M.Sc., BIOCHEMISTRY

Syllabus

Programme Code: 2PSBIC

2026-2028

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE (AUTONOMOUS)
(Affiliated to Bharathidasan University, Tiruchirappalli)
(Accredited by NAAC)
Sundarakkottai, Mannargudi – 614016,
Thiruvarur (Dt.), Tamil Nadu, India.

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
(Affiliated to Bharathidasan University, Tiruchirappalli)
(Accredited by NAAC)
SUNDARAKKOTTAI, MANNARGUDI – 614016
TAMIL NADU, INDIA

M.Sc., BIOCHEMISTRY
CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS–LOCF)

(For the candidates admitted in the academic year 2026–2027)

CHOICE BASED CREDIT SYSTEM

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Our College has moved to CBCS and implemented the grading system.

OUTCOME-BASED EDUCATION (OBE)

LEARNING OUTCOME- BASED CURRICULUM FRAMEWORK (LOCF)

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected of graduates of a programme of study. Learning outcomes specify what graduates completing a particular programme of study are expected to know, understand and be able to do at the end of their programme of study. The expected learning outcomes are used as reference points that would help to formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. They provide general guidance for articulating the essential learnings associated with programmes of study and courses with in a programme, maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate

student/graduate mobility and provide higher education institutions an important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programmes and academic standards.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a Degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC): A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Centric Elective Courses (DCEC): Elective course may be offered by the main discipline/subject of study is referred to as Discipline Centric Elective Course (DCEC). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

Generic Elective Courses: An elective course chosen generally from an **unrelated discipline/subject,** with an intention to seek exposure is called a Generic Elective. Generic Elective courses are designed for the students of other disciplines. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to optGeneric Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

Non Major Elective Course (NMEC): A student shall choose atleast two Non-major Elective Courses (NME) from outside his/her department.

Skill Enhancement Courses (SECs): These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge**.**

Field Study/ Industrial Visit /Case Study: It has to be completed during the fifth semester of the degree programme. Credit for this course will be entered in the fifth semester's marks statement.

Internship: Students must complete internship during summer holidays after the fourth semester. They have to submit are port of internship training with the necessary documents and have to appear for a viva-voce examination during fifth semester. Credit for internship will be entered in the fifth semester's mark statement.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL etc

EXAMINATION

Continuous Internal Assessment (CIA):

PG - Distribution of CIA

Marks Passing Minimum:		**50 %**
Assignments-3	=	30%
Tests-2	=	50%
Seminar	=	10 %
Attendance	=	10%

Question Paper Pattern

Section A: includes two sub sections

Section A1 (10x1=10 marks)

One word question/ Fill in/ True or False/ Multiple Choice Questions

Two Questions from Each unit

Section A2 (5x2=10 marks)

Match the following/ Short Answers

One question from each unit

Total Marks-20

Section B: (5x4=20 marks)

Paragraph Answers either/or type,

One Question from each unit

Section C: (10x3=30 marks)

Essay Type AnswersAnswer3 out of 5 Questions

One Question from each unit

Section A: K1 Level

Section B: K2, K3 and K4 Level

Section C: K5 and K6 Level

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1.	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2.	K2	Comprehension/ Understanding	The learner explains ideas or concepts
3.	K3	Application/Applying	The learner uses information in a new way
4.	K4	Analysis/Analyzing	The learner distinguishes among different parts
5.	K5	Evaluation/Evaluating	The learner justifies and or decision
6.	K6	Synthesis/Creating	The learner creates a new product or point of view

WEIGHTAGE of K–LEVELS IN QUESTION PAPER

(Cognitive Level) K-LEVELS →	Lower Order Thinking			Higher Order Thinking			Total
	K1	K2	K3	K4	K5	K6	
END SEMESTER EXAMINATIONS (ESE)	20	20			30		70
Continuous Internal Assessment (CIA)	20	20			30		70

QUESTION PATTERN FOR END SEMESTER EXAMINATION / Continuous Internal Assessment		
SECTION		**MARKS**
SECTION –A1 (No choice, One Mark) **TWO** questions from each unit **SECTION –A2** (No choice, Two Mark) **ONE** question from each unit	(10x1=10) (5x2=10)	**20**
SECTION –B (Either/or type, 4-Marks) **ONE** question from each unit	(5x4=20)	**20**
SECTION –C (3 out of 5)(10 Marks) **ONE** question from each unit	(3x10=30)	**30**
Total		**70**

BLUE PRINT OF QUESTION PAPER FOR END SEMESTER EXAMINATION							
DURATION: 3.00 Hours.							**Max Mark:75**
K-LEVELS **SECTION**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total Marks**
SECTION –A (One Mark, No choice) (10x1=10)	10						**10**
(2-Marks, No choice) (5x2=10)	10						**10**
SECTION –B (5-Marks) (Either/or type) (5x4=20)		04	08	08			**20**
SECTION –C (10 Marks) (3 out of 5)(3x10=30) Courses having only **K5, K6** levels, K5 level- 3 Questions, K6 level - 2 Questions **(One K6 level question is compulsory)**					20	10	**30**
Total	**20**	**04**	**08**	**08**	20	10	**70**

EVALUATION
GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then be graded as per the scheme provided in Table-1.

Grade Point Average (GPA) will be calculated from the first semester onwards for all semester. From the second semester onwards, the total performance with in a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), respectively. These two are calculated by the following formulae:

$$GPA=\frac{\sum_{i=1}^{n} C_i G_i}{\sum_{I=1}^{n} C_i} \qquad WAM(\text{Weighted Average Marks})=\frac{\sum_{i=1}^{n} C_i M_i}{\sum_{I=1}^{n} C_i}$$

Where,

C_i is the Credit earned for the Course i
G_i is the Grade Point obtained by the student for the Course i
M_i is the marks obtained for the course i and
n is the number of Courses **Passed** in that semester.

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

1. The classification of final results shall be based on the CGPA, as indicated inTable-2.
2. For the purpose of Classification of Final Results, the candidates who earn the CGPA 9.00 and above shall be declared to have qualified for the Degree as 'Outstanding'. Similarly the candidates who earn the CGPA between 8.00 and 8.99, 7.00 and 7.99, 6.00 and 6.99 and 5.00 and 5.99 shall be declared to have qualified for their Degree in the respective programmes as 'Excellent', 'Very Good', 'Good', and 'Above Average' respectively.
3. Absence from an examinations hall not be taken an attempt.

Table-1: Grading of the Courses

Marks Range	Grade Point	Corresponding Grade
90 and above	**10**	**O**
80 and above and below 90	**9**	A**+**
70 and above and below 80	**8**	**A**
60 and above and below 70	**7**	**B+**
50 and above and below 60	**6**	**B**
Below 50	**NA**	**RA**

NA-Not Applicable, RA- Reappearance

The candidates performance in every current semester is indicated by **Semester Grade Point Average (SGPA)** and from the second semester onwards, the continuous performance including previous semester/s is indicated by **Cumulative Grade Point Average (CGPA)**

Table-2: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average

*****The candidates who have passed in the first appearance and within the prescribed duration of the PG Programme are eligible. If the candidate's Grade is O/A+ with more than one attempt, the performance is fixed as "Very Good"

VISION

Imparting quality education in Biochemistry to make the students to document the biological resources with scientific validation so as to enhance the quality of life.

MISSION

- To provide a learning environment to the students to understand, analyze and augment the basic analytical skills in Biochemistry.
- To expose the students and make them well versed in the various biochemical processes and update their knowledge and skills in advanced biochemical techniques.

PROGRAM OUTCOME

PO. No	Programme Outcomes (*Upon completion of the M.Sc., Degree Programme, the Post graduate will be able to)*
PO-1	**Disciplinary Knowledge**: demonstrate in-depth knowledge and understanding of theories, policies, and practices in one or more disciplines that form a part of a Post Graduate program of study in Master of Science.
PO-2	**Critical Thinking and Problem Solving**: apply analytic thought to a body of knowledge, analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence, identify relevant assumptions or implications, formulate coherent arguments, critically evaluate practices, policies and theories by following scientific approach to knowledge development: solve problems and extrapolate the same to real life situation.
PO-3	**Information/digital literacy and Communication Skills:** use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data: communicate thoughts and ideas analytically and effectively in writing and orally using appropriate media, and present complex information in a clear and concise manner to different groups.
PO-4	**Research-related skills:** Conduct independent inquiry in a chosen scientific discipline, demonstrate sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesizing and articulating; recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; plan, execute and report the results of an experiment or investigation.
PO-5	**Scientific reasoning and Reflective Thinking:** analyze, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; critically and sensibly evaluate life experiences, with self-awareness and reflexivity of both self and society.
PO-6	**Multidisciplinary Approach, Innovation and Entrepreneurship:** propose novel ideas of interdisciplinary approach in providing better solutions and new ideas for the sustainable developments; identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.
PO-7	**Moral and ethical awareness/reasoning:** embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work, demonstrate the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, appreciate environmental and sustainability issues, and adopt objective, unbiased and truthful actions in all aspects of work.
PO-8	**Self directed Learning:** work independently, identify appropriate resources required for a project, and manage a project till completion.
PO-9	**Lifelong Learning:** engage in continuous learning for professional growth and development, acquire knowledge and skills, adapt to changing environment and to changing trades and demands of work place through knowledge / skill Development/ reskilling.
PO-10	**Multicultural Competence, Social Interaction and Effective Citizenship:** understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups and elicit views of others, mediate disagreements and help reach conclusions in group settings, and demonstrate empathetic social concern and equity centered national development

