. Safety measures and Good Laboratory Practices in microbiology laboratory b. Sterilization,Culture and 47mphibian preparation c. Staining of bacteria – Gram Staining	K6	12
III	Physiology & Cell Biology a. Test for blood grouping (Haemagglutination). b. Peripheral Blood smear –Staining and Interpretation	K5	15
IV	Group Experiments a. Separation of proteins based on molecular weight by SDS PAGE b. Agarose gel electrophoresis of genomic DNA	K5	13
V	Industrial visit can be 47mphibian to students through Academia – Industry collaborative Program	K5	10
Course Outcome	CO1:The student will be able to employee relevant techniques for isolation and purification of enzymes and gain skill in kinetic studies which is essential for research activity	K6	
	CO2: Student will acquire ability in performing enzyme assay, and explicate the methods that form the basis of enzyme characterization.	K5	
	CO3: Learn the Basic concepts in microbiology and cell biology which will be helpful for interdisciplinary research work.	K6	
	CO4: Students will be trained in separation techniques used in molecular Biology which will be supportive in their future research	K6	

	CO5: Industrial visits will provide the students with an opportunity to learn practically through interaction, working methods and employment practices. Students will have an exposure to Industrial standard and current work practices	K5

Learning Resources				
Text Books	1. David Plummer (2001) An Introduction to Practical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd 2. Jayaraman, J (2011), laboratory Manual in Biochemistry, New age publishers 3. Fundamentals of Enzymology; 3rd Edn. Nicholas C. Price and Lewis Stevens, Oxford University Press (2012).			
Reference Books	1. Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis; Robert A. Copeland , Wiley-VCH Publishers (2000). 2. Cappuccino JG & Sherman N (2005). Microbiology-A Laboratory Manual, Pearson Education 3. Practical Enzymology, Second Revised Edtion: Hans Bisswanger, Wiley – Blackwell; 2 edition			
Website Link	1.https://www.researchgate.net/publication/337146254_Kinetic_studies_with_alkaline_phosphate 2.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846332/ 3.https://www.ijsr.net/archive/v3i8/MDIwMTU0MDk=.pdf			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M2PBCP02	**LAB COURSE IN ENZYMOLOGY, MICROBIOLOGY AND CELL BIOLOGY**	DSC PRACTICAL II	II	4	-	-	4	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**L**	**S**	**M**	**S**
CO 2	**S**	**S**	**S**	**S**	**M**	**S**	**L**	**S**	**M**	**S**
CO 3	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**S**	**M**	**S**
CO 4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**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 Member Secretary
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCC07	INDUSTRIAL MICROBIOLOGY	DSC THEORY -VII	III	6	2	4	-	4
Objective	This course provides knowledge on microorganism structure, classification, and use in industries, fermentation techniques, production and purification of fermented products, and basic concepts of food and agricultural microbiology.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Microorganisms -** Structure of bacteria, fungi and viruses and their classification. Types and characteristics of microorganisms used in Industry (a) Food Industry (b) Chemical Industry (c) Pharmaceutical Industry	K2	12
II	**Fermentation -** Fundamentals and principles of microbial fermentation techniques. Fermentation – types, techniques, design and operation of fermenters including addition of medium. Environmental conditions required for the growth and metabolism of industrially and pharmaceutically important microbes. Sterilization methods in fermentation techniques, air, gas, culture medium sterilization. Steam- filtration and chemicals. Types and constituents of fermentative culture medium and conditions of fermentations, Antifoaming devices.	K3	13
III	**Recovery and estimation of products of fermentation-** Production of ethanol, acetic acid and citric acid by fermentation. Production of Enzymes- amylase, protease, lipase, Production of pharmaceuticals by fermentation– penicillin, streptomycin, riboflavin, vitamin B12.Beverages-wine, beer.	K4	15
IV	**Food Microbiology:** Production of dairy products-bread, cheese and yoghurt (preparation and their types). Food borne diseases- Bacterial and Non Bacterial. Food preservation – Principles–Physical methods: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, Chemical methods – salt, sugar, organic acids, SO2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins.	K4	10
V	**Agricultural Microbiology:** General Properties of soil, microorganisms in soil – decomposition of organic matter in soil. Biogeochemical cycles, nitrogen fixation, Production of bio fertilizers and its field applications – Rhizobium, azotobacter, blue green algae, mycorrhizae, azospirilium, Production of biofuels (biogas- methane), soil inoculants **Current Trend - *Canned food and spoilage ***	K4	10
	…… Self Study.		
	CO1: Understand the structure and various types of Microorganisms used in various industries.	K2	

	CO2: Identify the uses of microorganisms in various industrial applications	K3
	CO3:.Develop the concepts of fermentation process, harvest and recovery of organic acids, enzymes, antibiotics and vitamins.	K3
	CO4: Categorize the types of microbial fermentation processes and their applications in pharmaceutical industry.	K4
	CO5: Classify the use of microorganisms in beverages, diary and food industries.	K4

Learning Resources	
Text Books	1. David J. Cook, Charles W. Bamforth. Food, Fermentation and Micro-Organisms, 2nd edition, Blackwell Science Ltd, 2019. 2. Pelczar MJ, Chan ECS and Krieg NR. Microbiology. 5th edition , McGraw Hill Book Company, 2001 3. Ananthanarayanan R and Paniker CKJ. Text book of Microbiology:11th edition, Universities Press (India) Pvt.Ltd, 2020
Reference Books	1. Frazier, W.C. and Westhoff, D.C. Food Microbiology, 3rd edition ;TataMcGrawHill Publishing Company Ltd, New Delhi, 2003 2. Gould GW. New Methods of Food Preservation. 1st edition,; 2012. 3. Baltz. Manual of Industrial Microbiology and Biotechnology: 3rd edition, 2010. 4. Karl R. Matthews, Kalmia E. Kniel, Thomas J. Montville. Food Microbiology: An Introduction: 4thedition, American Society for Microbiology, 2017.
Website Link	1. https://nptel.ac.in/courses/102/105/102105058/ 2. https://nptel.ac.in/courses/102/106/102106053/ 3. https://nptel.ac.in/courses/126/103/126103017/
Self-Study Material	https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/food_technology/food_microbiology/26.canned_foods_and_spoilage_/et/106_et_et.pdf

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCC07	INDUSTRIAL MICROBIOLOGY			DSC THEORY VII	III	6	2	4	-	4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	M	S	S	M	S	S	M	M	M
CO3	S	M	L	S	M	M	S	S	M	S
CO4	M	S	S	S	L	M	S	M	S	M
CO5	S	S	M	S	S	M	M	S	S	S

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation		
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation		
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE		
Designed By	**Verified By**		**Approved by Member Secretary**
Dr.M.DEVI	HOD		Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCC08	**MOLECULAR BIOLOGY**	**DSC THEORY - VIII**	**III**	**6**	**4**	**2**	**-**	**4**
Objective	To learn about inheritance, Central Dogma of molecular biology and their regulation in gene expression							

Unit	Course Content	Knowledge Levels	Sessions
I	**Mendel's laws of inheritance-dominance**-complete, incomplete and co-dominance, multiple alleles-gene mapping in haploids and diploids, recombination mapping- restriction mapping- modes of gene information transfer in bacterial- conjugation, transformation and transduction. The bacterial chromosome, the eukaryotic genome- chromosome structure – Histones, Nucleosome, chromatin- heterochromatin, euchromatin, chromatin remodeling, DNAase hypersensitive sites, organelle genomes – mitochondrial and chloroplast genome.	K3	14
II	**DNA replication and repair**: Enzymes of replication, prokaryotic replication mechanisms, primosome & replisomes, eukaryotic DNA replication, the role of topoisomerases and telomerase, regulation of replication, difference between prokaryotic and eukaryotic replication. Mutations –Types of mutations, mechanisms of mutations, mutagenic agents. DNA repair mechanisms – Direct repair, excision repair, mismatch repair, recombination repair, SOS response, eukaryotic repair systems. Recombination and mobile genetic elements- the Holliday model,	K4	15
III	**Transcription** – Prokaryotic transcription-subunits of RNA polymerase, E. coli promoters, sigma factor and promoter recognition, alternative sigma factors, initiation, elongation, Rho- dependent and independent termination of transcription. Eukaryotic transcription- Initiation, promoter elements, RNA polymerases, transcription factors **Translation** – organization of the ribosome, the genetic code, evidence for a triplet code, deciphering the genetic code, wobble hypothesis, deviation in the genetic code, unusual codons. Activation, initiation, elongation and termination of translation in E.coli. The role of tRNA and rRNA and inhibitors of protein synthesis.	K4	14
IV	**Regulation of gene expression in prokaryotes**–Positive and negative control, the lac operon, identification of operator and regulator sequences by mutations, induction and repression. Catabolite repression. *Trp* operon – Attenuation, alternative secondary structures of *trp* mRNA. **Regulation of gene expression in eukaryotes**- Response elements, DNA-binding motifs, steroid receptors, association of methylation and histone acetylation with gene expression.	K5	14
V	**Post transcriptional modifications in eukaryotes**- RNA processing- mRNA 5' capping and 3'poly-adenylation, introns and exons, RNA splicing,- spliceosome assembly, alternative splicing, processing of tRNA and rRNA, self-splicing, ribozymes. **Post translational modification of proteins**- Proteolytic cleavage,	K5	15

	covalent modifications, glycosylation of proteins, disulfide bond formation, Protein sorting – signal peptides, transport of secretory proteins, Golgi and post-golgi sorting, coated vesicles, targeting of mitochondrial, lysosomal and nuclear proteins, **Current trends * Heat shock proteins***		
	…… Self Study.		
Course Outcome	**CO1:** Identify the genome organization, DNA replication, recombination, and transposition, their significance, damage causes, and repair methods for mutations and lesions.	K3	
	CO2: Discover the method of Transcription and genetic code	K4	
	CO3: Acquire knowledge of the molecular basis of RNA processing and RNA splicing and the various human pathologies that can result from defects of RNA modification.	K4	
	CO4: Comprehend the techniques of gene silencing and its applications.	K5	
	CO5: Evaluate the knowledge they have gained in understanding the above vital life processes to enhancing their analytical and problem-solving skills and develop an interest to pursue high quality research	K5	

Learning Resources

Text Books	• Lewin‘s Genes XII : 12th edition, Krebs JE, Goldstein ES, Kilpatrick ST ;Prentice Hall,Delhi • Molecular Biology of the Gene : 6th edition, Watson JD , Baker TA, Bell S, Gann A, LevineM, Losick R; Cold Spring Harbor Laboratory Press, New York • Essential Cell Biology :3rd edition, Alberts B, Bray D, Hopkin K, Johnson A, Lewis J, RaffM, Roberts K, Walter P ; Garland Science, New York
Reference Books	• Molecular Cell Biology : 8th edition , Lodish H, Arnold Berk; W.H.Freeman & Co, New York • Karp‘s Cell and Molecular Biology: Concepts and Experiments, 8th Edition; Wiley, India • An Introduction to Genetic Analysis 12th edition,, Griffith A. F, Doebley J, Peichel C, David A, Wassarman DA; Albion Press.W.H.Freeman & Co ,New York
Website Link	https://microbenotes.com/post-translational-modification/ https://www.onlinebiologynotes.com/transcription-in-prokaryotes/ https://www.nature.com/scitable/topicpage/regulation-of-transcription-and-gene-expression-in-1086/
Self-Study Material	https://link.springer.com/book/10.1007/978-1-4020-5585-0

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M3PBCC08	**MOLECULAR BIOLOGY**	**DSC THEORY - VIII**	**III**	**6**	**4**	**2**	**-**	**4**	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**L**	**M**	**L**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**M**	**M**	**L**	**M**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**L**	**M**	**L**	**M**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**M**	**L**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**S**

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc – Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCC09	**GENE EDITING, CELL AND GENE THERAPY**	**DSC THEORY - IX**	**III**	**6**	**4**	**2**	**-**	**4**
Objective	To Acquire knowledge about molecular genetic disease techniques, sequencing skills,animal model comparison, vector features, viral/non-viral gene transfer techniques, cell culture characteristics, therapeutic strategies, safety/ethics, and patents.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Gene Editing**: Basis of gene editing, DNA repair mechanisms, Double strand DNA breaks, Non homologous End-Joining (NHEJ), Homology directed repair, Programmable nucleases for gene editing, Mega nucleases, Zinc-Finger nucleases, Transcription Activator-Like Effector Nucleases (TALEN), CRISPR-Cas systems, gene editing using CRISPR-Cas, drawbacks and major challenges to present gene editing techniques, gene editing for human disease therapy.	K3	12
II	**Gene and cell therapy**: Basics of Gene and cell therapy, types of gene therapy, gene therapy strategies, therapeutic targets for gene therapy, choice of the therapeutic target, administration routes, delivery systems, expression of transgene, persistence of the gene therapy, cell targeting, immunological response to the therapy, ethical and legal issues, concerns about gene and cell therapy.	K4	12
III	**Vectors for Gene therapy**: Non-viral and viral vectors for gene therapy, Physical methods of gene delivery, Polymer, Lipid and inorganic material based chemical systems for gene delivery, Viral vectors, Lentiviral, Adenoviral, Adeno-associated virus, Herpes Simplex virus, vaccinia, baculoviral vectors for gene delivery, choice of viral vector and oncolytic virus. Gene therapy applications, Gene therapy for cancer, suicide and oncolytic gene therapy.	K4	12
IV	**Stem cells and tissue regeneration**: Adult and fetal stem cells, embryonic stem cells, cell reprogramming, induced pluripotent stem cells (iPSC), Chemically induced pluripotent stem cells (CiPSC), reprogramming factors, iPSC derived progenitors cells, Organoids, three dimensional (3D) bioprinting.	K5	12
V	**Regulatory and Ethical Considerations** of stem cell and Gene Therapy, pluripotent stem cell-based cell replacement therapies. Assessing Human Stem Cell Safety, Use of Genetically Modified Stem Cells in Experimental Gene Therapies. **Current trend - * Cancer Stem cells ***	K5	12
	…… Self Study.		
Course Outcome	**CO1:** Ability to read, and evaluate scientific articles within the subjects of immune therapy, gene therapy and cell therapy	**K3**	
	CO2: Compare gene of their interest for several downstream purposes with a robust comprehension about wide variety of applicable gene delivery vectors..	**K4**	
	CO3: Analyze and provide examples of diseases that can be treated with immune therapy, gene therapy and cell therapy.	**K4**	
	CO4: Examine the gaps and need for further research within their chosen topic of immune therapy, gene therapy or cell therapy.	**K5**	
	CO5: The student will critically analyze the ethical and social implications	**K5**	

	of immune, gene, or cell therapy, urging them to contemplate upcoming technologies for futuristic benefits.		

Learning Resources	
Text Books	Daniel Marshak, Richard L. Gardener and David Gottlieb, Stem Cell Biology, Cold Spring Harbour Laboratory Press Stewart Sell, Stem Cells Handbook, Humana Press; Totowa NJ, USA; Oct. 2003 Stem Cell and Gene-Based Therapy: Frontiers in Regenerative Medicine, Alexander Battler,
Reference Books	J.J. Pasternak, An Introduction to Human Molecular Genetics (2nd Edition), 2005 Thomas F. Kresina Upadhyay, S. K, An Introduction to Molecular Medicine and Gene Therapy 1st Edition (Ed.). (2021). Tom Strachan & Andrew Read, Human Molecular Genetics (4th Edition), 2010.
Website Link	https://www.yourgenome.org/theme/what-is-crispr-cas9/ https://www.dvcstem.com/post/stem-cell-therapy https://microbenotes.com/stem-cells/
Self-Study Material	https://ebookcentral.proquest.com/lib/inflibnet-ebooks/reader.action?docID=1603101&ppg=39

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
23M3PBCC09	GENE EDITING, CELL AND GENE THERAPY	DSC THEORY - IX	III	6	4	2	-	4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO1	S	L	M	S	M	M	M	M	M	M
CO2	S	S	S	S	M	M	M	M	M	S
CO3	S	M	S	S	M	S	S	S	S	S
CO4	S	L	M	M	M	M	S	M	M	S
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCP03	**PRACTICAL: CLINICAL BIOCHEMISTRY**	**DSC PRACTI CAL -III**	**III**	**4**	**-**	**-**	**4**	**4**
Objective	To learn about the biological sample collection, analysis, liver, cardiac, renal function tests, immunological methods, MS Excel skills, and modern laboratory operations.							

S.No	Course Content	Knowledge Levels	Total Hours
I	**Haematology:** RBC count, WBC count – total and differential count, ESR, PCV, MCV. Bleeding Time, Clotting Time, Estimation of hemoglobin.	K5	10
II	**Liver function test:** Estimation of bilirubin – direct and indirect. Estimation of plasma protein, A/G ratio Assay of ALP and ACP Assay of AST and ALT	K5	10
III	**Renal function test:** Collection and Preservation of Urine sample Qualitative tests for normal and pathological components of urine. BUN: Estimation of blood Urea, creatinine, and uric acid.	K5	10
IV	Estimation of blood glucose by orthotoluidine Estimation of cholesterol by Zak's method Estimation of triglycerides, free fatty acids and phospholipids.	K6	10
V	**Group Experiments** a. Antigen – Antibody Reaction – HCG kit method , RA kit method b. Phlebotomy –Venipuncture , Different techniques of venipuncture c. Collection of blood ,Serum or Plasma separation and Storage d. Automation in Clinical Biochemistry –Autoanalyser, Semiautoanalyser	K6	10
	…… Self Study.		
Course Outcome	**CO1:** Acquire skills in hematology techniques and learn to interpret serum electrolyte concentrations.	K5	
	CO2: Gain capability to assess liver function and interpret biochemical data in clinical contexts**.**	K5	
	CO3: Develop proficiency in performing renal function tests and reporting abnormalities within reference ranges.	K5	
	CO4: Learn to measure blood glucose and lipid profiles, evaluate changes, and accurately record observations.	K6	
	CO5: Enhance practical skills through group experiments, preparing for work in healthcare and familiarization with clinical lab automation.	K6	

Learning Resources	
Text Books	1. Practical Clinical Biochemistry: Methods and Interpretations by Ranjna Chawla, Publisher: Jaypee Brothers Medical Publishers, 2020 2. Textbook of Medical Biochemistry by Rana Shinde, Publisher: Jaypee Brothers Medical Publishers, 2018

	3. A Textbook of Practical Biochemistry" by Rajagopal G. and Praveen R. Singh, Publisher: CBS Publishers & Distributors Pvt Ltd, 2018 4. Practical Manual of Clinical Biochemistry" by Vikas Gowda, Publisher: Jaypee Brothers Medical Publishers, 2019
Reference Books	1. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics" by Carl A. Burtis, David E. Bruns, Publisher: Elsevier, Year: 2015 (7th Edition) 2. Clinical Chemistry: Principles, Techniques, and Correlations" by Michael L. Bishop, Edward P. Fody, and Larry E. Schoeff, Publisher: Lippincott Williams & Wilkins, Year: 2017 (8th Edition) 3. Practical Clinical Biochemistry" by Allan Gaw, Michael Murphy, Rajeev Srivastava, Robert A. Cowan, and Denis St. J. O'Reilly, Publisher: Churchill Livingstone, Year: Most recent edition
Website Link	https://uomustansiriyah.edu.iq/media/lectures/6/6_2019_12_01!05_05_20_PM.pdf https://img1.wsimg.com/blobby/go/eda849b5-0706-4fa4-8bc1-c28aaff08b58/Practical%20Biochemistry%20(%20PDFDrive%20).pdf https://archive.org/details/practicalclinica0000varl

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
23M3PBCP03	PRACTICAL: CLINICAL BIOCHEMISTRY	DSC PRACTI CAL -III	III	4	-	-	4	4

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO 5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	M	S
CO3	S	S	S	M	S	M	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S
CO5	S	M	M	S	M	M	S	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 Member Secretary
Dr.M.Shabana Begum	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCC10	**PHARMACEUTICAL BIOCHEMISTRY**	**DSC THEORY - X**	**IV**	**6**	**2**	**4**	**-**	**4**
Objective	To Acquire knowledge about drug target identification, molecular docking, virtual screening, enzyme role, biochemical mechanisms, clinical trials phases, and methodologies.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Drug discovery and development**, drug target identification and validation, Hit identification, General principles of screening, correlations between various animal models and human situations, Correlation between in-vitro and in-vivo screens; Special emphasis on cell-based assay, biochemical assay, radiological binding assay, Pharmacological assay, In vitro, In vivo & Ex-vivo experiments, lead optimization, preclinical studies.	K2	12
II	**Bioinformatics approaches for drug development**: Identification of potential molecules, chemical compound library preparation, Identification of target in pathogen, Ligand & protein preparation, Molecular docking, Binding free energy estimation, High throughput virtual screening, Docking protocol validation and enrichment analysis, Single point energy calculation, Pharmacokinetics and Pharmacodynamics, ADME & toxicity prediction, Molecular dynamic simulation.	K3	12
III	**Drug metabolism & interactions:** Drug-receptor interactions, receptor theories and drug action, Xenobiotics, xenobiotics phases (Phase-I, Phase-II and Phase-III), role of cytochrome P450 oxidases and glutathione S-transferases in drug metabolism, factors affecting drug metabolism, Enzymes as a drug target, Kinase inhibitors, ATPase inhibitors, drug protein interaction, DrugDNA interaction. Basic ligand concepts-agonist, antagonist, partial agonist, inverse agonist, efficiency and potency. Forces involved in drug- receptor complexes. Receptor classification – the four super families. Receptor binding assays- measurement of Kd, Bmax and IC50.	K3	12
IV	**Biochemical mode of action of antibiotics**- penicillin and chloramphenicol, actions of alkaloids, antiviral and antimalarial substances. Biochemical mechanism of drug resistance- sulphonamides. Drug potency and drug efficacy. General principles of chemotherapy: chemotherapy of parasitic infections, fungal infections, viral diseases. Introduction to immunomodulators and chemotherapy of cancer.	K4	12
V	**Clinical trials (Phase-I, Phase-II, Phase-III and Phase-IV clinical trial).** Main features of clinical trials, including methodological and organizational considerations and the principles of trial conduct and reporting. Key designs surrounding design, sample size, delivery and assessment of clinical trials**. Current trend - * Vaccine production***	K5	12

	…… Self Study.		
Course Outcome	CO1: Students will be able to understand the drug development pipeline from concept to clinical trials.	K2	
	CO2: Students will be skilled in validating and applying docking protocols for new drug candidates.	K3	
	CO3: Students will be knowledgeable about the impact of drug metabolism on drug efficacy and safety.	K3	
	CO4: Students will be able to explain how various drugs function at a biochemical level.	K4	
	CO5: Students will be proficient in planning and executing clinical trials according to regulatory standards.	K5	

Learning Resources

Text Books	1. Drug Discovery and Development: Technology in Transition, 2nd Edition" by Humphrey P. Rang, Publication Year: 2012 2. An Introduction to Medicinal Chemistry, 6th Edition" by Graham L. Patrick, Publication Year: 2017 3. Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy, 4th Edition" by David E. Golan, Publication Year: 2016
Reference Books	1. Bioinformatics: Sequence and Genome Analysis, 2nd Edition" by David W. Mount, Publication Year: 2004 2. Pharmacokinetics and Metabolism in Drug Design, Third Edition" by Dennis A. Smith, Charlotte Allerton, Amit S. Kalgutkar, Han Waterbeemd, Don K. Walker, and Raimund Mannhold, Publication Year: 2012 3. Essentials of Pharmacology for Health Professions, 8th Edition" by Bruce Colbert and Ruth Woodrow, Publication Year: 2019
Website Link	https://www.britannica.com/science/antibiotic https://pharmacentral.com/learning-hub/technical-guides/drug-discovery-and-development-a-step-by-step-guide/ https://www.britannica.com/science/drug-chemical-agent
Self-Study Material	https://microbenotes.com/vaccines-introduction-and-types/

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCC10	**PHARMACEUTICAL BIOCHEMISTRY**	**DSC THEORY - X**	**IV**	**6**	**2**	**4**	**-**	**4**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	M	S	S
CO3	S	M	S	M	S	M	S	L	S	S
CO4	S	M	S	S	S	M	S	S	S	S
CO5	S	M	M	S	M	M	S	S	M	S

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Dr.M.Shabana Begum	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCC11	**BIOCHEMICAL TOXICOLOGY**	**DSC THEORY - XI**	**IV**	**6**	**2**	**4**	**-**	**4**
Objective	To learn the biochemical basis of drugs, their toxicity, chemotherapeutic value, toxicology, dose-response relationships, toxicological testing procedures, and biochemical pathways of drug toxicity.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Fundamentals of Toxicology and dose-Response Relationships:** Introduction, Biomarkers Criteria of Toxicity, Evaluation of Toxicity Interactions; Dose Response; Measurement of Dose-Response; Relationships Linear Dose Response, Hormesis; Hazard and Risk Assessment, Duration and Frequency of Exposure and Effect.	K2	12
II	**Factors Affecting Toxic Responses**: Disposition: Absorption ,Sites of absorption, distribution, Excretion; Metabolism: types of Metabolic change phase I reactions; Phase 2 reactions; control of Metabolism, Toxication Vs. Detoxication	K3	12
III	**Toxicity testing**; Test protocol, Genetic toxicity testing & Mutagenesis assay: In vitro test systems: bacterial mutation tests-Reversion test, Ames test, Fluctuation test, and Eukaryotic mutation test. In vivo test system Mammalian mutation test Host mediated assay and Dominant Lethal test. Biochemical basis of toxicity: Mechanism of toxicity: Disturbance of excitable membrane function, Altered Calcium homeostasis, Covalent binding to cellular macromolecules & genotoxicity, Tissue specific toxicity	K3	12
IV	**Toxic Responses to Foreign Compounds**: Direct Toxic Action: Tissue Lesions; Mechanism and response in cellular toxicity, pharmacological, physiological and Biochemical effects; Developmental Toxicology-Teratogenesis; Immunotoxicity Genetic Toxicity; Chemical Carcinogenesis	K4	12
V	**Biochemical Mechanisms of Toxicity**: Tissue Lesions: Liver Necrosis; kidney Damage; Lung Damage, Liver damage, Cardiac damage; Neurotoxicity; Exaggerated and Unwanted pharmacological effects; Physiological effects; Biochemical Effects: Lethal Synthesis and Incorporation, Interaction with specific Protein Receptors; Teratogenesis; Immunotoxicity; multi-Organ Toxicity. **Current trend - *Drug Addiction***	K5	12
	…… Self Study.		
	CO1: Understand the role of toxicological biomarkers to assess drug toxicities	K2	
	CO2: Discover the role of disposition of drug in human system and their metabolism and methodologies pertaining to toxicological studies..	K3	

Course Outcome	**CO3:** Identify the functions of different organs on drug disposition and associated drug toxicities.	K3
	CO4: Determine the toxicological response to foreign compounds and their pharmacological, physiological and biochemical effects.	K4
	CO5: Examine the mechanism of toxicity and clinical symptoms with underlying physiological disturbances	K5

Learning Resources				
Text Books	1. Principles Of Toxicology by: Karen E Stine, Thomas M Brown 2006 Publisher. Crc Press 2. Principles of Biochemical Toxicology by John A. Timbrell Publisher: Informa Healthcare 3. Environmental Toxicology by Sigmund F. Zakrzewski, (2002) Publisher: Oxford University Press, USA			
Reference Books	Gad, Shayne C, Acute toxicology testing Published 1998 Stanley, Lesley, Molecular and Cellular toxicology : An introduction, Published 2014 David. E. Golan, Principles of Pharmacology, Wolters Kluwer (India) Pvt.Ltd.			
Website Link	1. https://www.iloencyclopaedia.org/part-iv-66769/toxicology-57951/mechanisms-of-toxicity#:~:text=At%20the%20cellular%2Fbiochemical%20level,substance)%20enzyme%20inhibition%20or%20induction. 2. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004061923052709omkar_zool_Toxic_effects_of_xenobiotics.pdf 3. https://www.cmmcp.org/sites/g/files/vyhlif2966/f/uploads/dose-response_relationships_in_toxicology.pdf			
Self-Study Material	https://nida.nih.gov/publications/drugfacts/understanding-drug-use-addiction#:~:text=Drug%20addiction%20is%20a%20chronic,intense%20urges%20to%20take%20drugs.			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCC11	**BIOCHEMICA L TOXICOLOGY**	**DSC THEORY - XI**	**IV**	**6**	**2**	**4**	**-**	**4**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	S	L	M	M	M	M
CO2	M	M	S	M	M	L	M	S	S	S
CO3	S	S	S	M	M	L	S	S	M	M
CO4	S	M	S	M	M	M	S	S	M	M
CO5	M	S	S	S	S	M	M	M	S	S

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Mr.S.Maharajan	Mr.P.Tamilmani	Dr.S.Shahitha

List of Elective Course details for M.Sc., Biochemistry

Syllabus – LOCF – CBCS Pattern

Effective from the academic Year 2023 – 2024 onwards

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	I	23M1PBCE01	Microbiology and Immunology
2	I	23M1PBCE02	Immunology and Immunotechnology
3	I	23M1PBCE03	Bio safety, lab safety and IPR
4	I	23M1PBCE04	Cancer Biology
5	II	23M2PBCE05	Energy and drug metabolism
6	II	23M2PBCE06	Biomedical Instrumentation
7	II	23M2PBCE07	Nutritional Biochemistry
8	II	23M2PBCE08	Biochemistry in Human Health
9	III	23M3PBCE09	Biostatistics and Data Science
10	III	23M3PBCE10	Research Methodology
11	III	23M3PBCE11	Clinical Laboratory Techniques
12	III	23M3PBCE12	Molecular basis of diseases and therapeutic strategies
13	IV	23M4PBCE13	Developmental Biology
14	IV	23M4PBCE14	Plant Biochemistry

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCE01	**Microbiology And Immunology**	DSE THEORY - I	I	5	3	2		4
Objective	This course covers microorganism classification, environmental roles, food contamination prevention, pathogenicity, antimicrobial agents, and industrial applications.							