PROGRAM SPECIFIC OUTCOME

PSO. No	**Programme Specific Outcomes** (***Upon completion of the M.Sc., Degree Programme, the Post graduate will be able to)***
PSO1	Understand the principles and methods of various techniques in Biochemistry, Immunology, Microbiology, Enzyme kinetics and Molecular Cell Biology. Based on their understanding, the students may would be able to design and execute experiments during their final semester project, and further research programs.
PSO2	Insight on the structure-function relationship of biomolecules, their synthesis and breakdown, the regulation of these pathways, and their importance in terms of clinical correlation. Students will also acquire knowledge of the principles of nutritional biochemistry and understand diseases and their prevention
PSO3	To understand the concepts of cellular signal transduction pathways and the association of aberrant signal processes with various diseases. Acquire insight into the immune system and its responses, and use this knowledge in the processes of immunization, vaccine development, transplantation and organ rejection.
PSO4	To visualize and appreciate the central dogma of molecular biology, regulation of gene expression, molecular techniques used in rDNA technology, gene knocks -out and knock-in techniques.
PSO5	To create awareness in students about the importance of good laboratory practices and the importance of ethical and social responsibilities of a researcher. Teach them how to review literature and the art of designing and executing experiments independently and work as a part of a team.

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M.Sc., BIOCHEMISTRY
CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)
(Applicable to the candidates admitted from the academic year 2026-2027)

ELIGIBILITY: A Candidates who have passed Bachelor level examination in Botany / Zoology/ Biochemistry /Biotechnology / Microbiology / Genetics / Medicine / Agriculture / Life Sciences / Chemistry / Pharmacy from any recognized University in India or abroad

Sem.	Course	Course Code	Course Title	Ins. Hrs.	Credit	Exam Hrs.	Marks		Total
							Int.	Ext.	
I	Core Course - I (CC - I)	P26BC101	Chemistry of Biomolecules	6	4	3	30	70	100
	Core Course - II (CC - II)	P26BC102	Analytical and Molecular Techniques	6	4	3	30	70	100
	Core Practical - I (CP - I)	P26BC103P	Analytical and Molecular Techniques (P)	6	4	3	40	60	100
	Discipline Centric Elective Course - I (DCEC-I)	P26BCDE11A	Nutritional Biochemistry	5	4	3	30	70	100
		P26BCDE11B	Cell Biology						
		P26BCDE11C	Energy and Drug Metabolism						
	Generic Elective Course - I (GEC - I)	P26BCGE11A	Ecology and Environmental Biology	5	3	3	30	70	100
		P26BCGE11B	Food Microbiology						
		P26BCGE11C	Principles of Human Genetics						
	Skill Enhancement Course - I (SEC - I)	P26SEBC11	Forensic Applications of Biochemistry	2	2	3	30	70	100
	Value Added Course – I (VAC-I)*	P26BCVA11	Advanced Artificial Intelligence Applications in Biochemistry	-	2*	-	30	70	100*
	Total			**30**	**21**	**-**	**-**	**-**	**600**
	Core Course - III (CC - III)	P26BC204	Advanced Enzymology	6	4	3	30	70	100
	Core Course - IV (CC - IV)	P26BC205	Intermediary Metabolism and Regulation	6	4	3	30	70	100

II	Core Practical - II (CP - II)	P26BC206P	Advanced Enzymology (P)	6	4	3	40	60	100
	Discipline Centric Elective Course - II (DCEC - II)	P26BCDE22A	Human Physiology	4	4	3	30	70	100
		P26BCDE22B	Biotechnology and Genetic Engineering						
		P26BCDE22C	Cancer Biology						
	Generic Elective Course – II (GEC - II)	P26BCGE22A	Developmental Biology	4	3	3	30	70	100
		P26BCGE22B	Bioinformatics						
		P26BCGE22C	Bioethics and IPR						
	Skill Enhancement Course - II (SEC - II)	P26SEBC22	Medical Coding and Healthcare Documentation	2	2	3	30	70	100
	Non-Major Elective Course - I (NMEC- I)			2	2	3	30	70	100
	Total			**30**	**23**	**-**	**-**	**-**	**700**
Summer Internship / Industrial Activity during the Summer Vacation after 1st Year									
III	Core Course - V (CC - V)		Molecular Biology	6	4	3	30	70	100
	Core Course - VI (CC - VI)		Clinical Biochemistry	6	4	3	30	70	100
	Core Practical - III (CP - III)		Clinical Biochemistry (P)	6	4	3	40	60	100
	Discipline Centric Elective Course - III (DCEC - III)		Pharmaceutical Biochemistry	5	4	2	30	70	100
			Biochemistry of Signal Transduction						
			Medical Laboratory Technology						
	Generic Elective Course – III (GEC - III)		Research Methodology	5	3	3	30	70	100
			Nanotechnology						
			Genomics and Proteomics						
	Non-Major Elective Course - II (NMEC - II)			2	2	3	30	70	100
	Internship / Industrial Activity @		Internship with Viva-Voce	-	2	-	20	80	100
	Value Added Course – II (VAC - II)*		Advances in Data Science Using Python and R Programming	-	2*	-	30	70	100*
	Total			**30**	**23**	**-**	**-**	**-**	**600**
IV	Core Course - VII (CC - VII)		Immunology	6	4	3	30	70	100
	Core Course - VIII (CC - VIII)		Microbial and Plant Biochemistry	6	4	3	30	70	100
	Core Practical – IV (CP - IV)		Microbial and Plant Biochemistry (P)	6	4	3	40	60	100
	Discipline Centric		Endocrinology	4	4	2	30	70	100

	Elective Course - IV (DCEC - IV)		Environmental Chemistry and Toxicological Biochemistry						
			Quality Control in Biochemical Laboratory						
	Entrepreneurship / Industry Based Course		Innovation & Start up Development in Biochemistry	3	3	3	30	70	100
	Project Work @		-	5	5	-	20	80	100
	Extra Credit Course Other than VAC**		MOOC - NPTEL / SWAYAM**	-	2**	-	-	-	-
	Total			**30**	**24**	**-**	**-**	**-**	**700**
Grand Total					**91**				**2600**

LIST OF DISCIPLINE CENTRIC ELECTIVE COURSE

Discipline Centric Elective Course - I (DCEC - I)	
1.	Nutritional Biochemistry
2.	Cell Biology
3.	Energy and Drug Metabolism
Discipline Centric Elective Course - II (DCEC - II)	
1.	Human Physiology
2.	Biotechnology and Genetic Engineering
3.	Cancer Biology
Discipline Centric Elective Course - III (DCEC - III)	
1.	Pharmaceutical Biochemistry
2.	Biochemistry of Signal Transduction
3.	Medical Laboratory Technology
Discipline Centric Elective Course - IV (DCEC - IV)	
1.	Endocrinology
2.	Environmental Chemistry and Toxicological Biochemistry
3.	Quality Control in Biochemical Laboratory

LIST OF GENERIC ELECTIVE COURSE (GEC)

GENERIC ELECTIVE COURSE - I (GEC - I)	
1.	Ecology and Environmental Biology
2.	Food Microbiology
3.	Principles of Human Genetics
GENERIC ELECTIVE COURSE - II (GEC - II)	
1.	Developmental Biology
2.	Bioinformatics
3.	Bioethics and IPR
GENERIC ELECTIVE COURSE - III (GEC - III)	
1.	Research Methodology
2.	Nanotechnology
3.	Genomics and Proteomics

NON-MAJOR ELECTIVE COURSE (NMEC)		
Semester	**Couse Code**	**Title of the Course**
II	P26NMEBC21	Biochemistry of Life Style Disorders
III	-	Biochemical Analysis of Food Adulteration

SUMMARY OF CURRICULUM STRUCTURE OF PG PROGRAMMES: SCIENCE

S. No.	**Types of the Course**	**No. of Courses**	**Credits for each Course**	**Total Credits**	**Marks**
1.	Core Course (CC)	8	4	32	800
2.	Core Practical (CP)	4	4	16	400
3.	Discipline Centric Elective Course (DCEC)	4	4	16	400
4.	Generic Elective Course (GEC)	3	3	9	300
5.	Skill Enhancement Course (SEC)	2	2	4	200
6.	Non-Major Elective Courses (NMEC)	2	2	4	200
7.	Internship / Industrial Activity @	1	2	2	100
8.	Entrepreneurship / Industry Based Course	1	3	3	100
9.	Project Work @	1	5	5	100
Total		**26**	**-**	**91**	**2600**
Value Added Courses *		2*	2	4*	200

*	**The value added courses credit will not be included in the total CGPA. These courses are extra-credit courses. Instruction hours for these courses is 30 hours**
@	Summer Internship will be carried out during the summer vacation after the First year. Viva Voce will be conducted by the college and Marks shall be sent to the University and the same will be included in the 3rd semester Mark Statement.