Unit	Course Content	Knowledge Levels	Sessions
I	Taxonomical classification – bacteria, viruses (DNA, RNA), algae, fungi and protozoa. Distribution and role of microorganisms in soil, water and air. Charaka's classification of microbes, lytic cycle and lysogeny. Types of culture media, isolation of pure culture, growth curve and the measurement of microbial growth.	K3	10
II	Contamination and spoilage of foods – cereals, cereal products, fruits, vegetables, meat, fish, poultry, eggs, milk and milk products. General principles of traditional and modern methods of food preservation – Removal or inactivation of microorganisms, boiling, steaming, curing, pasteurization, cold processing, freeze drying, irradiation, vacuum packing, control of oxygen and enzymes. Microbes involved in preparation of fermented foods – cheese, yoghurt, curd, pickles, rice pan cake, appam, ragi porridge (கேழ்வரகுகூழ்)and bread.	K3	10
III	Food poisoning- bacterial food poisoning, *Salmonella, Clostridium blotulinum* (botulism), *Staphylococcus aureus*, fungal food poisoning – aflatoxin, food infection – *Clostridium, Staphylococcus* and *Salmonella*. Pathogenic microorganisms, *E. coli, Pseudomonas, Klebsilla, Streptococcus, Haemophilus, & Mycobacterium*, causes, control, prevention, cure and safety. Food microbiological screening-Real time PCR, ELISA, Aerobic and anaerobic Plate Count, dye reduction method, anaerobic lactic acid bacteria, anaerobic spore formers, Hazard analysis critical control point(HACCP)	K4	10
IV	Antimicrobial chemotherapy, General characteristics of antimicrobial agents. Mechanism of action – sulfonamides, sulphones and PAS. Penicillin, streptomycin- spectra of activity, mode of administration, mode of action, adverse effects and sensitivity test., Antiviral and antiretroviral agents, Antiviral RNA interference, natural intervention (Natural immune modulators routinely used in Indian medical philosophy).	K5	10
V	Immune system- definition and properties. Cells of the immune system – neutrophils, eosinophils, basophils, mast cells, monocytes, macrophages, dendritic cells, natural killer cells, and lymphocytes (B cells and T cells). Lymphoid organs- Primary and Secondary; structure and functions. Antigens and Complement System: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Antigen – antibody	K5	10

	interactions – molecular mechanism of binding. Affinity, avidity, valency, cross reactivity and multivalent binding. Immunoglobulins & Immune Response: Structure, classes and distribution of antibodies. Antibody diversity. Immune system in health & disease, Transplantation immunology- graft rejection and HLA antigens. Immunological techniques, Flow cytometry and its application.		
Course Outcome	CO1:Classify (by both ancient and modern modes) different types of microorganisms and explain life cycle of the microbes	K3	
	CO2: Identify food-decaying microorganisms, apply countermeasu understand the role of beneficial microbes in daily food consumpti	K3	
	CO3: Discover the common pathogenic bacterial and fungi that cause toxic effects and also will be able to employ curative measures.	K4	
	CO4: Analyses various features of wide variety of antimicrobial agents along with their mode of action, in addition, being able to apprehend the valuable potentials of traditional and easily available herbs.	K4	
	CO5: Examine the knowledge gained in production of industrially important products as both pharmaceutical and nutraceutical.	K5	

Learning Resources

Text Books	1. Michael J.Pelczar Jr.(2001) Microbiology (5th ed), McGraw Hill Education (India) Private Limited 2. Frazier WC ,Westhoff DC, Vanitha NM (2010) Food Microbiology (5th ed), McGraw Hill Education (India) Private Limited 3. Willey J and Sherwood L (2011) ,Prescott's Microbiology (8th ed) McGraw Hill Education (India)
Reference Books	1. Judy Owen , Jenni Punt Kuby (2013) ,Immunology (Kindt, Kuby Immunology) (7th ed) W. H. Freeman & Co 2. Brooks GF and Carroll KC (2013) JawetzMelnick&Adelbergs Medical Microbiology,(26th ed) McGraw HillEducation Greenwood D (2012) ,Medical Microbiology, ElsevierHealth 3. Ananthanarayanan ,Paniker and Arti Kapil (2013) Textbook of Microbiology (9th ed) OrientBlackSwan
Website Link	https://www.frontiersin.org/articles/10.3389/fphar.2020.578970/full#h9 https://www.frontiersin.org/articles/10.3389/fmicb.2018.02151/full https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7559905/

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M1PBCE01	**Microbiology And Immunology**	DSE THEORY - I	I	4	2	2		3	

CO-PO Mapping

CO Number	PO1	PO 2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO 5
CO 1	**S**	**L**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**M**	**L**	**M**	**S**	**S**
CO 3	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**M**	**L**	**M**
CO 4	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**
CO 5	**S**	**L**	**S**	**S**	**M**	**L**	**L**	**S**	**S**	**S**

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

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Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Dr.M.Shabana Begam	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCE02	Immunology And Immunotechnology	DSE THEORY - II	I	4	2	2		3
Objective	To study the immune responses of human body against antigen, immunological techniques and vaccine synthesis.							

Unit	Course Content	Knowledge Levels	Sessions
I	The Immune System: History of immunology- Cells and Organs of the immune system- primary and secondary lymphoid organs. Differentiation and Generation of T-cells and B-cells from bone marrow. Stem cells – sources, types, properties & applications. Antigens– types, properties that influence antigenicity & immunogenicity, epitopes, crossreactions. Haptens and mitogens. Adjuvants-types and properties. Antibodies– structure, types of immunoglobulins-structure, properties and functions, immunoglobulin superfamily. Complement cascades-components, mechanism of Classical, Alternative and other pathways, biological consequences of complement cascades and their fragments.	K2	10
II	Types of immunities –Innate and Acquired. Immune response-Humoral and Cellular immuneresponses-their characteristics & effector mechanisms. Regulation of immune response. Immune response to infections-bacterial, viral, fungal and others. Immunodeficiency diseases-primary and secondary .Immuno genetics-antibody diversity- theories of antibody formation, organization of immunoglobulin gene and their expression, class switching. Major Histocompatibility Complex- organization, structure and functions of MHC and HLA genes and non-MHC molecules. Gene products. Role in antigen processing and presentation.	K3	10
III	Hypersensitivity and Autoimmunity: Hypersensitivity–classification, causes, mechanism, clinical manifestations, diagnosis and treatment of TypesI–IV hypersensitivities. Autoimmunity- classification, role of MHC, TH cells and TCR in autoimmunity, spectrum of autoimmune diseases, overlap, pathogenesis, diagnosis and treatment of autoimmune diseases	K3	10
IV	Transplantation Immunology: Immunology of Allogeneic Transplantation,Types of Graft Rejection, Specific Immunosuppressive Agents, Immunology of Xenogeneic Transplantation, Transplantation- types of grafts, principles involved and mechanism of transplantation of various organs ,immunosuppressive therapy, Graft Versus Host Disease. Role of MHC in transplantation, disease susceptibility and resistance and genet control of primary histocompatibility	K4	10
V	Immunotechniques: Antigen-antibody interactions-Precipitation techniques. Agglutination techniques, ABO blood grouping & Rh typing.Tagged assays-RIA, ELISA, immunofluorescence, immunoblotting, immunoelectron microscopy. Isolation of pure antibodies, Assays for complement, FACS, Flow cytometry. Antibody engineering – Hybridoma technology- polyclonal and monoclonal antibody production and their applications. Recombinant antibody production. Vaccine production- types of vaccines, principles of vaccine production, production of conventional and modern vaccines, new vaccine strategies and vaccines under development. Vaccination strategies, immunization schedules.	K5	10

Course Outcome	CO1:Understand basics of immune system and about the cells and organs of immune system		K2	
	CO2: Describe the Antigen and Antibody structure and properties and obtain the knowledge about the hybridoma technology		K3	
	CO3: Familiarize with complement system, autoimmunity and immunodeficiency disorders		K3	
	CO4: Discover a clear idea about the immunization and hypersensitivity reactions.		K4	
	CO5: Comprehend the antigen and antibody reactions and immunological techniques		K5	
Learning Resources				
Text Books	1. Immunology by Ivan Roitt, Jonathan Brostoff,andDavidMale.Mosby,London.6thedition,2001. 2. Clark WR, The experimental foundations of modern immunology. JohnWiley and SonsInc.NewYork.1991. 3. Noel R. Rose, Herman Friedman, John L. Fahey. Manual of Clinical Laboratory Immunology.ASM.3rded., 1986.			
Reference Books	1. Kuby Immunology.W.H.Freeman&Co.Fourth edition, 2005. 2. Cellular and molecular immunology, by Abul Abbas, Andrew Lichtman, and Jordan Pober. W.B.Saunders. 3. Immunobiology – the immune system in health and disease, by Charles Janeway, Jr. and Paul Travers.Garland Publishing, Inc.			
Website Link	https://www.frontiersin.org/articles/10.3389/fphar.2020.578970/full#h9 https://www.frontiersin.org/articles/10.3389/fmicb.2018.02151/full https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7559905/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCE02	Immunology And Immunotechnology	DSE THEORY - II	I	4	2	2		3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**L**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**M**	**L**	**M**	**S**	**S**
CO 3	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**M**	**L**	**M**
CO 4	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**
CO 5	**S**	**L**	**S**	**S**	**M**	**L**	**L**	**S**	**S**	**S**

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Dr.M.Shabana Begum	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCE03	**Biosafety, Lab Safety And IPR**	DSE THEORY – III	I	4	2	2		3
Objective	Learn hazards of handling bio and chem agents, implement lab safety and Understand patents, their importance, and ethics in research.							

Unit	Course Content	Knowledge Levels	Sessions
I	Biosafety: Historical background; introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; recommended biosafety levels for infectious agents and infected animals; biosafety guidelines – government of India, roles of IBSC, RCGM, GEAC etc. for GMO applications in food and agriculture; environmental release of GMOs; risk assessment; risk management and communication; national regulations and international agreements.	K3	13
II	Laboratory safety – Chemical, electrical and fire hazards; handling and manipulating human or animal cells and tissues, toxic, corrosive or mutagenic solvents and reagents; mouth pipetting, and inhalation exposures to infectious aerosols, Safe handling of syringe needles or other contaminated sharps, spills and splashes onto skin and mucous membranes. Health aspects; toxicology, allergenicity, antibiotic resistance. History of biosafety microbiology and molecular biology, Risk assessment, Personal protective equipment, Laboratory facilities and safety equipment, Disinfection, decontamination, and sterilization, Regulatory compliance, Laboratory security and emergency response and administrative controls	K3	12
III	Intellectual Property Rights (IPR): Introduction to patents, types of patents, process involved in patenting in India, trademarks, copyright, industrial design, trade secrets, traditional knowledge, geographical indications, history of national and international treaties and conventions on patents, WTO, GATT, WIPO, Budapest Treaty, Patent Cooperation Treaty (PCT) and TRIPS. Patent databases: Searching international databases; analysis and report formation. Indian Patent Act 1970; recent amendments; filing of a patent application; precautions before patenting disclosure/non-disclosure; procedure for filing a PCT application. The patentability of microorganisms-claims, Characterization and repeatability disposition in the culture collections, legal protection for plants and other higher organisms, new plant varieties by rights, tissue culture protocols	K4	12
IV	Patent filing and infringement: Patent application- forms and guidelines, fee structure, time frames; types of patent applications: provisional and complete specifications; PCT and convention patent applications, international patenting-requirement, financial assistance for patenting-introduction to existing schemes; Publication of patents- gazette of India, status in Europe and US. Research Patenting: Patenting by researchers and scientists-University/organizational	K4	12

	rules in India and abroad. Detailed information on patenting biological products, Case studies on patents (basmati rice, turmeric, neem etc.), and patent infringement		
V	Bioethics: Introduction to bioethics, human genome project and its ethical issues, genetic manipulations and their ethical issues, ethical issues in GMOs, foods and crops in developed and developing countries, environmental release of GMOs, ethical issues involved in stem cell research and use, use of animals in research experiments, animal cloning, human cloning and their ethical aspects, testing of drugs on human volunteers.	K5	11
Course Outcome	**CO1:** Discover and implement various aspects of biosafety and carry out risk assessment of products in biological research	K3	
	CO2: Identify the basic concepts of ethics and safety that are essential for different disciplines of science and procedures involved and protection of intellectual property and related rights.	K3	
	CO3: **A**ppreciate the intellectual property rights and its implementation of on the invention related to biological research.	K4	
	CO4: Appraise the statutory bodies that regulate the property rights and its validity in various countries.	K4	
	CO5: Critique the ethical concerns associated with modern biotechnology processes and plan accordingly.	K5	

Learning Resources

Text Books	V. Shree Krishna, (2007). Bioethics and Biosafety in Biotechnology, New Age International Pvt. Ltd. Publishers. (Unit III, Unit IV and Unit V) Deepa Goel, Shomini Parashar, (2013). IPR, Biosafety and Bioethics, Pearson. (Unit II) R. Ian Freshney, 2016. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 6th Ed, John Wiley & Blackwell. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007. (Unit I)
Reference Books	Biosafety in Microbiological and Biomedical Laboratories, (2020) 6th Ed. (https://www.cdc.gov/labs/pdf/SF_19_308133-A_BMBL6_00-BOOK-WEB-final3.pdf) Kankanala C., (2007), Genetic
Website Link	V. Shree Krishna, (2007). Bioethics and Biosafety in Biotechnology, New Age International Pvt. Ltd. Publishers. (Unit III, Unit IV and Unit V) Deepa Goel, Shomini Parashar, (2013). IPR, Biosafety and Bioethics, Pearson. (Unit II) R. Ian Freshney, 2016. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 6th Ed, John Wiley & Blackwell. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007. (Unit I)

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M1PBCE03	**Biosafety, Lab Safety And IPR**	DSE THEORY – III	I	4	2	2		3	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO 1	S	S	S	M	S	M	S	S	S	S
CO 2	S	S	S	L	M	M	S	S	S	S
CO 3	S	M	M	M	S	M	S	S	S	M
CO 4	S	M	M	L	S	L	S	S	S	M
CO 5	S	S	S	L	S	M	S	S	S	S

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCE04	**Cancer Biology**	DSE – IV	I	4	2	2		3
Objective	To understand the genetic basis of cancer and the disease processes involved in malignancy.							

Unit	Course Content	Knowledge Levels	Sessions
I	Cell signaling; Extra cellular signal molecules, Cell surface receptor proteins- Ion channel linked receptors, G-Protein coupled receptors, and Enzyme linked receptors. Signal transduction; RTK-Ras dependent pathway, RTK-Ras independent pathway, MAP kinase pathways.	K2	12
II	Overview of cell cycle, check points in cell cycle, Regulation of cell cycle. Programmed cell death or Apoptosis: mechanism, regulation, pro-apoptotic regulators.	K3	12
III	Introduction to cancer, Differences between normal cell and cancer cell, Cytological changes, Molecular changes and genetic changes in cancer cell. Onset of cancer: Carcinogenesis- initiation, promotion and progression, Tumor micro environment influence cancer development, Angiogenesis	K4	12
IV	Causes of cancer- physical and chemical carcinogens. Oncogenes, viral oncogenes, activation of proto oncogenes.	K4	13
V	Tumor suppressor genes- Rb, p53, BCL2 and BRCA2. Loss of heterozygosity, Tumor markers.	K5	11
Course Outcome	CO1: Understand cell signal transduction pathways	K2	
	CO2: Identify the concepts of apoptosis	K3	
	CO3: Develop the process of carcinogenesis	K4	
	CO4: Aware of carcinogens.	K4	
	CO5: Evaluate the functions of tumor suppressor genes	K5	

Learning Resources	
Text Books	1. Weinberg, R.A. "The Biology of Cancer" Garland Science, 2007 2. McDonald, F etal., " Molecular Biology of Cancer" IInd Edition. Taylor & Francis, 2004.
Reference Books	1. King, Roger J.B. "Cancer Biology" Addison Wesley Longman, 1996. 2. Ruddon, Raymond W. " Cancer Biology" IIIrd Edition . Oxford University Press, 1995. 2. Cell Biology- Organelle structure and Function- David E Sadava 2004, Panima publishing Corporation, New Delhi

Website Link	https://www.mlsu.ac.in/econtents/1466_Unit%203-study%20Notes%20on%20Cancer.pdf https://www.cancer.gov/publications/dictionaries/cancer-terms/def/metastasis https://www.cancer.gov/about-cancer/treatment/types			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M1PBCE04	**Cancer Biology**	DSE – IV	I	4	2	2		3	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**L**	**M**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**M**	**M**	**M**	**S**	**M**	**S**	**S**	**S**	**M**
CO 4	**S**	**M**	**M**	**L**	**S**	**L**	**S**	**S**	**S**	**M**
CO 5	**S**	**S**	**S**	**L**	**S**	**M**	**S**	**S**	**S**	**S**

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCE05	**ENERGY AND DRUG METABOLISM**	DSE THEORY V	II	3	3	-	-	3
Objective	This course covers fundamental thermodynamic concepts, electron flow in phosphorylation, autotrophic energy conversion, Krebs cycle's versatility, and xenobiotic metabolism phases							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Thermodynamic- principles in biology- Concept of entropy, enthalpy and free energy change. Redox systems. Redox potential and calculation of free energy. Biological oxidation – Oxidases, dehydrogenases, hydroperoxidases, oxygenases. Energy rich compounds – phosphorylated and non- phosphorylated. High energy linkages.	K2	10
II	Electron transport chain-various complexes of ETC, Q-cycle. Inhibitors of ETC. Oxidative phosphorylation-P/O ratio, chemiosmotic theory. Mechanism of ATP synthesis – role of F0- F1 ATPase, ATP-ADP cycle. Inhibitors of oxidative phosphorylation ionophores, protonophores .Regulation of oxidative phosphorylation	K3	10
III	Light reaction-Hills reaction, absorption of light, photochemical event. Photo ETC-cyclic and non-cyclic electron flow. Photophosphorylation-role of CF0-CF1 ATPase. Dark reaction- Calvin cycle, control of C3 pathway, and Hatch-Slack pathway (C4 pathway), Photorespiration. Synthesis and degradation of starch	K4	10
IV	Interconversion of major food stuffs. Energy sources of brain, muscle, liver, kidney and adipose tissue. Amphibolic nature of Citric acid cycle. Anaplerotic reaction. Krebs cycle, Inhibitors and regulation of TCA cycle. Transport of extra mitochondrial NADH – Glycerophosphate shuttle, malate aspartate shuttle. Energetics of metabolic pathways – glycolysis, (aerobic and anaerobic) ,citric acid cycle, beta oxidation	K4	10
V	Activation of sulphate ions – PAPS, APS, SAM and their biological role. Metabolism of xenobiotics – Phase I reactions – hydroxylation, oxidation and reduction. Phase II reactions – glucuronidation, sulphation, glutathione conjugation, acetylation and methylation. Mode of action and factors affecting the activities of xenobiotic enzymes.	K5	10
Course Outcome	CO1: Appreciate the relationship between free energy and redox potential and will be able to justify the role of biological oxidation and energy rich compounds in maintaining the energy level of the system	K2	
	CO2: Gain knowledge on role of mitochondria in the production of energy currency of the cell	K3	
	CO3: Acquaint with the process of photosynthesis	K4	
	CO4: Comprehend on the diverse role of TCA cycle and the energy obtained on complete oxidation of glucose and fatty acid	K4	
	CO5: Correlate the avenues available to metabolize the xenobiotics	K5	

Learning Resources				
Text Books	1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman 2. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012), Harper's Illustrated Biochemistry, (29th ed), McGraw-Hill Medical 3. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.			
Reference Books	1. Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill. 2. Devlin RM (1983) Plant Physiology (4th ed), PWS publishers 3. Taiz L , Zeiger E (2010), Plant Physiology (5th ed), Sinauer Associates, Inc			
Website Link	1. https://chemed.chem.purdue.edu/genchem/topicreview/bp/ch21/gibbs.php 2.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7767752/#:~:text=The%20mitochondrial%20electron%20transport%20chain,cellular%20ATP%20through%20oxidative%20ph osphorylation. 3. https://www.researchgate.net/figure/Oxidative-phosphorylation-in-mitochondrial- electron-transport-chain-ETC-and-proton_fig1_230798915 4.https://www.lyndhurstschools.net/userfiles/84/Classes/851/photosynthesis%20light%20&%20dark%20reactions%20ppt.pdf?id=560837 5.https://bajan.files.wordpress.com/2010/05/amphibolic-nature-of-krebs-cycle.pdf 6.https://www.sciencedirect.com/topics/medicine-and-dentistry/xenobiotic-metabolism#:~:text=Xenobiotic%20metabolism%20can%20be%20defined,more%20readily%20excreted%20hydrophilic%20metabolites			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M2PBCE05	**ENERGY AND DRUG METABOLISM**	DSE THEORY V	II	3	3	-	-	3	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**M**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**L**
CO 5	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Dr.M.Devi	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCE06	**BIOMEDICAL INSTRUMENTATION**	DSE THEORY VI	II	3	3	-	-	3
Objective	The Course focus on the instrumentations used in the medical field. By learning this course, the students can able to understand the basic concepts in Biomedical Instrumentation which will be very useful for operating the instruments in future.							

Unit	**Course Content**	**Knowled ge Levels**	**Sessions**
I	**Biomedical Instrumentation**: Definition, Classification of Biomedical equipments – Diagnostic, therapeutic and clinical Laboratory equipments, sources of biomedical signals, components, design factors and characteristics.	K3	10
II	**Biosensors** – Principle and mechanism of calorimetric, potentiometric, 52mphib and optical biosensors. Autoanalyser – types and application. **Electrodes**- theory, types-biopotential, microelectrodes, metal plate and needle electrodes. Transducers – types – magnetic induction, piezoelectric, photovoltaic, thermoelectric, strain guage.	K3	9
III	**Biopotential Recorders**: Resting and action potential, propagation of action potential, wave forms- ECG, EMG, EEG, EOG, EGG & ERG. **Specialized Medical Equipments:** X- ray machine, Angiogr	K4	9
IV	**Physiological assist devices**- pace makers, artificial heart valves, defibrillators, nerve and muscle stimulator (Galvanic and interrupted Galvanic current), heart-lung machine- mechanical functions, oxygenators- bubble, film. Kidney machine-hemo and peritoneal dialysis.	K5	8
V	**Advances in biomedical instrumentation**- Lasers, endoscopes- types. Cryogenic surgery. Gamma ray camera, computerized tomography, infrared thermography, ultrasonic imaging, magnetic resonance imaging..	K5	10
Course Outcome	CO1: Explain the classification of biomedical instruments	K3	
	CO2: Analyze the working of Biosensors, electrodes and transducers	K3	
	CO3: Relate the principle & working of biopotential recorders	K4	
	CO4: Describe the principles and working physiological assist devices	K5	
	CO5: Summarize the recent advancements in biomedical instruments	K5	

Learning Resources	
Text Books	**1.** *Anandanatarajan*, R. 2013. Biomedical Instrumentation and measurements. PHI Learning Pvt., Ltd. New Delhi. 2. *Arumugam*, M. 2011. Biomedical Instrumentation. Anuradha publications, Chennai. 3. *Khandpur, R. S.* 1995. Hand book of Biomedical instrumentation. Tata Mc.Graw-Hill publishing company Ltd., New Delhi.

Reference Books	1. Biomedicalinstrumentation,LeslieCromwell,FredJ.Weibell,ErichA.Pfeiffer,19 80.2nd Edn.Prentice-Hall, 2. Medical Instrumentation, JohnG.Webster, 2003, JohnWiley&Sons. 3. Principles of applied Biomedical instrumentation by L.A. Goddes andL.E. Baker,			
Website Link	https://kanchiuniv.ac.in/coursematerials/Biomedical%20instrumentation.pdf https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SIC1311.pdf			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCE06	**BIOMEDICAL INSTRUMENTATION**	DSE THEORY VI	II	3	3	-	-	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**M**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**L**
CO 5	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Mrs.M.Priyanga Gandhi	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCE07	**NUTRITIONAL BIOCHEMISTRY**	DSE THEORY VII	II	3	3	-	-	3
Objective	This course covers fundamental concepts of growth, health, nutrition, physiology, and metabolism, emphasizing their integration with biochemistry. It also addresses nutritional requirements for healthy individuals and diet adjustments during illness.							

Unit	Course Content	Knowledge Levels	Sessions
I	Basic concepts - Nutrition - Food groups and balanced diet. Novel Foods. Calorific value of foods: Direct and indirect calorimetry. Empty calories. Basal metabolic rate: Factors affecting BMR. SDA and physical activity. Calculation of day's energy requirement. Assessment of nutritional status. Lactose intolerance. Nutritional requirement and biochemical changes in different physiological states -infancy, childhood, pregnancy, lactation, and ageing. Sports nutrition.	K3	9
II	Elements of nutrition - Plant and animal sources of simple and complex carbohydrates, fats and proteins and their requirement. Biological significance, deficiency and toxicity of macronutrients and micronutrients. Role of dietary fibre. Protein sparing action of carbohydrates and fats. Essential amino acids. Essential fatty acids. Effects of naturally occurring food toxins, preservatives, additives, alcohol and tobacco on health.	K3	9
III	Vitamins and Minerals- Dietary sources, classification, biochemical functions, requirements, absorption, metabolism and excretion. Vitamin B complex as coenzyme. Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.	K4	8
IV	Malnutrition - Diseases arising due to Protein - Calorie Malnutrition and undernutrition (Kwashiorkor and Marasmus), Prevention of malnutrition. Deficiency diseases associated with vitamin B complex, vitamin C and A, D, E & K vitamins - Mineral deficiency diseases - aetiology, sign and symptoms and dietary supplementation. Enrichment and fortification (vitamins and minerals)	K5	9
V	Nutrition in diseases – Aetiology, signs and symptoms , treatment and dietary management during fever(Typhoid and Malaria) and infectious diseases(COVID-19), Jaundice, hyper acidity (Ulcer), Atherosclerosis, Hypertension, kidney diseases and diabetes in adults. Starvation and Obesity. Inter-relationship of nutrition, infection, immunity and poverty	K5	10
	CO1: Plan a balanced diet based on an individual's energy requirement, Assess nutritional status of an individual	K3	

Course Outcome	CO2: Describe the biochemical , physiological and nutritional functions of macronutrients and their integrated role. Understand the role played by antinutritional factors	K3
	CO3: Analyze the functions of vitamins and minerals ,and fluids and electrolyte balance in different physiological states and in sports persons	K4
	CO4: Justify nutritional deficiency conditions , its prevention and dietary management	K5
	CO5: Acquire knowledge about the importance of balanced diet and diet therapy	K5