Summer Internship / Industrial Activity & Project
Scheme of Evaluation

Description	**Marks**
Report	80
Viva	20
Total	100

SEMESTER - I

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- CC -I: Chemistry of Biomolecules

Ins. Hrs./Week: 6 **Course Credit**: 4 **Course Code**: **P26BC101**

COURSE OBJECTIVES

- To provide comprehensive knowledge on the structure, classification, properties and biological functions of carbohydrates, proteins, lipids and nucleic acids.
- To develop understanding of the structural organization and biochemical significance of biomolecules and their role in cellular functions and metabolism.
- To explain the chemistry, biological importance and functional properties of vitamins, minerals, porphyrins and related biomolecules in living systems.
- To impart knowledge on the molecular architecture, synthesis and stabilization of proteins and nucleic acids and their physiological relevance.
- To enable students to correlate the structure of biomolecules with their biochemical functions, clinical significance and applications in biological systems.

UNIT- I: Homo and Heteroglycans (20 Hours)

Polysaccharides - occurrence, structure, properties and functions of homoglycans- starch, glycogen, cellulose, dextrin, inulin, and chitin. Occurrence, structure, properties and functions of heteroglycans - hyaluronic acid, keratan sulphate and chondroitin sulphate. Bacterial cell wall polysaccharides, Blood group substances, Sialic acid, Glycoproteins, Lectins - biological functions.

UNIT – II: Proteins (20 Hours)

Classification, structure and properties of amino acids, Essential and non- essential amino acids. Non protein amino acids. Proteins - Classification based on solubility, shape, composition and function. Properties of proteins. Denaturation and renaturation of proteins. Structure of peptide bonds. Chemical synthesis of polypeptides. Protein structure - Primary, secondary, tertiary and quaternary structures of protein. Forces stabilizing the secondary, tertiary and quaternary structures of proteins. Ramachandran Plot Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (haemoglobin, myoglobin).

UNIT – III: Lipids (16 Hours)

Definition and classification of lipids. Fatty acids - classification, nomenclature, structure and properties. Triacylglycerols. Classification, structure and function of prostaglandins. Chemical properties and functions of phospholipids and their structures - lecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens. Glycolipids (cerebrosides and gangliosides), Isoprenoids and sterols (cholesterol), bile acids and bile salts. Types and functions of plasma lipoproteins.

UNIT – IV: Nucleic Acids (16 Hours)

Structure of purines and pyrimidines. Components of nucleic acids - nucleosides, nucleotides, and polynucleotides. Isolation of nucleic acids. Properties of DNA: buoyant density, viscosity,

hypochromicity, denaturation and renaturation– the cot curve. Chemical synthesis of oligonucleotides. DNA: structure of different types (A, B and Z DNA), biological role. Structure and role of different types of RNA.

UNIT – V: Vitamins and Porphyrins (18 Hours)

Structure and biochemical properties of water soluble and fat soluble vitamins and their coenzyme activity. Macro minerals (Ca, P, Mg, Na, K, Cl) and micro minerals/trace elements (Co, I, Fe, Mn, Zn, and F) - their sources, daily requirements, functions and deficiency diseases symptoms. Porphyrins the porphyrin ring system, chlorophyll, haemoglobin, myoglobin and cytochrome.

UNIT –VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Recent developments in the design of biomolecule based nanostructures in clinical research.

Total Lecture Hours-90

COURSE OUTCOMES

The students are able to,

1. Understand the source, chemical structure, properties, function and uses of various polysaccharides.
2. Explain amino acid structures, their physical and chemical properties, and primary, secondary, tertiary and quaternary structure of proteins.
3. Knowledge of lipid structure and function, explain how it plays a role in signaling pathways.
4. Understand the structure of nucleic acids and its chemical synthesis.
5. Understand the biological importance of vitamins and minerals in the biological system.
6. Analyze the applications of biomolecular nanostructures in drug delivery, diagnostics, vaccine development, and cancer therapy.

TEXT BOOK(S)

1. Metzler, D. E. (2023). *The chemical reactions of living cells* (2nd ed.). Academic Press.
2. Nelson, D. L., & Cox, M. M. (2012). *Lehninger principles of biochemistry* (6th ed.). W.H. Freeman.
3. Satyanarayan, U. (2022). *Biochemistry* (4th ed.). Arunabha Sen Books & Allied (P) Ltd.
4. Stryer, L. (2021). *Biochemistry* (7th ed.). W.H. Freeman.
5. Voet, D., & Voet, J. G. (2020). *Biochemistry* (4th ed.). John Wiley & Sons, Inc.
6. Zubay, G. L. (2007). *Biochemistry* (4th ed.). McGraw-Hill.

REFERENCE BOOK(S)

1. Berg, J. M., Tymoczko, J. L., & Stryer, L. (2019). *Biochemistry* (9th ed.). W.H. Freeman.
2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2023). *Principles of biochemistry* (8th ed.). W.H. Freeman.
3. Liljas, A. (2019). *Textbook of structural biology* (2nd ed.). World Scientific Publishers.
4. Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry* (7th ed). W.H. Freeman.
5. Satyanarayana, U., & Chakrapani, U. (2020). *Biochemistry* (5th updated ed.). Elsevier.

E-RESOURCES

1. https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3A_Biochemistry_Online_(Jakubowski)

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3. https://ocw.mit.edu/courses/biology/7-88j-protein-folding-and-human-disease-spring-2015/study-materials/
4. https://www.open.edu/openlearn/science-maths-technology/science/biology/nucleic-acids-and-chromatin/content-section-3.4.2
5. https://www.genome.gov/genetics-glossary/Cell-Membrane
6. https://nptel.ac.in/content/storage2/courses/102103012/pdf/mod3.pdf.
7. www.chem.libretexts.org/Bookshelves/Biological_Chemistr
8. www.bio.libretexts.org/Bookshelves/Biochemistry
9. www.open.oregonstate.education/aandp

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	1	2	3	2	2	2	3	2		2	2	3	3	3
CO 2	3	2	1	3	2	2	2	3	2		2	2	3	3	
CO 3	3	2	2	3	3	2	1	3	2		2	2	3	1	
CO 4	3	2	2	3	2	2	2	3	2		2	2	3	3	
CO 5	3	3	2	3	2	2	2	3	2		2	2	3	3	
CO 6	3	3	2	3	3	2	1	3	2		2	2	3	1	

S-Strong (3) M-Medium (2) L-Low (1)

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- CC –II: Analytical and Molecular Techniques

Ins. Hrs./Week: 6 **Course Credit**: 4 **Course Code**: **P26BC102**

COURSE OBJECTIVES

- To provide fundamental knowledge on units of measurement, buffer systems, pH, electrochemical principles, and physicochemical properties of biological solutions.
- To develop understanding of cell fractionation, centrifugation, membrane separation methods, and radioisotope techniques used in biochemical investigations.
- To familiarize students with the principles, instrumentation, and applications of chromatographic techniques for separation and purification of biomolecules.
- To impart knowledge on electrophoretic and blotting techniques employed in the analysis of proteins and nucleic acids.
- To introduce students to modern spectroscopic, imaging, and structural characterization techniques used in biochemical, clinical, and molecular research.

UNIT – I: Units of Measurement of Solutes in Solution (18 Hours)
Normality, Molarity, molality and milliosmol. Ionic strength.pH, pOH, Henderson – Hesselbalch equation, buffers, pH of body fluids. Measurement of pH by indicators, Zwitterions.pH dependent ionization of amino acids and proteins. Viscosity, surface tension and Donnan membrane equilibrium. Principles of electrochemical techniques – measurement of pH by glass electrode and hydrogen electrode. Oxygen electrode – principles, operation of a Clarke electrode and its applications.

UNIT–II: Cell Fractionation Techniques and Radio Isotope Techniques (18 Hours)
Cell lysis, differential and density gradient centrifugation, Salting in, Salting out, Dialysis, Ultrafiltration. Ultra Centrifugation - preparative and analytical ultracentrifuge, Svedberg's constant, Sedimentation velocity and Sedimentation equilibrium, Schlieren optics. Radioisotope technique: Radioactive decay constant, half life of an isotope, Detection and measurement of radioactivity, Geiger Muller counters, scintillation counting, auto radiography and RIA, Application of isotopes in biological studies.

UNIT – III: Chromatographic Techniques (18 Hours)
Principles, Instrumentation and Applications of Paper, Column, TLC, Adsorption, Ion exchanges, Gel filtration, Affinity, GLC, Chromato focusing, HPLC, FPLC.

UNIT – IV: Electrophoretic Techniques (18 Hours)
Polyacrylamide gel electrophoresis, SDS-PAGE, 2D – PAGE, Isoelectric focusing, Visualizing protein bands – CBB & Silver staining. Agarose gel Electrophoresis, pulse field electrophoresis, high voltage electrophoresis, Capillary Electrophoresis, RFLP, FISH. Blotting techniques and its applications – Western, Northern & Southern.