Learning Resources				
Text Books	1. Srilakshmi. E .(2016) Nutrition Science, New Age International Publishers. 2. Mahan, Kathleen L. (2004) Krause's Food, Nutrition and Diet Therapy, W.B.Saunder's 11th Edition 3. Andreas M. Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1st ed) CRC Press.			
Reference Books	1. M. Swaminathan (1995) Principles of Nutrition and Dietetics. Bappco 2. Margaret Mc Williams (2012). Food Fundamentals (10th ed) Prentice Hall 3. Tom Brody (1998) Nutritional Biochemistry (2nd ed). Academic Press, USA			
Website Link	https://www.jmedscindmc.com/article.asp?issn=1011-4564;year=2014;volume=34;issue=5;spage=211;epage=213;aulast=Shrivastava https://www.researchgate.net/figure/Relationship-between-malnutrition-infection-and- immunity-Malnutrition-is-considered-the_fig1_280722727 https://en.wikipedia.org/wiki/Novel_food			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards												
Course Code	**Course Title**				**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M2PBCE07	**NUTRITIONAL BIOCHEMISTRY**				DSE THEORY VII	II	3	3	-	-	3	
CO-PO Mapping												
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**		
CO 1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**		
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**		
CO 3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**		
CO 4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**L**		
CO 5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**		
Level of Correlation between CO and PO	L-LOW				M-MEDIUM				S-STRONG			
Tutorial Schedule	Group Discussion, Quiz program, Model preparation											
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation											
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE											

Designed By	**Verified By**	**Approved by Member Secretary**
Mr.S.Maharajan	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCE08	**BIOCHEMISTRY IN HUMAN HEALTH**	DSE THEORY VIII	II	4	2	2	-	3
Objective	This course aims to equip students with current knowledge about the biochemical foundations of human diseases, including mechanisms, progression, and the role of antioxidants in promoting human health							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	International Agencies-Introduction to biochemistry programme, Relationship of health and biochemistry, Role of various agencies to improve the nutritional status of the community (WHO, UNICEF, NIN, ICAR, FAO, CSIR). National Health Programs- Planning, Execution and Evaluation of various health programs.	K3	10
II	Energy – Energy content of food, energy utilization in cells. Basal metabolic rate (BMR) and specific dynamic action (SDA) and factors affecting BMR. Energy balance and Energy requirements of man and woman and factors affecting energy requirements.	K3	12
III	Community Health and Communicable Diseases Concepts of community Health, National Health Policy .Epidemiology of Communicable Diseases Factors responsible for the spread of communicable diseases, mode of transmission — typhoid fever, tuberculosis, leprosy, filariasis and AIDS.	K4	15
IV	Non-communicable diseases Etiology and management of diseases like Obesity, Diabetes mellitus, and Cardiovascular disorders. Immune responses to SARS-CoV-2,Vaccines and Immunotherapy. Preventive health checkups (PHC)- important parameters/biomarkers; relevance of PHC in health and disease prevention/early diagnosis.	K5	13
V	Antioxidants and human health Chemistry of free radicals and reactive oxygen species, Free radicals in health and disease. Antioxidant defence enzymes- Superoxide dismutase, catalases, glutathione peroxidase, Glutatione reductase, glutathione-S-transferases.	K5	10
Course Outcome	CO1: Identify the energy requirements for humans in maintaining health	K3	
	CO2: Construct the energy values and requirements	K3	
	CO3: Discover the basic concept of Communicable Diseases	K4	
	CO4: Criticize the basic concept of non-Communicable Diseases	K5	
	CO5: Acquire knowledge about the importance of antioxidants	K5	

Learning Resources	
Text Books	1. The Assessment of Nutritional Status of Community WHO/FAO. Jelliffe, D. B. Latest Ed. Monograph series No.53, WHO Geneva. 2. Nutrition in the Community 2nd Ed. Maclaren, D. S. 1986. John Willey and Sons, NewYork. 3. Manual on Community Nutrition. Mann, S. K, Sangha, J. K, Mehta, U and Jain, R. 1999. College of Home Science, PAU, Ludhiana.
Reference Books	1. Text Book of Biochemistry for Medical Students. Vasudevan D.M and Sreekumari S. 2007 5th Edition. Jaypee Publishers. 2. Textbook of Medical Biochemistry. Chatterjea M. N and Rana Shinde 2012 8th EditionJaypee Brothers Medical Publishers (P) Ltd New Delhi 110 002, India.
Website Link	https://www.srgtalent.com/blog/the-importance-of-biochemistry-in-medical-science https://www.ncbi.nlm.nih.gov/books/NBK554545/

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCE08	**BIOCHEMISTRY IN HUMAN HEALTH**	DSE THEORY VIII	II	3	3	-	-	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	M	M
CO 2	S	S	S	S	S	S	S	S	M	M
CO 3	S	S	S	S	S	S	S	S	M	M
CO 4	S	S	S	S	S	S	S	S	M	L
CO 5	S	S	S	S	S	S	S	S	M	M

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

Tutorial Schedule	Group Discussion, Quiz program, Model preparation
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc., Biochemistry Microbiology, Biotechnology Allied Syllabus LOCF-CBCS with effect from2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCE09	**BIOSTATISTICS AND DATA SCIENCE**	**DSE THEORY– V**	**IV**	**3**	**3**	**-**	**-**	**3**
Objective	To summarize the data and to obtain its salient features from the vast mass of original data, understand the concept of various measures of dispersion, To understand the concepts of sampling and learning test of significance, To understand the concept of various attributes and relate to Biological studies, To gain knowledge in SPSS, a software package which gives a perfect graphical representation and appropriate result for the data that has been entered							

Unit	Course Content	Knowledge Levels	Sessions
I	**Measures of Central Tendency :** Nature of biological and clinical experiments – Collection of data in experiment Primary and Secondary data. Methods of data collection. Classification and tabulation. Different forms of diagrams and graphs related to biological studies. Measures of Averages- Mean, Median, andmode. Use of these measures in biological studies.	K2	9
II	**Measures of Dispersion :** Measures of Dispersion for biological characters – Quartile deviation, Mean deviation, Standard deviation and coefficient of variation. Measures of Skewness and kurtosis. Correlation and regression – Rank correlation – Regression equation. Simple problems based on biochemical data.	K2	9
III	**Test of significance :** Basic concepts of sampling- Simple random sample stratified sample and systemic sampling. Sampling distribution and standard error. Test of significance based on large samples. Test for mean, difference of means, proportions and equality of proportions.	K3	9
IV	**Small sample test :** Small sample test – Students _t'test for mean, difference of two way means, tests for correlation and regression coefficients. Chi-square test for goodness of a non independence of attributes. F test for equality of variances. ANOVA- one way and two way. Basic concept related to biological studies	K3	9
V	**Introduction to Data Science :** Introduction to Data Science, Definition of data science, importance, and basic applications, Machine Learning Algorithms, Deep Learning, Artificial Neural Networks and their Application, Reinforcement Learning, Natural Language Processing Artificial Intelligence (AI), Data Visualization, Data Analysis, Optimization Techniques, Big Data, Predictive Analysis. Application of AI in medical, health and pharma industries **Current Trent : * Measures of Dispersion ***	K4	9
Course	**CO1:** Concepts of statistical population and sample, variables and attributes. Tabular and graphical representation of data based onvariables.	K2	
	CO2: Conditions for the consistency and criteria for the independenceof data based on attributes. Measures of central tendency, Dispersion, Skewness and Kurtosis.	K2	

Outcome	**CO3:** Learning different sampling methods and 64mphibian statistical significance.	K3
	CO4: Understanding students t-test, ANOVA, Chi square test to analyse the significance of various research.	K3
	CO5: Learning on data science, algorithm for machine learning, artificial intelligence and big data, their applications in clinical and pharma domain.	K4

Learning Resources	
Text Books	1. Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, NewDelhi, 35thRevised Edition. 2. Gupta S. C and Kapoor, V. K. (2002). Fundamentals of Mathematical Statistics, SultanChand & Sons Pvt. Ltd.,New Delhi.
Reference Books	1. Warren,J; Gregory,E; Grant,R (2004), ―Statistical Methods in Bioinformatics‖,1st edition,Springer 2. Milton,J.S.(1992),. ―Statistical methods in the Biological and Health Sciences‖, 2nd edition ,Mc Graw Hill, 3. Rosner,B (2005), ―Fundamentals of Biostatistics‖, Duxbury Press 4. Introducing Data Science, Davy Cielen, Anro DB Meysman, Mohamed Ali.
Website Link	https://www.ibm.com/docs/en/SSLVMB_28.0.0/pdf/Accessibility.pdf https://pure.tue.nl/ws/portalfiles/portal/19478370/20160419_CO_Mzolo.pdf https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5453888/ https://home.ubalt.edu/ntsbarsh/excel/excel.htm https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf https://www.ibm.com/support/pages/ibm-spss-statistics-28-documentation\
Self-Study Material	Nature of biological and clinical experiments – Collection of data in experiment Primary and Secondary data. Methods of data collection. Classification and tabulation. Different forms of diagrams and graphs related to biological studies. N-List Link: https://nlist.inflibnet.ac.in/search/Record/EBC4513906 https://ebookcentral.proquest.com/lib/inflibnet-ebooks/reader.action?docID=3386956&ppg=17

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

M.Sc., Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M3PBCE09	**BIOSTATISTICS AND DATA SCIENCE**	**DSE THEORY– V**	**IV**	**3**	**3**	**-**	**-**	**3**	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	S	S	L	M	S	S	S	S	S
CO 2	S	M	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	M	L	M	S	S	M
CO 4	S	S	M	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Chalk and Board Teaching, Power Point Presentation, Group Discussion and Virtual Learning
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Dr.S.Mohan Prabhu	Dr.S.Mohan Prabhu	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCE10	Research Methodology	DSE THEORY _ X	III	4	2	2	-	3
Objective	The students can summarize data, understand dispersion measures, sampling and learning tests of significance, and understand attributes related to biological studies.							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Nature of biological and clinical experiments – Collection of data in experiment- Primary and secondary data. Methods of data collection. Classification and tabulation. Different forms of diagrams and graphs related to biological studies. Measures of Averages- Mean, Median, and mode. Use of these measures in biological studies. Measures of Dispersion for biological characters – Quartile deviation, Mean deviation, Standard deviation and coefficient of variation. Measures of skewness and kurtosis.	K3	10
II	Correlation and regression – Rank correlation – Regression equation. Simple problems based on biochemical data. Basic concepts of sampling- Simple random sample stratified sample and systemic sampling. Sampling distribution and standard error. Test of significance based on large samples. Test for mean, difference of means, proportions and equality of proportions	K3	10
III	Small sample tests – Students_t‘ test for mean, difference of two way means, tests for correlation and regression coefficients. Chi-square test for goodness of a non independence of attributes. F test for equality of variances. ANOVA-one way and two way. Basic concept related to biological studies	K4	10
IV	Meaning and significance of research, characteristics and types of research, the research process, features of good research study. Research applications. Research report – Structure and components of scientific reports, types of report, writing and documentation of research report, developing successful research proposals	K4	10
V	Research problem – components of research problem, formulation of research problem, Research Design – Classification of research designs, need for research design, features of good research design, experimental research design	K5	10
Course Outcome	**CO1:** Concepts of statistical population and sample, variables and attributes. Tabular and graphical representation of data based on variables	K3	
	CO2: Conditions for the consistency‘ and criteria for the independence of data based on attributes. Measures of central tendency, Dispersion, Skewness and Kurtosis	K3	
	CO3: Learning different sampling methods and 67mphibian statistical significance	K4	
	CO4: Inspect students t test , ANOVA , Chi square test to analyse the	K4	

	significance of various research	
	CO5: Evaluate the gained knowledge about concept, philosophical consideration and epistemology of science, ethical terms, principles and theories of bioethics	K5

Learning Resources	
Text Books	1. Zar, J.H. (1984) —Bio Statistical Methods‖, Prentice Hall, International Edition 2. Sundar Rao P. S.S., Jesudian G. & Richard J. (1987), —An Introduction to Biostatistics‖, 2nd edition,.Prestographik, Vellore, India,. 3. Warren,J; Gregory,E; Grant,R (2004), —Statistical Methods in Bioinformatics‖,1st edition,Springer
Reference Books	1. Milton,J.S.(1992),. —Statistical methods in the Biological and Health Sciences‖, 2nd edition ,Mc Graw Hill, 2. Research methods for biological science. Gurumani.N, 2007.MJP pub. 3. Research methods in biological science. Dr.S.Palanichamy, & M. Shanmugavelu,
Website Link	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5453888/ https://home.ubalt.edu/ntsbarsh/excel/excel.htm https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M2PBCE10	Research Methodology	DSE THEORY _ X	III	4	2	2	-	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	M	M
CO 2	S	S	S	S	S	S	S	S	M	M
CO 3	S	S	S	S	S	S	S	S	M	M
CO 4	S	S	S	S	S	S	S	S	M	L
CO 5	S	S	S	S	S	S	S	S	M	M

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

Tutorial Schedule	Chalk and Board Teaching, Power Point Presentation, Group Discussion and Virtual Learning
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Dr.S.Mohan Prabhu	Dr.S.Mohan Prabhu	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCE11	CLINICAL LABORATORY TECHNIQUES	DSE THEORY XI	III	3	3	-	-	3
Objective	The course aims to educate students on routine clinical techniques in medical laboratories and the analysis of biological samples for disease diagnosis.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Clinical laboratory standards** and Basic laboratory safety, hazards in the clinical laboratory. Specimen processing: blood – Phlebotomy, Methods of collection, Anticoagulants – EDTA, Double oxalate, Sodium citrate, Sodium fluoride, Potassium oxalate, Heparin. Preparation of serum and protein free filtrate	K2	6
II	**Blood:** Difference between serum and plasma. Blood cell count: TC – Haemocytometry, DC, Platelet count. Estimation of Hemoglobin – Sahli's Method, Cyan met Haemoglobin method, PCV – Microhaematocrit method. ESR – Westergren's method, bleeding time – Duke's method. Clotting time – Capillary tube method. Clinical interpretation of haematological tests – Anemia, polycythemia and leukemia	K3	9
III	**Human blood group system:** ABO, sub groups of ABO, variants of ABO and Rh blood group system. Blood transfusion: Definition and clinical significance. Complications, Blood banking: Blood collection – Screening of donor. Criteria for rejecting donor. Blood collection procedure. Transportation of blood. Storage of blood and changes in the stored blood	K4	9
IV	**Urine analysis:** Urine – Methods of collection. Storage – Preservatives. Gross examination of urine, chemical examination of urine. Reducing sugar , Protein, ketone bodies, bile salts and bile pigments Stool examination – Specimen collection, Physical & chemical examination, Test for Occult, Microscopic examination of stool.	K4	8
V	**Sputum Analysis:** Specimen collection, macroscopic examination – Color, Volume, Odour. Microscopic examination. Semen Analysis: Collection, Gross examination, Microscopic examination, Chemical examination of semen. **Current Trend - *Ultrasound Imaging Advances and Applications ***	K4	8
	…… Self Study.		
	CO1: Explain about the laboratory safety, hazards in clinical laboratories	K2	
	CO2: Describe the methods of analysis of blood.	K3	