UNIT – V: Spectroscopic Techniques (18 Hours)

Spectroscopic technique: Colorimetry, spectrophotometry – UV & visible, Principle – Beer Lambert's law, Extinction coefficient. Principle Instrumentation and application - AAS, Fluorimetry. Basic principle and application of mass spectra, NMR, ESR, MS, MALDI-TOF, MRI, CT scans. Biochips (DNA chips, Protein chips and Sensor chips).Vibration Spectra – IR – Principles and Applications. X-ray crystallography – protein crystals, Bragg's law.

UNIT – VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Application of analytical techniques in diagnostics. Ex: qRT-PCR and its application with specific context to identification of Covid-19 infection.

Total Lecture Hours -90

COURSE OUTCOMES

The students are able to,

1. Attain 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.
2. Demonstrate knowledge to implement the theoretical basis of chromatography in upcoming practical course work.
3. Demonstrate knowledge to implement the theoretical basis of electrophoretic techniques in research work.
4. Tackle more advanced and specialized spectroscopic techniques that are pertinent to research.
5. Tackle more advanced and specialized radioisotope and centrifugation techniques that are pertinent to research work.
6. Explain the principles and diagnostic applications of modern analytical techniques such as qRT-PCR, with special reference to the detection and identification of COVID-19 infection.

TEXT BOOK(S)

1. Boyer, R. F. (2022). *Biochemistry laboratory: Modern theory and techniques* (2nd ed.). Prentice Hall.
2. Freifelder, D. M. (2018). *Physical biochemistry: Applications to biochemistry and molecular biology*. W.H. Freeman.
3. Rajan, K. (2011). *Analytical techniques in biochemistry and molecular biology*. Springer.
4. Robyt, J. F. (2015). *Biochemical techniques: Theory and practice* (1st ed.). CBS Publishers & Distributors.
5. Segel, I. H. (2021). *Biochemical calculations* (2nd ed.). John Wiley & Sons.
6. Sheehan, D. (2022). *Physical biochemistry: Principles and applications* (2nd ed.). Wiley-Blackwell.
7. Wilson, K., & Walker, J. (2023). *Principles and techniques of biochemistry and molecular biology* (7th ed.). Cambridge University Press.

REFERENCE BOOK(S)

1. Upadhyay, A., Upadhyay, K., & Nath, N. (2014). *Biophysical chemistry: Principles and techniques* (4th ed.). Himalaya Publishing House.
2. Ghosal, S., & Srivastava, A. (2009). *Fundamentals of bioanalytical techniques and instrumentation* (2nd ed.). PHI Learning Pvt. Ltd.

3. Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.). New Age International Publishers.
4. Katoch, R. (2018). *Analytical techniques in biochemistry and molecular biology* (1st ed.). Springer.
5. Boyer, R. (2012). *Biochemistry laboratory: Modern theory and techniques* (2nd ed.). Prentice Hall.
6. Seader, J. D., Henley, E. J., & Roper, D. K. (2011). *Separation process principles: Chemical and biochemical operations* (3rd ed.). John Wiley & Sons.
7. Wilson, K., & Walker, J. (2018). *Principles and techniques of biochemistry and molecular biology* (8th ed.). Cambridge University Press.

E-RESOURCES

1. https://www.kau.edu.sa/Files/0017514/Subjects/principals%20and%20techiniques%20of%20biochemistry%20and%20molecular%20biology%207th%20ed%
2. https://ocw.mit.edu/courses/biology/7-88j-protein-folding-and-human-disease-spring-2015/study-materials/
3. https://www.open.edu/openlearn/science-maths-
4. technology/science/biology/nucleic-acids-and-chromatin/content-section-3.4.2
5. https://www.genome.gov/genetics-glossary/Cell-Membrane
6. https://nptel.ac.in/content/storage2/courses/102103012/pdf/mod3.pdf.
7. www.thermofisher.com
8. www.bio-rad.com
9. www.cytivalifesciences.com
10. www.iaea.org
11. www.beckman.com

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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CO 2	3	2	1	3	2	2	2	3	2	2	2	3	3		3
CO 3	3	2	2	3	3	2	1	3	2	2	2	3	1		3
CO 4	3	2	2	3	2	2	2	3	2	2	2	3	3		3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	2	2	3	3	2	1	3	2	2	2	3	1		3

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- CP- I: Analytical and Molecular Techniques (P)

Ins. Hrs./Week: 6 **Course Credit: 4** **Course Code: P26BC103P**

COURSE OBJECTIVES

- To develop practical skills in the analysis of physicochemical properties of lipids through determination of saponification value, iodine number, and acid number of edible oils.
- To train students in the isolation and purification of nucleic acids such as DNA and RNA from biological sources.
- To provide hands-on experience in studying enzyme activity and the effect of activators on enzymatic reactions.
- To familiarize students with biochemical separation and purification techniques including dialysis, thin layer chromatography (TLC), paper chromatography (PC), and SDS-PAGE.
- To enable students to interpret experimental results and apply laboratory techniques for the qualitative and quantitative analysis of biomolecules.

EXPERIMENTS

1. Isolation of DNA from plant/animal source.
2. Isolation of RNA from Yeast/Ecoli
3. Desalting of proteins by dialysis
4. Separation of polar and non-polar lipids by TLC
5. Rf value calculation of various amino acids and sugar using TLC
6. Rf value calculation of various amino acids and sugar using PC
7. Separation of proteins by SDS PAGE

Total Hours-90

COURSE OUTCOMES

The students are able to,

1. Enable the wider knowledge about principles and techniques to be employed for the biomolecules under investigation.
2. Inculcate the knowledge of various isolation and purification techniques of macromolecules like DNA, RNA, Glycogen and Starch,
3. Perform colorimetric estimations to quantify important metabolites like lactate and tryptophan and minerals like calcium and iron from various sources.
4. Achieve training in subcellular fractionation and to identify them by markers.
5. Acquire knowledge of various chromatographic techniques.
6. Analyse knowledge of various Electrophoresis techniques.

TEXT BOOK(S)

1. Jayaraman, J. (2021). *Laboratory manual in biochemistry*. New Age Publishers.
2. Metzler, D. E. (2013). *The chemical reactions of living cells* (2nd ed.). Academic Press.
3. Seader, J. D., Henley, E. J., & Roper, D. K. (2011). *Separation process principles: Chemical and biochemical operations* (3rd ed.). John Wiley & Sons.
4. Voet, D., & Voet, J. G. (2010). *Biochemistry* (4th ed.). John Wiley & Sons, Inc.
5. Wilson, K., & Walker, J. (2018). *Principles and techniques of biochemistry and molecular biology* (8th ed.). Cambridge University Press.

REFERENCE BOOK(S)

1. Plummer, D. (2001). *An introduction to practical biochemistry* (3rd ed.). McGraw Hill Education (India) Pvt. Ltd.
2. Varley, H. (2016). *Practical clinical biochemistry* (6th ed.). CBS Publishers.
3. Debiyi, O., & Sofowora, F. A. (1978). Phytochemical screening of medical plants. *Iloyidia*, *3*, 234–246.
4. Chavhan, A. S., & Shinde, S. A. (2019). *A guide to chromatography techniques* (1st ed.).
5. Katoch, R. (2011). *Analytical techniques in biochemistry and molecular biology*. Springer.

E-RESOURCES

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/
4. https://www.life.illinois.edu/biochem/455/Lab%20exercises/2Photometry/spectro photometry.pdf
5. https://ijpsr.com/bft-article/determination-of-total-flavonoid-and-phenol-content-in-mimusops-elengi-linn/?view=fulltext
6. https://skyfox.co/wp-content/uploads/2020/12/Practical-Manual-of- Biochemistry.pdf
7. www.thermofisher.com/in/en/home/life-science/learning-center.html
8. www.bio-rad.com
9. www.addgene.org/mol-bio-reference
10. www.ncbi.nlm.nih.gov

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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CO 3	3	1	2	3	2	3	1	3	1	2	2	3	1		3
CO 4	2	2	2	3	2	2	2	3	2	2	2	1	3		3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1	2	3	2	3	1	3	1	2	2	3	1		3

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I-DCEC-I: Nutritional Biochemistry
Ins. Hrs./Week: 5 **Course Credit: 4** **Course Code: P26BCDE11A**

COURSE OBJECTIVES

- To understand the basic concepts of food, nutrition, energy metabolism, and methods used for assessment of nutritional status.
- To gain knowledge about the nutritional importance of biomolecules and disorders related to malnutrition and obesity.
- To develop the ability to plan balanced diets for different age groups based on nutritional requirements and recommended food groups.
- To study the types, functions, applications, and safety aspects of food additives used in food processing and preservation.
- To understand the role of nutraceuticals, functional foods, probiotics, prebiotics, and natural plant pigments in promoting human health and disease prevention.

UNIT-I: Concepts of food and nutrition **(15 Hours)**

Basic food groups-energy yielding, body building and functional foods. Modules of energy. Calorific and nutritive value of foods. Measurement of calories by bomb calorimeter. Basal Metabolic Rate (BMR) - definition, determination and factors affecting BMR. Respiratory Quotient (RQ) of nutrients and factors affecting the RQ. SDA-definition and determination-Anthropometric measurement and indices – Height, weight, chest and waist circumference BMI.

UNIT-II: Significance of Biomolecules **(15 Hours)**

Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, Protein Energy Ratio and Net Protein Utilization. Protein Energy Malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures.

UNIT-III: Balanced diet with field project **(15 Hours)**

Example of low and high cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance, food pyramid. Junk foods- definition and its adverse effects.

UNIT- IV: Food additives **(15 Hours)**

Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing

agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives.

UNIT-V: Nutraceuticals and Functional Foods (15 Hours)

Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits.

UNIT–VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Concept and importance of food safety and hygiene. Importance of personal hygiene and sanitation in food handling industries.

Total Lecture Hours-75

COURSE OUTCOMES

The students are able to,

1. Cognizance of basic food groups viz. carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value
2. Identify and explain nutrients in foods and the specific functions in maintaining health.
3. Classify the food groups and its significance
4. Understand the effect of food additives
5. Describe the importance of nutraceuticals and pigments
6. Explain the concept and importance of food safety, hygiene, personal sanitation, and hygienic practices followed in food handling industries.

TEXT BOOK(S)

1. Linda Kelly De Bruyne and Kathryn Pinna. (2023). Nutrition for Health and Health Care (Mind Tap Course List), 7th Edition, Cengage Learning publisher, USA.
2. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. (2016). Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.
3. Swaminadhan M. (2015). Principles of Nutrition and Dietics. Bappco.
4. Tom Brody. (2018). Nutritional Biochemistry (2^{nd} ed), Academic press, USA.
5. Garrow JS, James WPT and Ralph A. (2000). Human Nutrition and Dietetics (10^{th} ed), Churchill Livingstone.
6. Andreas M. Papas. (2013). Antioxidant Status, Diet, Nutrition, and Health (1^{st} ed), CRC.

REFERENCE BOOK(S)

1. Phyllis A. Balch CNC. (2023). Prescription for Nutritional Healing: A Practical A-to-Z Reference to Drug-Free Remedies Using Vitamins, Minerals, Herbs, & Food Supplements, Sixth Edition, Avery publisher, USA.
2. Branen AL, Davidson PM and Salminen S. (2001). Food Additives (2^{nd} ed.), Marcel Dekker.
3. Gerorge AB. (1996). Encyclopedia of Food and Color Additives, Vol. III. CRC Press.
4. Fatih Yildiz. (2010). Advances in food Biochemistry, CRC Press, Boca Raton, USA.
5. Hui YH. (2006). Food Biochemistry and Food Processing, Blackwell Publishing, Oxford,

UK.
6. Geoffrey Campbell Platt. (2009). Food Science and Technology, Wiley-Blackwell, UK.

E-RESOURCES

1. http://old.noise.ac.in/SecHmscicour/
2. https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat- protein.html
3. https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and minerals
4. https://ncert.nic.in/textbook/pdf/kehe103.pdf
5. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBC1101.pdf
6. www.who.int/health-topics/nutrition
7. www.fao.org/nutrition/en/
8. www.nin.res.in

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 2	3	2	1	3	2	2	2	3	2	2	2	3	3		2
CO 3	3	1	2	3	2	3	1	3	1	2	2	3	1		3
CO 4	2	2	2	3	2	2	2	3	2	2	2	1	3		3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1	2	3	2	3	1	3	1	2	2	3	1		3

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- DCEC-I: Cell Biology

Ins. Hrs./Week:5 **Course Credit**: 4 **Course Code**: **P26BCDE11B**

COURSE OBJECTIVES:

- To understand the fundamental concepts of cell biology, including cell theory, types of cells, and structural organization of prokaryotic and eukaryotic cells.
- To gain knowledge about the structure and functions of cell membranes, membrane transport mechanisms, and specialized cellular junctions.
- To study the organization and functions of various cell organelles, cytoskeletal components, and cell communication systems.
- To understand the events and regulation of the cell cycle, mitosis, meiosis, apoptosis, and their relevance to cancer biology.
- To learn the basic concepts, classification, properties, and biological significance of stem cells and their role in tissue renewal and regenerative medicine.

UNIT – I: The Cell **(15 Hours)**

Cell theory, Protoplasm and Organismal theory, Broad classification of cell types – Bacteria, Prokaryotes and Eukaryotes. Cell Membranes: Basic properties of Cell Membranes – The lipid Bilayer: Composition and Structural Organization, Membrane proteins: Structure and basic functions, Membrane transport of small molecules and the electrical properties of Membranes, Endocytosis and Exocytosis. Specialized structures - Cell Junctions – Occluding, Anchoring and Gap, Ion channels. The plant Cell wall.

UNIT – II: Cell Organelles **(15 Hours)**

Organelles bounded by Double membrane Envelopes (Nucleus and Mitochondria), Organelles bound by single membrane (Peroxisome, ER, GA, Lysosomes). Ribosomes, Dictyosomes, Microbodies. Plastids- Chloroplast, Chromoplast and Leucoplast. Vacuoles and Centrosomes.

UNIT – III: Internal Organization of the Cell **(15 Hours)**

The Cytoskeleton: Components of Cytoskeleton, Structure and basic functions of Microtubules, Microfilaments, Intermediate filaments. Cell Communication: Cell- Cell Junctions, Tight Junction, Gap Junction, Cell – Matrix Anchoring junctions: Desmosomes, Adhering Junctions. Cell-Cell Adhesion proteins: Cadherins, Catenins, Integrins, Selectins. Plasmodesmata in Plants. The extracellular Matrix of Animals, Collagens, Elastins, Fibronectin, Laminin.

UNIT – IV: Cell Cycle **(15 Hours)**

Overview of Cell cycle: Mitosis and Meiosis, Stages of Mitosis and Meiosis, Crossing over and Linkage. Model organisms and methods to study the cell cycle. Regulation of CDK activity and role of checkpoints. Apoptosis and Cancer.

UNIT – V: Stem Cells **(15 Hours)**

Overview/Concepts: Introduction to Concepts in Stem Cell Biology-Potency, Plasticity, Self

Renewal and Expansion, Properties, Stem Cells. Classification and Sources. Embryonic Stem cells, Stem cell Morphology Differentiation, Origin and Types of Stem cells. Stem cells and Tissue Renewal.

UNIT – VI:Current Contours (For Continuous Internal Assessment Only- Self Study)

Microscopy: Light microscopy, fluorescent microscopy, confocal microscopy, Phase contrast microscopy, electron microscopy. SEM, TEM. Freeze fracture technique, FACS, Tunel assay, comet assay, clonogenic assay and cell toxicity assays.

Total Lecture Hours-75

COURSE OUTCOMES

The students are able to,

1. Explain the structure and functions of basic components of prokaryotic and eukaryotic cells, especially the organelles.
2. Familiarize the cytoskeleton and chromatin.
3. Illustrate the structure, composition and functions of cell membrane related to membrane transport.
4. Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells.
5. Relate the structure and biological role of extra cellular matrix in cellular interactions.
6. Explain the principles and applications of advanced microscopy techniques, cell analysis methods, and cytotoxicity assays used in modern biological and biomedical research.

TEXT BOOK(S)

1. Alberts, B. (2024). *Essential cell biology* (2nd ed.). W. W. Norton & Company.
2. Arumugam, N. (2019). *Cell biology* (10th ed.). Saras Publication.
3. Devasena, T. (2012). *Cell biology*. Oxford University Press India.
4. Alberts, B., & Bray, D. (2013). *Essential cell biology* (4th ed.). Garland Science.
5. Earnshaw, W. C. (2023). *Cell biology* (4th ed.). Elsevier. ISBN-13: 9780323758000.

REFERENCE BOOK(S)

1. Alberts, B. (2023). *Essential cell biology* (6th ed.). W. W. Norton & Company.
2. Cooper, G. M. (2020). *The cell: A molecular approach*. Sinauer Associates.
3. Lippincott Williams. (2006). *Cell and molecular biology*. Lippincott Williams & Wilkins.
4. Lodish, H., et al. (2007). *Molecular cell biology* (6th ed.). W.H. Freeman.
5. Powar, C. B. (2023). *Cell biology* (3rd ed.). Himalaya Publishing House. ISBN-13: 9789350246696.