	CO3: Illustrate the various blood grouping systems, complications in blood transfusion, methods in collection and storage of blood in blood bank	K4
	CO4: Handle and examine biological samples like urine and stools	K4
	CO5: Describe the analysis of Sputum and Semen	K4

Learning Resources	
Text Books	1. Kanai.L. Mukherjee. Medical Laboratory Technology, Volume III. Tata McGraw- Hill Publishing Co. New Delhi. 2005. 2. Sadasivam Sand A. Manickam Biochemical Methods, Second Edition, New Age International Publishers, New Delhi, 1992 3. J.Jayaraman. Laboratory Manual in Biochemistry, New Age International Publishers, New Delhi, 1981
Reference Books	2. Ramnik Sood. Medical Laboratory Technology. Jaypee Brothers Medical Publishers Ltd., New Delhi, 2006 3. Naresh Kumar and Johnson Bright Clinton. Advanced Medical Laboratory Techniques. AkiNik Publications, 2021. 4. Ajmani PS. Handbook of Clinical Laboratory Techniques, 2023
Website Link	1. https://iris.who.int/bitstream/handle/10665/65957/WHO_DIL_LAB_99.1_REV.2.pdf;jsessionid=C1BC1734584FF004CF7D808AD3CCA108?sequence=1 2. https://www.researchgate.net/publication/5563904_Specimen_collection_and_handling_Standardization_of_blood_sample_collection 3. https://www.osmosis.org/learn/Complete_blood_count_(CBC)_-_Red_blood_cells_(RBC):_Nursing
Self-Study Material	https://link.springer.com/book/10.1007/978-1-4614-1180-2

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCE11	CLINICAL LABORATORY TECHNIQUES	DSE THEORY XI	III	3	3	-	-	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**M**	**S**	**L**	**M**	**M**	**M**	**M**	**M**	**S**
CO3	**S**	**S**	**M**	**L**	**S**	**S**	**M**	**M**	**S**	**M**
CO4	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**M**	**S**
CO5	**S**	**S**	**M**	**M**	**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	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved by Member Secretary**
Dr.M.DEVI	HOD	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCE12	**MOLECULAR BASIS OF DISEASES AND THERAPEUTICS STRATEGIES**	**DSE THEORY - VI**	**III**	**3**	**3**	**-**	**-**	**3**

Objective	To Acquire knowledge about the blood sugar regulation, diabetes management, cancer, tumor metastasis, nervous system organization, impaired features, renal diseases, and cardiac disorders.

Unit	Course Content	Knowledge Levels	Sessions
I	**Mechanism of blood sugar regulation in human body**. Pathophysiology of Type I and II diabetes, Diabetes – investigation methods for the diagnosis of diabetes. Nutritional care. Complications related to diabetes – Diabetic cardiovascular disease, retinopathy, neuropathy and nephropathy. Cellular and molecular mechanism of development of diabetes- Management of Type I and Type II diabetes, drugs for the treatment of diabetes.	K2	10
II	**Biology of cancer**: Overview of hallmarks of cancer. Tumorigenesis, Tumor progression and mechanism of Metastasis. Proto-oncogene to oncogene. Oncogene- myc and src family. Tumor suppressor gene-Rb and p53 pathway in cancer. Diagnosis- Non-invasive imaging techniques, Tumor diagnosis, Interventional radiology, New imaging technique, Molecular techniques in cancer diagnosis.- treatment of cancer- surgery, radiotherapy, chemotherapy, hormonal treatment, and biological therapy. Introduction to personalized medicine.	K3	10
III	**Brain- neuronal network-** memory- Neurogenerative diseases- Parkinson and Alzheimer Disease- molecular understanding of the neurodegenerative diseases- treatment modalities	K3	7
IV	**Acute and chronic renal failure**, glomerular diseases–glomerulonephritis, nephritic syndrome, diabetes insipidus, diagnosis of kidney disease.	K4	8
V	**Cardiovascular diseases**, Lipids and lipoproteins in coronary heart disease-cardiac enzymes, Molecular changes during cardiac remodeling – 70 hypertrophy of hearts – heart failure- treatment modalities. **Current trend - *Obesity***	K5	10
	…… Self Study.		
Course Outcome	**CO1:** Understand about the complications of diabetes mellitus and its management.	K2	
	CO2: Comprehensive understanding of the concepts of cancer biology and implicating the theoretical concepts for further research	K3	
	CO3: Identify and appreciate the pathophysiology of conditions affecting the nervous system.	K3	
	CO4: Analyze the concept of renal and cardiac diseases with emphasis related to mechanistic aspects and therapeutic interventions.	K4	

	CO5: Evaluate the experimental models for non-communicable diseases and in-depth understanding of drug development for future research or project dissertations	K5	

Learning Resources	
Text Books	1. Wills' Biochemical Basis of Medicine: 2nd edition,Thomas H, Gillham B;Elsevier 2. Molecular Biochemistry of Human Diseases,2021,Feuer G ,de la Iglesia F; CRC Press
Reference Books	1. The Biochemical basis of disease:2018,Barr AJ; Portland Press
Website Link	1. https://www.healthline.com/health/kidney-health/acute-vs-chronic-renal-failure 2. https://www.cancer.gov/about-cancer/understanding/what-is-cancer#:~:text=Cancer%20is%20a%20disease%20caused,are%20also%20called%20genetic%20changes. 3. https://books.lib.uoguelph.ca/human-physiology/chapter/glucose-regulation-3/
Self-Study Material	https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight#:~:text=Obesity%20is%20a%20chronic%20complex,the%20risk%20of%20certain%20cancers.

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCE12	**MOLECULAR BASIS OF DISEASES AND THERAPEUTICS STRATEGIES**			**DSE THEORY - VI**	**III**	**3**	**3**	**-**	**-**	**3**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	S	S	S	S	S
CO2	S	M	S	L	M	M	M	M	M	S
CO3	S	S	M	L	S	S	M	M	S	M
CO4	S	M	M	M	M	M	S	S	M	S
CO5	S	S	S	M	M	S	S	S	S	S

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

Tutorial Schedule		
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved by Member Secretary**
Mr.S.Maharajan	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCE13	**DEVELOPMENTAL BIOLOGY**	**DSE- THEORY - XIII**	**IV**	**5**	**5**	**-**	**-**	**3**
Objective	To acquire in-depth understanding of developmental Biology, cell death mechanisms and cell fate decision							

Unit	Course Content	Knowledge Levels	Sessions
I	**Overview of Developmental biology:** Background of Developmental biology – Principles of developmental biology –Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenicsin analysis of development.	K2	12
II	**Model organisms Gametogenesis** – production of gametes, Formation of zygote, fertilization and early development: molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants;cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination. Drosophila Developmental biology- Axis formation, Genes & mutation. C.elegans– Vulva formation, Axis formation.	K3	12
III	**Regeneration Developmental Biology** - Stem cells – Definition, Classification, Embryonic and adult stem cells, properties, identification, Culture of stem cells, Differentiation and dedifferentiation, Stem cell markers, techniques and their applications in modern clinical sciences. Three- dimensional culture and transplantation of engineered cells. Tissue engineering – skin, bone and neuronal tissues.	K3	12
IV	**Morphogenesis & Organogenesis**: Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibian and chick; organogenesis – vulva formation in Caenorhabditis elegans, eye lens formation, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.	K4	12
V	**Cellular senescence and Cell fate decision**: Cellular senescence – concepts & Frizzled receptor in Development and disease. Diabetes and developmental biology, Cell death pathways in developments. Markers of important diseases. **Current trend - * Apoptosis ***	K4	12
	…… Self Study.		
Course Outcome	CO1.Understand about the background of developmental biology	K2	
	CO2.Gain abundant knowledge about model oraganisms and gametogenesis	K3	
	CO3.Gain knowledge about stem cells and their applications in regenerative therapy	K3	

	CO4.Comparative knowledge about organogenesis	K4
	CO5: Discover the basics of cell death mechanisms and cell fate decision.	K4

Learning Resources	
Text Books	Developmental biology: VIII edition, Gilbert, SF; Sinauer Associates, Inc 2014
Reference Books	Developmental Biology By Twyman Rm 2010
Website Link	https://www.uou.ac.in/sites/default/files/slm/BSCBO-202.pdf https://media.medfarm.uu.se/play/attachmentfile/video/977/handouts2.pdf https://vle.upm.edu.ph/pluginfile.php/202097/mod_resource/content/1/Module%203.%20Gametogenes is.pdf
Self-Study Material	https://ebookcentral.proquest.com/lib/inflibnet-ebooks/reader.action?docID=775002&ppg=17

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
23M4PBCE13	DEVELOPMENTAL BIOLOGY	DSE- THEORY - XIII	IV	5	5	-	-	3

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S	M	L	S	S	M
CO2	M	M	M	M	M	S	M	S	M	M
CO3	M	M	L	M	M	S	L	S	L	L
CO4	S	M	L	S	S	M	S	S	M	S
CO5	S	M	S	S	L	M	M	S	M	M

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

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCE14	**PLANT BIOCHEMISTRY**	**DSE THEORY - VII**	**IV**	**5**	**5**	**-**	**-**	**3**
Objective	To provide a basic understanding of plant physiology, photosynthesis, nitrogen fixation, and pytohormones. This paper also provides the knowledge about secondary metabolites and plant tissue culture							

Unit	Course Content	Knowledge Levels	Sessions
I	**Water absorption** – Mechanism of water absorption, symplast and apoplast concepts. Transpiration – types, mechanism and factors affecting transpiration. Photosynthesis – Photosynthetic apparatus, role of photosynthetic pigments, Biochemistry of light reactions of Photosynthesis – photo systems, factors affecting photosynthesis, cyclic and non-cyclic photo phosphorylation. Biochemistry of dark reactions of Photosynthesis – Carbon reactions in C3, C4 and CAM plants – Calvin cycle, Hatch – Slack pathway	K2	12
II	**Nutrients** – Role of macro and micronutrients in plants and hydroponics, Nitrogen fixation and its types. Biochemistry of symbiotic and nonsymbiotic nitrogen fixation. Physiology of nodule formation. Gene manipulation of nitrogen fixation genes. Nitrogen assimilation, Interrelationship between photosynthesis and nitrogen metabolism.	K3	12
III	**Phytohormones**: Biosynthesis, transport, distribution, mechanism of action and physiological effects of Phytohormones – Auxin, Gibberellins, Cytokines, Abscisic acid and Ethylene. Phytochrome, biological clock, physiology and biochemistry of seed germination. Dormancy – types and methods to overcome dormancy. Senescence.	K3	12
IV	**Secondary metabolites** – Basic biosynthetic pathways. Functions of secondary metabolites – Flavonoids, alkaloids, terpenoids, anthocyanins, Tannins, steroids and lignin. Applications of secondary metabolites – Drug development, Biopesticides and Biofertilizers.	K4	12
V	**Plant tissue culture-** Micropropagation, Callus induction, cell and protoplast culture, organogenesis and somatic embryogenesis. Applications of tissue culture for crop improvement in agriculture, horticulture and forestry. **Current trend - * Nutraceuticals and Natural product derivatives ***	K5	12
	…… Self Study.		
Course Outcome	**CO1:** Understand the basic knowledge of mechanism of water transport and Photosynthesis	K2	
	CO2: Describe the nitrogen fixation mechanisms in plants and interrelationship between photosynthesis and nitrogen metabolism	K3	
	CO3: Identify the Biosynthesis, transport, distribution, mechanism of action and physiological effects of plant hormones	K3	

	CO4: Assess the role of secondary metabolites in drug development.	K4
	CO5: Know about the isolation, fusion and culture of protoplast and also understand genetic manipulation of plants	K5

Learning Resources	
Text Books	1. A Textbook of Plant Physiology, Biochemistry and Biotechnology" by S.K. Verma and Mohit Verma - Publisher: S. Chand Publishing; Year: 2019 2. Plant Physiology by S.N. Pandey and B.K. Sinha - Publisher: Vikas Publishing House; Year: 2018 3. Fundamentals of Plant Physiology by V.K. Jain - Publisher: S. Chand Publishing; Year: 2018 4. Introduction to Plant Physiology by R.C. Mishra - Publisher: Kalyani Publishers; Year: 2017 5. Textbook of Human Nutrition by Anjana Agarwal and Shobha A Udipi - Publisher: Oxford University , 2017
Reference Books	1. Plant Physiology and Development by Lincoln Taiz, Eduardo Zeiger, Ian M. Møller, and Angus Murphy, Sinauer Associates, an imprint of Oxford University Press, 6th Edition, 2015 2. Biochemistry & Molecular Biology of Plants by Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones, Wiley-Blackwell, 2nd Edition, 2015 3. Physiology of Woody Plant by Stephen G. Pallardy, Academic Press, 3rd Edition, 2007 4. Principles of Plant Nutrition by Konrad Mengel and Ernest A. Kirkby, Springer, 5th Edition, 2001
Website Link	https://archive.nptel.ac.in/courses/102/103/102103016/ https://onlinecourses.swayam2.ac.in/ugc19_hs33/preview https://onlinecourses.swayam2.ac.in/cec20_bt01/preview
Self-Study Material	https://ebookcentral.proquest.com/lib/inflibnet-ebooks/reader.action?docID=5613477&ppg=149

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

M.Sc. - Biochemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCE14	**PLANT BIOCHEMISTRY**			**DSE THEORY - VII**	**IV**	**5**	**5**	**-**	**-**	**3**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	M	S
CO3	S	M	S	M	S	M	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	M	S	M	M	S	S	L	S

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

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Dr.M.Shabana Begum	Mr.P.Tamilmani	Dr.S.Shahitha

List of Soft Skill Course (SEC) details for M.Sc., Biochemistry

Syllabus – LOCF – CBCS Pattern

Effective from the academic Year 2023 – 2024 onwards

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	I	23M1PBCS01	Tissue culture techniques
2	I	23M1PBCS02	Scientific writing skills and Presentation

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCS01	**Tissue Culture Techniques**	Soft Skill – I	I	2	2	-	-	2
Objective	Students will gain knowledge about plant and Animal tissue culture, transgenic plants, Nitrogen fixation, significance of viral vectors and the concepts of animal biotechnology. They will acquire the skill to set up tissue culture laboratory.							