E- RESOURCES

1. https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf
2. https://www.medicalnewstoday.com/article/320878.php
3. https://biologydictionary.net /cell
4. https://www.foodinsight.org/?utm_source=chatgpt.com
5. https://www.nin.res.in/?utm_source=chatgpt.com
6. www.fao.org
7. www.who.int
8. www.fssai.gov.in
9. www.nin.res.in

10. www.foodinsight.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 3	3			3		2		2		3	3	3	3	3	3
CO 4	3	2	2	3		2		2	2	3	3	3	3	3	3
CO 5	3			3		2		2		3	3	3	3	3	3
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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- DCEC-I: Energy and Drug Metabolism

Ins. Hrs./Week:5 **Course Credit**:4 **Course Code**: **P26BCDE11C**

COURSE OBJECTIVES

- To provide fundamental knowledge of thermodynamic principles, redox systems, biological oxidation, and energy-rich compounds involved in biological processes.
- To develop understanding of bioenergetics, electron transport chain, oxidative phosphorylation, ATP synthesis, and energy metabolism of carbohydrates and lipids.
- To familiarize students with the biochemical mechanisms of photosynthesis, photophosphorylation, carbon fixation pathways, and starch metabolism in plants.
- To impart knowledge on the metabolism of xenobiotics, Phase I and Phase II detoxification reactions, and the role of cytochrome P450 enzymes in drug metabolism.
- To enable students to understand the physiological significance, regulation, and factors affecting xenobiotic metabolism and cellular energy production.

UNIT-I: Thermodynamics (15 Hours)

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.

UNIT-II: Bioenergetics (15 Hours)

Electron transport chain-various complexes of ETC. Inhibitors of ETC. Oxidative phosphorylation -P/O ratio, chemiosmotic theory. Mechanism of ATP synthesis – role of F0-F1 ATPase, ATP-ADP cycle. Regulation of oxidative phosphorylation. Energy sources of brain, muscle, liver, kidney and adipose tissue. Amphibolic nature of Citric acid cycle. 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.

UNIT-III: Photosynthesis (15 Hours)

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.

UNIT-IV: Drug Metabolism – I (15 Hours)

Activation of sulphate ions–PAPS, APS, SAM and their biological role. Metabolism of

xenobiotics – Phase I reactions – hydroxylation, oxidation and reduction. Role of Cytochrome P_{450} in drug metabolism, Physiological importance of xenobiotic metabolism.

UNIT-V: Drug Metabolism – II **(15 Hours)**

Phase II reactions – glucuronidation, sulphation, glutathione conjugation, acetylation and methylation. Mode of action and factors affecting the activities of xenobiotic enzymes. Physiological importance of xenobiotic metabolism.

Unit VI – Current Contours (For Continuous Internal Assessment Only – Self Study)

Recent advances in bioenergetics, mitochondrial dysfunction in metabolic diseases, reactive oxygen species and oxidative stress, modern approaches in photosynthesis research, and emerging trends in xenobiotic metabolism and detoxification.

Total Lecture Hours-75

COURSE OUTCOMES

The students are able to,

1. 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
2. Gain knowledge on role of mitochondria in the production of energy currency of the cell.
3. Acquaint with the process of photosynthesis
4. Comprehend on the diverse role of TCA cycle and the energy obtained on complete oxidation of glucose and fatty acid.
5. Correlate the avenues available to metabolize the xenobiotics.
6. Discuss recent advances in bioenergetics, oxidative stress, drug biotransformation, nanotechnology-based drug delivery, personalized medicine, and emerging trends in xenobiotic metabolism and detoxification.

TEXT BOOK(S)

1. Ferrier, D. R. (2023). *Biochemistry* (6th ed.). Lippincott Williams & Wilkins.
2. Frayn, K. N., & Evans, R. D. (2019). *Human metabolism: A regulatory perspective* (4th ed.). John Wiley.
3. Garrett, R. H., & Grisham, C. M. (2010). *Biochemistry* (4th ed.). Mary Finch Publishers.
4. Goodwin, T. W., & Mercer, E. I. (1983). *Introduction to plant biochemistry* (2nd ed.). Pergamon Press.
5. Harborne, J. B. (1997). *Plant biochemistry* (5th ed.). Harcourt Asia (P) Ltd., India, & Academic Press.
6. Pandya, A. (2015). *A textbook of metabolism: Lipids, proteins and carbohydrates* [Kindle ed.]. Amazon Asia-Pacific Holdings Pvt. Ltd.
7. Voet, D., & Voet, J. G. (2010). *Biochemistry* (4th ed.). John Wiley & Sons, Inc.

REFERENCE BOOK(S)

1. Devlin, T. M. (2000). *Plant physiology* (4th ed.). PWS Publishers.
2. Metzler, D. E. (2023). *The chemical reactions of living cells* (2nd ed.). Academic Press.
3. Murray, R. K., Granner, D. K., Mayes, P. A., & Rodwell, V. W. (2012). *Harper's illustrated biochemistry* (29th ed.). McGraw-Hill Medical.

4. Nelson, D. L., & Cox, M. M. (2018). *Lehninger principles of biochemistry* (6th ed.). W.H. Freeman.
5. Taiz, L., & Zeiger, E. (2015). *Plant physiology* (5th ed.). Sinauer Associates, Inc.
6. Zubay, G. L. (2019). *Biochemistry* (4th ed.). McGraw-Hill.

E-RESOURCES

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%20phosphorylation
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
5. https://bajan.files.wordpress.com/2010/05/amphibolic-nature-of-krebs-cycle.pdf
6. www.ncbi.nlm.nih.gov/books/
7. www.kegg.jp
8. www.expasy.org
9. www.iubmb.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 2	2	2			3	2	2	3	2	2	2	3	3		3
CO 3	3	1			2	2		2	1	1	2	3	1		3
CO 4	2	2	2	1	3	2	2	3	2	2	3	1	3	2	3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		2
CO 6	3	2	2	3		2		2	2	3	3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- GEC – I: Ecology and Environmental Biology

Ins. Hrs./Week: 5 **Course Credit: 3** **Course Code**: **P26BCGE11A**

COURSE OBJECTIVES

- To provide fundamental knowledge on the principles, branches, and ecological factors influencing organisms and ecosystems.
- To develop understanding of population ecology, ecological succession, food chains, food webs, and energy flow in ecosystems.
- To familiarize students with the structure, functions, productivity, and types of terrestrial and aquatic ecosystems.
- To impart knowledge on biodiversity, taxonomy, conservation strategies, endangered species, and biogeographical distribution of flora and fauna.
- To create awareness about environmental science, environmental pollution, biogeochemical cycles, and the interactions between humans and the environment.

UNIT – I: Ecology **(15 Hours)**

Definition, principle, branches and scope of ecology. Ecological factor: Abiotic – Physical and chemical factors: Soil, air, water, temperature, pH, humidity, radiation, wind, pressure, precipitation. Biotic – Limiting factors – Species interaction: Commensalism, amensalism, mutualism, competition, parasitism, prey-predator relationship. Basic components of an ecosystem – structure and functional aspects of an ECOSystem, Trophic structure – Ecological Niche.

UNIT – II: Population **(15 Hours)**

Population: definition, characteristics, population density, natality, mortality, age distribution, growth patterns, population fluctuation, population equilibrium, biotic potentials, population dispersion and regulation of population. Ecological succession types, process, climax and significance of succession. Food chain – types of food chain with examples, food web, energy flow, ecological pyramid of biomass.

UNIT – III: Ecosystem **(15 Hours)**

Definition, concept, structure and function of an ecosystem: producers, consumers and decomposers. Primary and secondary productivity. Ecosystem types: Terrestrial – forest, mountain, deserts and grassland. Aquatic – Freshwater (lentic and lotic) and marine (Estuary, mangroves, corals, deep sea).

UNIT – IV: Biodiversity **(15 Hours)**

Definition, concept and types of biodiversity. Introduction to taxonomy. Biogeographical classification in India. Values of biodiversity. Status of biodiversity – Global, national and local status. Hot-spots of biodiversity. Endangered and threatened species. Strategies for biodiversity conservation – In- situ and Ex-situ conservation, Cryopreservation, Gene banks,

Gene pool and species conservation. National parks and sanctuaries. Common flora and fauna in India. Bioprospecting.

UNIT – V: Environmental Science **(15 Hours)**

Definition, principle and scope of Environmental science. Earth, man and Environment interactions. Geographical classification and zones. Significance of Atmosphere, lithosphere and Hydrosphere. Biosphere – global distribution of plant biomes, spatial distribution of animals – zoogeographic realms. Environmental pollution: definition types (Air, water and soil). Biogeochemical Cycles.

UNIT –VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Seminar talks on recent research topics in Ecology, Biodiversity and Environmental issues.

Total Lecture Hours-75

COURSE OUTCOMES

The students are able to,

1. Understand core concepts of physical environment and species interactions.
2. Knowledge of the environment and the role of human beings in shaping the environment.
3. Ability to correlate ecological dynamics and regulation of vital processes on earth as biogeochemical cycles.
4. Analytical ability to link cause and effect of pollution.
5. Understand the Indian constitutional provisions with respect to the environmental protection, division of powers, and fundamental rights.
6. Discuss recent research developments and emerging issues in ecology, biodiversity, and environmental science through seminar presentations and self-study.