Unit	Course Content	Knowledge Levels	Sessions
I	Animal cell culture – History and development, Pluripotency, Media, balanced salt solutions, Physical, chemical and metabolic functions of constituents of culture media, Role of carbon dioxide, Serum, growth factors and amino acids in media. Serum containing and serum free media. Constitution of a media for cell line. Essential equipment's required for animal cell culture	K3	6
II	Types of cell culture- Primary, Secondary, Organ culture and cell lines. Role of feeder layers in cell culture, Cell separation techniques, cell synchronization, Cell counting methods, cryopreservation, Cell banking procedures.	K3	6
III	Transfection of cells in culture- Animal viral vectors for transfection, Physical methods of transfection, HAT selection, selectable markers. Micro manipulation of cells, Gene targeting, gene silencing and Gene knockout and their applications. Cell culture as a source of valuable products –Transgenic Animals	K4	6
IV	Media composition (MS media) – Micropropagation techniques – direct and indirect organogenesis – somoclonal variation – somatic embryogenesis – haploid and triploid – Protoplast isolation, fusion and culture – hybrid and cybrid production, Synthetic seed production. Secondary metabolite production.	K4	6
V	Agrobacterium and crown gall tumors – Mechanism of T-DNA transfer to plants, Ti and Ri Plasmid vectors and their utility – Plant viral vectors. Symbiotic nitrogen fixation in Rhizobia, nif gene. Transgenic plant.	K5	6
Course Outcome	CO1: Construct the basics of cell culture medium	K3	
	CO2: Sketch the types of cell culture	K3	
	CO3: Conclude the basics of genetic engineering	K4	
	CO4: Examine the plant tissue techniques	K4	
	CO5: Evaluate the functions of viral vectors	K5	

Learning Resources	
Text Books	1.Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation. 2.Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill. 3. Chawla, H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009..

Reference Books	1. R. Ian Freshney, Culture of Animal cells – A Manual of Basic Technique Fourth Edition, WILEY LISS & Publications. 2. Glick, B.R. and Pasternark. 2002. Molecular Biotechnology: Principle and applications of recombinant DNA. 3. 3. Ramasamy.P. 2002.Trends in Biotechnology, University of Madras of Publications, Pearl Press .
Website Link	1 https://www.onlinebiologynotes.com/animal-cell-culture/ 2.https://microbenotes.com/animal-cell-culture/

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCS01	**Tissue Culture Techniques**	Soft Skill – I	I	2	2	-	-	2

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	M	S	M	S	S	S	S
CO 2	S	S	S	L	M	M	S	S	S	S
CO 3	S	M	M	M	S	M	S	S	S	M
CO 4	S	M	M	L	S	L	S	S	S	M
CO 5	S	S	S	L	S	M	S	S	S	S

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

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved by Member Secretary**
Mrs.M.Priyanga Gandhi	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PBCS02	**Scientific Writing Skills And Presentation**	Soft Skill - II	I	2	2	-	-	2
Objective	Students will develop writing skills and schedules to overcome barriers. They'll enhance data presentation and streamline manuscript preparation for efficient publishing.							

Unit	Course Content	Knowledge Levels	Sessions
I	Introduction to scientific writing Elements of a scientific paper: Abstract, introduction, materials & methods, results, discussion, conclusion, and references. Preparing figures and figure legends, citations. Appropriate use of colour and font size.	K3	6
II	Advanced Scientific Writing The art of writing: Basic principles, Creative writing skills. The organization of content: Structure and flow of ideas. Writing thesis and dissertation, Writing clinical study reports. Processing data & application of statistics Displaying data: Text, table, graph and defining terms and abbreviations.	K3	6
III	Structures of writing Sentences, Paragraphs, Parts of a paragraph, Writing laboratory records, journal articles, textbooks, research reports, reviews, scientific papers, Types of journals, Journal impact factor. Other forms of professional writing: composing professional emails and letters for various purposes; preparing an effective resume	K4	6
IV	Oral communication: Presentation skills: Oral presentation, Poster Preparation and presentation, Preparation of power point slides and presentations. Simplicity of presentation material Animation Effects, Graphic Representation.	K5	6
V	Plagiarism Referencing software: Mendeley, Endnote. Plagiarism: Definition, Common types of plagiarism, Intentional and Unintentional plagiarism, Detection of plagiarism by anti-plagiarism tools (Turnitin, Duplichecker, Viper, and plagiarism X checker), Penalties for plagiarism, Avoiding plagiarism.	K5	6
Course Outcome	CO1: Write effective and well-organized research papers that are supported by information from several different, credible sources	K3	
	CO2: Develop advanced scientific writing skills to write research articles, reviews, thesis, and proposals and to make oral, poster or power point presentations	K3	
	CO3: Document sources correctly and incorporate information from sources while following the principles of academic honesty.	K4	
	CO4: Evaluate the credibility of research sources, especially the online resources.	K5	
	CO5: Evaluate the best practices of scientific writing by adhering to research ethics and by avoiding plagiarism	K5	
Learning Resources			

Text Books	Cambridge University Press, Cambridge, UK. ISBN 978-1-107-69193-3. 1. Thomas, C George. 2019. Research Methodology and Scientific Writing 2nd edition. 2. JR, Matthews, RW, Matthews. 2014. Successful Scientific Writing. A step-by-step guide for the Biological and Medical Sciences. Fourth Edition.
Reference Books	1. Molecular Cell Biology – Lodish, Baltimore et al., 1995, Scientific American Book,. Davis, Martha. 1997. Scientific Papers and Presentations. San Diego: Academic Press 2. RA, Day, 1998. How To Write and Publish a Scientific Paper, 5th Edition, Oryx Press. ISBN-13: 978-1573561655 ISBN-10: 1573561657. 3. A H,Hofman, 2010. Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford University Press, New York, NY. 682 pp.
Website Link	https://plagiarismdetector.net https://www.duplichecker.com

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M1PBCS02	**Scientific Writing Skills And Presentation**	Soft Skill - II	I	2	2	-+	-	2

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	M	S	S	S	M	M	S	S
CO 2	S	M	S	S	M	S	S	M	M	M
CO 3	S	M	L	S	M	M	S	S	M	S
CO 4	M	S	S	S	L	M	S	M	S	M
CO 5	S	S	M	S	S	M	M	S	S	S

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

Tutorial Schedule	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha

List of Extra Disciplinary Course (EDC) for PG Degree offered by the M.Sc., Biochemistry

Syllabus – LOCF – CBCS Pattern

Effective from the academic Year 2023 – 2024 onwards

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	I	23M2PBCED1	Clinical Nutrition
2	II	23M3PBCED2	Human Physiology and Nutrition

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCED1	CLINICAL NUTRITION	EDC - I	II	3	3	-	-	2
Objective	1. To understand basic concepts involved in growth , health, nutrition, physiology and metabolism 2. To discuss the concepts and applications of nutrition in correlation with biochemistry 3.To define nutritional needs in healthy individuals and modification of diet during illness							

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.	K3	10
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.	K3	12
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	K4	15
IV	Water structure, physical and chemical properties. Vitamins- water soluble and fat soluble vitamins; Sources, chemical composition, Biological function and property, Deficiency diseases in human.	K4	13
V	Minerals Source and deficiency disorders of Macro-minerals; Sodium, Potassium, Calcium, Magnesium, Micro-minerals: Copper, 88 phosphorus, Iron, Iodine, Zinc and Selenium in human Prevention and control of Anemia.	K5	10
Course Outcome	**CO1:.** Plan a balanced diet based on an individual's energy requirement, Assess nutritional status of an individual	**K3**	
	CO2: Identify the biochemical, physiological and nutritional functions of macronutrients and their integrated role. Understand the role played by antinutritional factors	**K3**	
	CO3: Analyze the functions of vitamins and minerals, and fluids and electrolyte balance in different physiological states and in sports persons	**K4**	
	CO4: Identify nutritional deficiency conditions, its prevention and dietary management	**K4**	
	CO5: Acquire knowledge about the importance of balanced diet and diet therapy	**K5**	

Learning Resources				
Text Books	1. Srilakshmi. E .(2016) Nutrition Science, New Age International Publishers. Mahan, Kathleen L. (2004) Krause's Food, Nutrition and Diet Therapy, W.B.Saunder's 11th Edition 2.Nutrition in the Community 2nd Ed. Maclaren, D. S. 1986. John Willey and Sons, NewYork. 3. Srilakshmi. E .(2016) Nutrition Science, New Age International Publishers. Mahan, Kathleen L. (2004) Krause's Food, Nutrition and Diet Therapy, W.B.Saunder's 11th Edition			
Reference Books	1. M. Swaminathan (1995) Principles of Nutrition and Dietetics. Bappco Margaret Mc Williams (2012). 2. M. Swaminathan (1995) Principles of Nutrition and Dietetics. Bappco Margaret Mc Williams (2012)			
Website Link	ttps://en.wikipedia.org/wiki/Novel_food https://www.chemicalsafetyfacts.org/preservatives/ https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PBCED1	CLINICAL NUTRITION	EDC – I	II	3	3	-	-	2

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	M	S	S	S	M	M
CO 2	S	M	S	S	S	S	S	S	M	M
CO 3	S	S	S	S	S	S	S	S	M	M
CO 4	S	S	S	M	S	S	S	S	M	S
CO 5	S	S	S	S	S	S	S	S	M	M

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

Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, Seminar, CIA-I, CIA-II and ESE

Designed By	Verified By	Approved by Member Secretary
Mrs.M.Priyanga Gandhi	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCED2	HUMAN PHYSIOLOGY AND NUTRITION	EDC - II	III	3	3	-	-	2
Objective	To understand the functions and activities of organs, tissues or cells and of physical and chemical phenomena involved in the human body To understand nutritional needs in healthy individuals							

Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	Digestive system: outline of digestive system. Buccal, gastric and Intestinal digestion.Role of liver in digestion. Intestinal- Absorption and assimilation-hormonal influencein digestion. Excretory system ; Structure of kidney and ultra-structure of nephron. Formation and composition of urine. Outline of excretory system - 'Micturition'.	K2	10
II	Respiratory and Circulatory system: Types of respiration. - Outline of respiratory system' respiratory pigments, Transport of O2 and CO2. Factors affecting oxygen dissociation curve and carbon dioxide dissociation curve. Chloride shift. Circulatory organs, composition of blood, systemic, pulmonary circulation, Heartbeat, cardiac cycle, origin and conduction of heart beat, Regulation of heart beat, human heart' coronary circulation, ischemic heart disease, ECG, Blood pressure and cardiac output.	K3	12
III	Nervous and Muscular system: outline of nervous system, structure of neuron, types of neuron, neurotransmitters. Condition of nerve impulse transmission, synaptic transmission. Muscle – Types of muscle- Role of Actin and Myosin.- Action Potential. Neuro muscular junction. Reflex action.	K4	15
IV	Introduction on Nutrition: Food factors for human being. Nutritional classification, foods, Energy – Energy value of food and its determination, energy expenditure – components – basal metabolism, physical activity and thermogenesis foods' Basal metabolism: Definition, determination of basal metabolic rate (BMR). Standards of BMR factors affecting BMR, energy utilization in cells and energy balance.	K4	13
V	Nutritional consequences and Dietary Allowances Nutritive value of protein' Protein calorie malnutrition in children. protein and energy/ requirements Nitrogen balance and imbalance. Deficiency Disease of Vitamins and Minerals (Iron, sodium, potassium, fluoride, magnesium and calcium.) Infant nutrition, nutrition for preschool children, school children, adolescents, pregnant and lactating mothers. Industrial workers. Geriatric nutrition and Lathyrism. Therapeutic diets.	K5	10
Course	**CO1:** . Summarize the digestion process, exchange of gases, design of blood vessels and cardiac cycle	K2	
	CO2: Build the events in transmission of nerve impulses and mechanism of muscle contraction.	K3	
	CO3: Discover the structure and functions of digestive system, structure of nephron and mechanism of urine formation and role of kidney in maintenance of pH.	K4	

Outcome	**CO4:** Justify and explain nutrients in foods and the specific functions in maintaining health	K4	
	CO5: Explain the nutritional consequences in human health	K5	

Learning Resources

Text Books	1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6th ed). John Wiley & Sons. Inc. 2. Bruce Alberts and Dennis Bray (2013),Essential Cell Biology,(4th ed),Garland Science. 3. De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Cell and Molecular Biology.(8th ed). Lippincott Williams and Wilkins, Philadelphia.
Reference Books	1. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. (5th ed). Sunderland, Mass. Sinauer Associates, Inc. 2. Wayne M. Baker (2008) the World of the Cell. (7th ed). Pearson Benjamin Cummings Publishing, San Francisco. Cell Biology 6. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan3
Website Link	ttps://en.wikipedia.org/wiki/Novel_food https://www.chemicalsafetyfacts.org/preservatives/ https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/

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

M.Sc- Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M3PBCED2	HUMAN PHYSIOLOGY AND NUTRITION	EDC – II	III	3	3	-	-	2

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**M**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**M**
CO 3	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**M**
CO 4	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**
CO 5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**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 Member Secretary
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M. Sc Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCIS1	**INTERNSHIP**	**INTERNSHIP**	**III**	**-**	**-**	**-**	**-**	**2**
Objective	To give optimum exposure on the practical aspects of Microbiology industry							

S. No.	Guidelines for Internship Training Programme	Knowledge Levels	Sessions
1	The student should undergo **15 Days Internship** training in any Clinical Diagnostic lab/ Food industry / Water plant / Health care industry / Pharma industry / Research Labs / Biotech industry during the vacation which starts at the end of the 2nd Semester.	K6	
2	The training bridges the gap between the theoretical knowledge gained in the college and the practical application of the same in the industry / company. The student will have a better exposure about the workplace and its nuances.		
3	Schedule of visit to be made by the staff is to be prepared by the HOD / Staff-in-charge.		
4	The trainees should strictly adhere to the rules and regulations and office timings of the institutions to which they are attached.		
5	A Staff member of a Department (Guide) will be monitoring the performance of the Candidate.		
6	The students should maintain a daily logbook where the student should record his details of the training.		
7	The trainees have to obtain a certificate on successful completion of the internship from the chief executive of an organization.		
8	The student should submit an attendance certificate to the institution for 15 days internship training from an organization.		
9	Internship Training Report (30 – 50 pages) should be prepared by the student and submitted in a month's time and at the end of the semester student should present the report with a power point presentation.		
10	Industrial training reports shall be prepared by the students under the supervision of the faculty of the department.		
11	Industrial training report must contain the following: Cover page Copy of training certificate, Profile of an industry report about the work undertaken by them during the tenure of training observation about the concern findings.		

12	Practical viva – voce examination will be conducted with internal & external examiners at the end of the **3rd semester** and the credits will be awarded.		
13	Report Evaluation: External Viva-Voce examination will be conducted and the maximum mark is 100.		
Course Outcome	**CO1:** Apply new techniques and ideas in microbiology industry	K3	
	CO2: Analyze the results of new initiatives	K4	
	CO3: Create a new work plan with greater output	K6	
	CO4: Create a framework of work execution ideas	K6	
	CO5: Create a detailed technical work plan and terminologies to be	K6	
	followed in industry.		

Learning Resources	
Text Books	1. The Successful Internship by H. Frederick Sweitzer, Mary A. King, 2013. 2. Social Media Tools in Experiential Internship Learning by Samuel Kai Wah Chu, 2020.
Reference Books	1. The Intern Files: How to Get, Keep and Make the Most of Your Internship by Jamie Fedorko, 2006.
Website Link	1. http://gen.lib.rus.ec/

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

M. Sc - Biochemistry LOCF-CBCS with effect from 2022-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PBCIS1	**INTERNSHIP**		**INTERNSHIP**		**III**	**-**	**-**	**-**	**-**	**2**

CO-PO Mapping

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

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

Tutorial Schedule	-
Teaching and Learning Methods	-
Assessment Methods	**CIA – 100 Marks** 1. Work Log Book – 25 Marks 2. Training Report and Viva-Voce – 75 Marks

Designed By	Verified By	Approved by Member Secretary
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc., Biochemistry LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCPR1	**PROJECT**	**PROJECT WORK**	**IV**	**13**	**-**	**-**	**13**	**4**
Objective	To inculcate/impart skills on experiment designing, experiment execution and research report to provide skills on writing thesis dissertation							

Details	**Course Content**	**Knowledge Levels**	**Sessions**
	PROJECT PREPARATION FORMAT		
Cover Page & Title Page	**Cover Page & Title Page:** The fonts and locations of various items on this page should be exactly as shown in a specimen copy**.**		
Inside cover page	Inside cover page Same as cover page.		
Bonafide Certificate	**Bonafide Certificate**: The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14.		
Acknowledgement	**Acknowledgement:** This should not exceed one page.		
Abstract	**Abstract:** Abstract should be one page synopsis of the project report typed double line spacing, Font Style Times New Roman and Font Size 14.		
Contents	**Table of Contents:** The table of contents should list all headings, sub headings after the table of contents page, as well as any titles preceding it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents. One and a half spacing should be adopted for typing the matter under this head.		
Tables	**List of Tables**: The list should use exactly the same captions as they appear above the tables in the text. 1.5 spacing should be adopted for typing the matter under this head.		
Figures	**List of Figures**: The list should use exactly the same captions as they appear below the figures in the body of the text. One and a half spacing should be adopted for typing the matter under this head. All charts, graphs, maps, photographs and diagrams should be designated as figures. X and Y axes titles are mandatory for all the graphs.		
Symbols	**List of Symbols, Abbreviations and Nomenclature:** 1.5 spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.		
Chapters	**Chapter I - Introduction:** Statement of the Problem, Significance, Need for the study, Objectives		
	Chapter II- Review of literature		
	Chapter III- Methodology: Tools used, Procedures, Hypothesis.		
	Chapter IV- Results and Discussion: Tables and Figures, Statistical Presentations, Hypothesis Testing.		
	Chapter V- Summary and conclusion		
	Chapter VI- Scope of the Project		

	References		
Guidelines For Project Preparation			
Numbering	• Every page in the project report, except the project report title page, must be accounted for and numbered. • The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv.. • The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5.. • All printed page numbers should be located at the right corner at the bottom of the page.	K4-K6	
Chapters	• Use only Arabic numerals. Chapter numbering should be centered on the top of the page using large bold print. <Size 14><Times New Roman>	K4-K6	
TEXT			
Regular Text	**Regular Text**: Times Roman 12 pts and normal print.	K4-K6	
Chapter Heading	**Chapter Heading -** Times Roman 14 pts. Bold and capital.	K4-K6	
Section Headings	**Section Headings -** Times roman 12 pts. Bold and capital.	K4-K6	
Subsection Headings	**Subsection Headings** - times roman 12 pts. bold print and Leading capitals i.e, only first letter in each word should be in capital.	K4-K6	
Special Text	**Special Text-** Italics/Superscript /Subscript/Special symbols, etc., as per necessity. Special text may include footnotes, endnotes, physical or chemical symbols, mathematical notations, etc.	K4-K6	
Sections	**Sections:** Use only Arabic numerals with decimals. Section numbering should be left justified using bold print. Example: 1.1, 1.2, 1.3, etc.	K4-K6	
Sub Sections	**Sub Sections:** Use only Arabic numerals with two decimals. Subsection numbering should be left Justified using bold print. Example: 1.1.1, 1.1.2, 1.1.3, etc.	K4-K6	
References	Use only Arabic numerals. Serial numbering should be carried out based on Alphabetical order of surname or last name of first author. The format is written like, author name followed by year followed by title of the work followed by details of the journal. Same font as regular text, serial number and all authors names to be in bold print. Title and Journal names should be in italic. One Author: Williams, G. State and Society in. Onco State, Nigeria, Afrographika, 1980. Two Authors: Phizacklea, A & Miles, R. Labour and Racism. London, Routledge & Kegan Paul, 1980. 3+ Authors: O'Donovan, P., et al. The United States. Amsterdam, Time-Life International, 1966.	K4-K6	

Typing Instructions	**Typing Instructions:** The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style 'Times New Roman' and Font size 12. Use A4 (210 mm X 297 mm) bond un-ruled paper (80 gsm) for all copies submitted. Use one side of the paper for all printed/typed matter.	K4-K6	
Justification	**Justification:** The text should be fully justified	K4-K6	
Margins	**Margins:** The margins for the regular text are as follows LEFT - 1.5" RIGHT - 1" TOP - 1" BOTTOM - 1"	K4-K6	
Paragraph Spacing	Use 6 pts before & 6 pts after paragraphs. All paragraphs in the seminar/project report should be left justified completely, from the first line to the last line. Use 1.5 spacing between the regular text and quotations. Provide double spaces between: (a) From top of page to chapter title, (b) Chapter title and first sentence of a chapter, Use single spacing (a) In footnotes and endnotes for text. (b) In explanatory notes for tables and figures. (c) In text corresponding to bullets, listings, and quotations in the main body of seminar/project report. (d) Use single space in references and double space between references.	K4-K6	
Tables	All tables should have sharp lines, drawn in black ink, to separate rows/columns as and when necessary. Tables should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including tables on a page, should be avoided. Provide double spaces on the top and the bottom of all tables to separate them from the regular text, wherever applicable. The title of the table etc. should be placed on the top of the table. The title should be centered with respect to the table. The titles must be in the same font as the regular text and should be single spaced.	K4-K6	
Figures	All figures, drawings, and graphs should be drawn in black ink with sharp lines and adequate contrast between different plots if more than one plot is present in the same graph. The title of the figure etc. should be placed on the bottom of the figure. Figures should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including figures on a page, should be avoided. Provide double spaces on the top and the bottom of all figures to separate them from the regular text, wherever applicable. Figures should be centered with respect to the figure. The titles must be in the same font as the regular text and should be single spaced. The title format is given below: Fig. <blank><chapter number>.<serial number><left indent><figure	K4-K6	
Page Dimension & Binding Specifications	The project report should be prepared in A4 size. The dissertation shall be properly bound; The bound front cover should indicate in Silver and embossed letter.		

Course Outcome	**Co:1** Identification of research idea	K4	
	Co:2 Analyze of problem solving skills	K4	
	Co:3 Analyze sources for conduct of Research	K4	
	Co:4 Evaluate the research report	K5	
	Co:5 Create the research report	K6	

Learning Resources	
Text Books	1. Research Methodology: Methods and Techniques, by C.R. Kothari, New Age Publications, 2009.
Reference Books	1. Research Methodology: Methods and Techniques by C.R. Kothari, New Age Publications, 1985. 2. Essentials of Research Design and Methodology by: Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005.
Website Link	1. http://gen.lib.rus.ec/

M.Sc-Biochemistry Syllabus LOCF-CBCS with effect from 2023-2024 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
23M4PBCPR1	PROJECT AND VIVA	PROJECT WORK	IV	13	-	-	13	4

CO-PO Mapping

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

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

Tutorial Schedule	-
Teaching and Learning Methods	-
Assessment Methods	**EA - 100%** 1. Project Report & - 150 Marks 2. Internal - 50 Marks 3. Total - 200 Marks

Designed By	Verified By	Approved by Member Secretary
Mrs.T.Renuka	Mr.P.Tamilmani	Dr.S.Shahitha

M.Sc., Biochemistry for Competitive Examination Syllabus-LOCF-CBCS-Pattern with effect from2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4PBCOE1	**Biochemistry for Competitive Examination**	**Online Competitive Examination**	**IV**	**-**	**-**	**-**	**-**	**2**
Objective	Creating the awareness on competitive examination among students. Imparting knowledge about appearing for Competitive Examination and it impacts and developing an attitude for appearing such Examinations.							

	Course Content	**Knowledge Levels**	**Sessions**
	Assemblage of different papers related to Biochemistry in particular, Clinical Biochemistry, Immunology, Genetic Engineering, Gene Editing Technology, Nutritional Biochemistry, Biomolecules, Cell biology, Biochemical techniques, Microbial techniques, Medical coding, Enzymology, Molecular Biology, Human Physiology, Plant Biochemistry and Plant Therapeutics etc., Major emphasis has been put forth to include recent developments in the subjects. This course aims to give a holistic view of all the topics which comprised of some factual text points, multiple choice questions (MCQ), it is extremely suitable for students pursuing their higher degree in University/institute for their entrance exams, students preparing for various national and state level competitive entrance exams for higher studies. Getting job in various fields such as Food and Dairy Industries, Pharma Companies, R and D centers, Water treatment plants, Clinical Laboratory, IT sector (Medical Coding, Medical Transcription and Medical Billing) and Blood Bank etc., In addition, it is also useful for UPSC and PSC. **Rules for creating MCQ pattern.** 1. Objective type online examination will be conducted at the end of 4th semester. 2. Questions must be taken from all previous question papers of UPSC, PSC and University Common Entrance test for higher studies. 3. **Test for critical thinking**. Multiple choice questions to test the superficial knowledge. Learners to interpret facts, evaluate situations, explain the causes and effect, make inferences, and predict the results. **4. Emphasize for Higher-Level Thinking** Use memory-plus, application oriented questions. These questions require students to recall the principles, rules and facts in a real life context. **Eg.1**Ability to Justify Methods and Procedures	K1- K6	

	Which of the following biochemistry processes involves the synthesis of new molecules from simpler building blocks? a) Glycolysis b) Photosynthesis c) DNA replication d) Anabolism **Eg.2** <u>Ability to Interpret Cause-and-Effect Relationships</u> Which hormone is primarily responsible for regulating blood sugar levels in the human body? A) Insulin B) Estrogen C) Testosterone D) Melatonin **5. Mix up the order of the correct answers** Keep correct answers in random positions and don't let them fall into a pattern that can be detected **6. Use a Question Format** Multiple-choice items to be prepared as questions (rather than incomplete statements) Incomplete Statement Format: The capital of California is in Direct Question Format------- Less Effective. In which of the following city is the capital of California? This is Best format. **7. Keep Option Lengths Similar** Avoid making your correct answer the long or short answer **8. Avoid the "All the Above" and "None of the Above" Options** Students merely need to recognize two correct options to get the answer correct **9.** HOD's instruct to the faculty to prepare minimum 500 questions booklet (cumulatively for each programme) with solutions and circulate among the students.		
Course Outcome	**CO1:** Students will remember the advanced biochemical and molecular techniques.	K1	
	CO2: Students will be able to understand the basic rules and the concepts.	K2	
	CO3: To be able to apply in real life situations.	K3	

	CO4: To analyze and create the new ideas for various competitive examinations.	K4-K5	
	CO5: To assess forms and levels of critical thinking.	K2	
Text Books	1. MCQ's in Biochemistry by G.Vidya Sagar, New Age International Publisher Pvt. Ltd, 2018		
	2. Owen,J., Punt,J and Strand ford, S."Kuby Immunology", 7th Ed., W.H.Freeman Publication, NewYork, USA, 2012.		
	3. Watson JD, Hopkins NH, Roberts JW et al. (1987) Molecular Biology of the Gene, 4th edn. Menlo Park, CA: Benjamin-Cummings		
	4. Brown, T.A. 1995.Gene Cloning–An Introduction. [Third Edition]. Chapman and Hall, UK.		
Reference Books	400 Biochemistry MCQ's (Mcqs) For Neet and Net Examinations.		
Website Link	https://www.ugc.ac.in/old pdf /model curriculum/env.pdf https://swayam.gov.in/nc_details/NPTEL		

M.Sc., Biochemistry for Competitive Examination Syllabus-LOCF-CBCS-Pattern with effect from2023-2024 Onwards

Course Code	Course Title	Course Type	Sem.	Hours	L	T	P	C
23M4PBCOE1	Biochemistry for Competitive Examination	Online Competitive Examination	IV	-	-	-	-	2

CO - PO Mapping

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

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

Tutorial Schedule	CET/TRB/TNPSC/Bank/ Railway, Old question papers –solutions – online mock test
Teaching and Learning Methods	Self study, Group discussion, Chalk and Talk, Audio-Video Learning, learning through mock test and experienced learning
Assessment Methods	100 multiple choice questions through computer based online examinations passing minimum is 50%

Prepared By	Verified By	Approved by Member Secretary
Mr.P.Tamilmani	Mr.P.Tamilmani	Dr.S.Shahitha