TEXTBOOK(S)

1. Kormondy, E. J. (1996). *Concepts of ecology* (4th ed.).
2. Mackenzie, A., & Ball, A. S. (2024). *Instant notes in ecology* (2nd ed.).
3. Yadav, P. K., & Mishra, S. R. (2008). *Environmental biology*. Discovery Publishing House.
4. Dash, M. C. (1993). *Fundamentals of ecology* (2nd ed.). Tata McGraw-Hill Publishing Company.
5. Kumar, H. D. (2008). *Modern concepts of ecology* (8th ed.). Vikas Publishing House Pvt. Ltd.

REFERENCE BOOK(S)

1. Bakker, K. (2022). *The sounds of life: How digital technology is bringing us closer to the worlds of animals and plants*. Princeton University Press.
2. Martin, L. J. (2022). *Wild by design: The rise of ecological restoration*. Harvard University Press.
3. Rajagopalan, R. (2023). *Environmental studies: From crisis to cure* (4th ed.). Oxford University Press.
4. More, K. A. (Ed.). (2023). *Ecological studies in environmental science: New insights and perspectives*. Delve Publishing.

5. Dave, D., & Katewa, S. S. (2024). *Textbook of environmental studies* (3rd ed.). Cengage India.

E-RESOURCES

1. http://www.pdfdrive.com›ecology-and-environment-books
2. http:// www.freebookcentre.net › Biology › Ecology-Books
3. https://www.researchgate.net/publication/337146254_Kinetic_studies_with_alkalineph
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846332/
5. https://www.ijsr.net/archive/v3i8/MDIwMTU0MDk=.pdf
6. www.unep.org
7. www.cbd.int
8. www.iucn.org
9. www.worldwildlife.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 3	3	2			2	3		2	1	1	2	3	3		3
CO 4	3	2	2	1	2	3	2	3	2	2	2	3	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3		3
CO 6	3	2			2	3		2	1	1	2	3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI – 614 016
(For the Candidates admitted in the academic year 2026–2027)
DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- GEC - I: Food Microbiology

Ins. Hrs./Week:5 **Course Credit**:3 **Course Code**: **P26BCGE11B**

COURSE OBJECTIVES

- To provide fundamental knowledge on food composition, physicochemical properties of foods, and the role of microorganisms in food contamination and spoilage.
- To develop understanding of factors influencing microbial growth in foods and the principles of food fermentation and fermented food production.
- To familiarize students with the manufacture, spoilage, preservation, and microbial quality aspects of various food products and beverages.
- To impart knowledge on food-borne diseases, food poisoning microorganisms, toxins, and their impact on public health.
- To create awareness about food preservation methods, food sanitation, quality assurance systems, food safety standards, and government regulatory agencies related to food microbiology.

UNIT – I: Food and Microbial Contamination **(15 Hours)**

Concepts of food and nutrients - Physicochemical properties of foods - Food and microorganisms – Importance and types of microorganisms in food (Bacteria, Mould and Yeasts) - Sources of contamination- Factors influencing microbial growth in food – pH, moisture, Oxidation-reduction potential, nutrient contents and inhibitory substances.

UNIT – II: Food Fermentations **(15 Hours)**

Food Fermentations – Manufacture of fermented foods - Fermented dairy products (yoghurt and Cheese) - plant products- Bread, Sauerkraut and Pickles - Fermented beverages- Beer. Brief account on the sources and applications of microbial enzymes – Terminologies - Prebiotics Probiotics and synbiotics. Advantages of probiotics.

UNIT – III: Fermented Food Products **(15 Hours)**

Contamination, spoilage and preservation of cereals and cereal products - sugar and sugar products -Vegetables and fruits- meat and meat products- Spoilage of canned food.

UNIT – IV: Food Borne Diseases **(15 Hours)**

Food borne diseases and food poisoning – Staphylococcus, Clostridium, Vibrio parahaemolyticus and Campylobacter jejuni. Escherichia coli and Salmonella infections, Hepatitis, Amoebiosis. Algal toxins and Mycotoxins.

UNIT - V: Food Preservation **(15 Hours)**

Food preservations: principles- methods of preservations-Physical and chemical methods- food sanitations- Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies. FDA, EPA, HACCP, ISI. Food safety- control of hazards.

UNIT – VI: Current Contours (for continuous internal assessment only-Self Study)

Students may have a field visit to a food industry. Assignment, seminar and group discussion may be encouraged on Grain based fermented food - Koozhu, Pazhaiya soru, idli, dosa, Adai dosa, kallappam, dhokla etc.

Total Lecture Hours-75

COURSE OUTCOMES

The student are able to

1. Understand the basic concepts of food, nutrients, food microbiology, and factors influencing microbial growth and contamination in foods.
2. Describe the principles and processes of food fermentation and explain the production of fermented food products including dairy, cereal, vegetable, and beverage products.
3. Analyze spoilage mechanisms in various food products and explain methods used for preservation of cereals, fruits, vegetables, meat, and canned foods.
4. Identify major food-borne pathogens, toxins, and food poisoning agents and understand their impact on human health.
5. Evaluate food preservation techniques, quality assurance systems, food safety standards, and regulatory agencies involved in food control.
6. Develop awareness through experiential learning such as field visits, seminars, and case studies on traditional and fermented food systems.

TEXT BOOK(S)

1. Adams, M. R., & Moss, M. O. (2016). *Food microbiology* (4th ed.). Royal Society of Chemistry.
2. Jay, J. M., Loessner, M. J., & Golden, D. A. (2020). *Modern food microbiology* (8th ed.). Springer.
3. Frazier, W. C., & Westhoff, D. C. (2018). *Food microbiology* (5th ed.). McGraw Hill Education.
4. Ray, B., & Bhunia, A. (2013). *Fundamental food microbiology* (5th ed.). CRC Press.
5. Doyle, M. P., & Buchanan, R. L. (2013). *Food microbiology: Fundamentals and frontiers* (4th ed.). ASM Press.

REFERENCE BOOK(S)

1. Jay, J. M. (2000). *Modern food microbiology* (6th ed.). Aspen Publishers.
2. Tortora, G. J., Funke, B. R., & Case, C. L. (2019). *Microbiology: An introduction* (13th ed.). Pearson.
3. Montville, T. J., & Matthews, K. R. (2008). *Food microbiology: An introduction*. ASM Press.
4. Doyle, M. E., & Beuchat, L. R. (2007). *Food microbiology: Fundamentals and frontiers*. ASM Press.
5. Robinson, R. K. (2002). *Dairy microbiology handbook*. Wiley.

E-RESOURCES

1. https://www.fao.org/food-safety/en/
2. https://www.who.int/health-topics/food-safety
3. https://www.cdc.gov/foodsafety/
4. https://www.efsa.europa.eu/
5. https://www.fda.gov/food
6. https://www.sciencedirect.com/journal/international-journal-of-food-microbiology
7. www.fssai.gov.in
8. www.who.int
9. www.fao.org
10. www.fda.gov
11. www.icmsf.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 3	3	2			2	3		2	1	1	2	3	3		3
CO 4	3	2	2	1	2	3	2	3	2	2	2	3	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3		3
CO 6	3	2			2	3		2	1	1	2	3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I- GEC - 1: Principles of Human Genetics

Ins. Hrs./Week:5 **Course Credit**:3 **Course Code**: **P26BCGE11C**

COURSE OBJECTIVES

- To provide fundamental knowledge on the principles of genetics, Mendelian inheritance, gene interactions, and patterns of heredity.
- To develop understanding of chromosome structure, chromosomal abnormalities, sex determination, sex linkage, and cytoplasmic inheritance.
- To familiarize students with linkage, crossing over, chromosome mapping, and inheritance of human blood groups.
- To impart knowledge on the nature, structure, and function of genetic material, mutations, mutagens, and chromosomal aberrations.
- To introduce concepts of applied genetics including animal breeding, population genetics, evolutionary genetics, Hardy–Weinberg law, and ethical issues related to genetics.

UNIT-I: Introduction to Genetics **(15 Hours)**

Brief history/basic concepts of genetics, Cell division and chromosomes. Mendelian genetics/monohybrid, dihybrid cross. Mendelian genetics/ trihybrid cross, probability. Modification of Mendelian ratios/ incomplete and codominance. Modification of Mendelian ratios/ incomplete and codominance. Structure of Gene-Interaction of Gene - Commentary Factors, Supplementary Factors, Inhibitory and Lethal Factors -Atavism.

UNIT-II: Chromosome abnormalities **(15 Hours)**

Diploid chromosomes number- Sex differentiation and sex determination. The X chromosomes, Barrbodies, the Lyon hypothesis. Aneuploidy and polyploidy: Gene deletion,duplication,inversionsandtranslocation.SexLinkageinDrosopohilaandMan, Sex Influenced and Sex Limited Genes - Non-Disjunction and Gynandromorphs - Cytoplasmic Inheritance - Maternal Effect on Limnaea (Shell Coiling), Male Sterility (Rode's Experiment).CO2 sensitivity In Drosophila, Kappa particles in Paramecium, Milk Factor in Mice**.**

UNIT-III: Blood groups and Crossing over **(15 Hours)**

Blood Groups and their Inheritance in Human-Linkage and Crossing Over:-Drosophila - Morgans' Experiments- Complete and Incomplete Linkage, Linkage Groups, Crossing Over types, Mechanisms - Cytological Evidence for Crossing Over, Mapping of Chromosomes - Interference and Coincidence.

UNIT-IV: Nature and Function of Genetic Material (15 Hours)

Fine Structure of the Gene - Cistron, Recon, Muton - Mutation - Molecular Basis of Mutation, Types of Mutation, Mutagens, Mutable and Mutator Genes. Chromosomal Aberrations - Numerical and Structural Examples from Human.

UNIT-V: Applied Genetics (15 Hours)

Animal Breeding - Heterosis, Inbreeding, Out Breeding, Out Crossing, Hybrid Vigour. Population Genetics, Evolutionary genetics, Hardy Weinberg Law - Gene Frequency, Factors Affecting Gene Frequency, Eugenics, Euphenics and Euthenics, Bioethics**.**

UNIT – VI: Current Contours (for continuous internal assessment only-Self Study)

Recent advances in genetics and genomics, Human Genome Project, CRISPR-Cas gene editing technology, epigenetics, genetic counseling, personalized medicine, stem cell genetics, molecular diagnosis of genetic disorders, transgenic organisms, bioinformatics in genetics, and ethical issues in genetic engineering and gene therapy.

Total Lecture Hours-75

COURSE OUTCOMES

The students are able to,

1. Identify and describe the process and purposes of the cell cycle, meiosis and mitosis, as well as predict the outcomes of these processes.
2. Analyze genetics problems, make accurate predictions about inheritance of genetic traits, and map the locations of genes.
3. Identify the parts, structure, and dimensions of DNA molecules, RNA molecules, and chromosomes, and be able to categorize DNA as well as describe how DNA is stored.
4. Describe what causes and consequences of DNA sequence changes and how cells prevent these changes, as well as make predictions about the causes and effects of changes in DNA.
5. Describe applications and techniques of modern genetic technology, as well as select the correct techniques to solve practical genetic problems.
6. Explain recent advances in genetics and genomics, including CRISPR-Cas technology, personalized medicine, molecular diagnostics, bioinformatics applications, and ethical issues related to genetic engineering and gene therapy.

TEXT BOOK(S)

1. Cohn, R., Scherer, S., & Hamosh, A. (2023). *Thompson & Thompson genetics and genomics in medicine* (9th ed.). Elsevier.
2. Goldberg, M. L., et al. (2020). *Genetics: From genes to genomes* (6th ed.). McGraw-Hill Education.
3. Lewis, R. (2021). *Human genetics: Concepts and applications* (12th ed.). McGraw-Hill Education.
4. Turnpenny, P. D., & Ellard, S. (2021). *Emery's elements of medical genetics and genomics* (16th ed.). Elsevier.
5. Pritchard, J. (2023). *An owner's guide to the human genome: An introduction to human population genetics, variation, and disease*. Stanford University.

REFERENCE BOOK(S)

1. Brown, T. A. (2018). *Genomes 4*. Garland Science.
2. Hartl, D. L., & Jones, E. W. (2023). *Genetics: Analysis of genes and genomes* (8th ed.). Jones and Bartlett Publishers.
3. Snustad, P. D., & Simmons, M. J. (2016). *Principles of genetics* (7th ed.). John Wiley & Sons.
4. Griffiths, A. J. F., et al. (2015). *Introduction to genetic analysis* (11th ed.). W.H. Freeman.
5. Korf, B. R., & Arias, I. M. (2020). *Human genetics and genomics* (3rd ed.). Wiley.

E-RESOURCES

1. https://www.slideshare.net/vanessaceline/intorduction-to-genetics
2. www.goldiesroom.org/
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. www.ncbi.nlm.nih.gov
7. www.genome.gov
8. www.omim.org
9. www.ensembl.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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CO 4	3	2	2	1	2	2	2	3	2	2	2	3	3	2	3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1			2	2		2	1	1	2	3	1		3

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(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI – 614 016
(For the Candidates admitted in the academic year 2026–2027)

DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I-SEC- I: Forensic Applications of Biochemistry

Ins. Hrs./Week:2 **Course Credit**:2 **Course Code**: **P26SEBC11**

COURSE OBJECTIVES

- To provide fundamental knowledge of forensic biochemistry and its applications in criminal investigations, including the identification, collection, preservation, and documentation of biological evidence.
- To develop an understanding of forensic serology and the biochemical analysis of body fluids, including blood identification, blood grouping, and the use of biochemical markers in forensic examinations.
- To impart knowledge of DNA structure, molecular techniques, and forensic DNA profiling methods used in personal identification, paternity testing, and criminal investigations.
- To explain the principles of forensic toxicology, the biochemical effects of poisons and drugs, and analytical techniques employed in toxicological investigations.
- To familiarize students with advanced biochemical tools and emerging technologies in forensic science, including proteomics, metabolomics, biosensors, nanotechnology, and their applications in forensic investigations.

Unit I – Introduction to Forensic Biochemistry (6 Hours)
This unit introduces the scope, importance, and role of biochemistry in forensic science. It explains the nature and classification of biological evidence encountered in criminal investigations, methods of evidence collection and preservation, maintenance of chain of custody, and ethical and legal aspects related to forensic biochemical investigations.

Unit II – Forensic Serology and Body Fluid Analysis (6 Hours)
This unit deals with the biochemical analysis of body fluids such as blood, semen, saliva, urine, and sweat. It covers presumptive and confirmatory tests for blood identification, blood grouping and Rh typing, biochemical composition of body fluids, and the role of enzymes and protein markers in forensic examination.

Unit III – DNA Fingerprinting and Molecular Techniques (6 Hours)
This unit focuses on the structure and properties of DNA and methods used in forensic DNA analysis. Topics include DNA extraction and purification, polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP), short tandem repeats (STR), mitochondrial DNA analysis, and interpretation of DNA evidence in criminal investigations and paternity disputes.

Unit IV – Forensic Toxicology (6 Hours)
This unit explains the principles of forensic toxicology and the biochemical effects of poisons and toxic substances. It includes drug metabolism, alcohol and narcotic drug analysis,

postmortem toxicology, and analytical techniques such as chromatography and spectroscopy used for toxicological investigations.

Unit V – Advanced Biochemical Techniques in Forensics (6 Hours)

This unit discusses advanced applications of biochemistry in forensic science including proteomics, metabolomics, biosensors, and nanotechnology. It also covers forensic examination of hair, nails, and tissues, biochemical markers for age and gender determination, and recent developments and case studies in forensic biochemistry.

Unit VI – Current Contours (For Continuous Internal Assessment Only-Self Study)

The self-study unit encourages students to explore emerging areas in forensic biochemistry such as forensic biotechnology, artificial intelligence in forensic investigations, cyber forensics, and biochemical databases. Students will also review landmark forensic case studies and prepare seminar presentations based on recent scientific literature.

Total Lecture Hours-30

COURSE OUTCOMES

The Students are able to

1. Explain the principles and significance of biochemistry in forensic science investigations.
2. Analyse biological samples using forensic biochemical methods
3. Apply molecular techniques for DNA profiling, interpret toxicological findings in medico-legal investigations.
4. Interpret toxicological findings in medico-legal investigations.
5. Evaluate modern biochemical technologies and their applications in forensic science.
6. Evaluate recent advances in forensic biochemistry, including forensic biotechnology, artificial intelligence, cyber forensics, and emerging analytical technologies, and critically analyze their applications through case studies and scientific literature.

TEXT BOOK(S)

1. Saferstein, R. (2020). Criminalistics: An introduction to forensic science (13th ed.).
2. Houck, M. M., & Siegel, J. A. (2015). Fundamentals of forensic science (3rd ed.). Academic Press.
3. Butler, J. M. (2015). Forensic DNA typing: Biology, technology, and genetics of STR markers (2nd ed.). Academic Press.
4. Bardale, R. (2017). Principles of forensic medicine and toxicology. Jaypee Brothers Medical Publishers.
5. Sharma, B. R. (2014). Forensic science in criminal investigation and trials (5th ed.). Universal Law Publishing.

REFERENCE BOOKS

1. Butler, J. M. (2015). Forensic DNA typing: Biology, technology, and genetics of STR markers (2nd ed.). Academic Press.
2. Mozayani, A., & Noziglia, C. (Eds.). (2011). The forensic laboratory handbook: Procedures and practice. Humana Press.
3. Houck, M. M., & Siegel, J. A. (2015). Fundamentals of forensic science (3rd ed.). Academic Press.
4. Lappas, N. T., & Lappas, C. M. (2012). Forensic toxicology: Principles and concepts. Academic Press

5. Bardale, R. (2017). Principles of forensic medicine and toxicology. Jaypee Brothers Medical Publishers.

E-RESOURCES

1. http://pubmed.ncbi.nlm.nih.gov
2. http://www.ncbi.nlm.nih.gov
3. http://blast.ncbi.nlm.nih.gov/Blast.cgi
4. http://alphafold.ebi.ac.uk
5. http://www.rcsb.org
6. https://nij.ojp.gov/topics/forensics
7. https://www.aafs.org
8. https://www.forensicsciencesimplified.org
9. https://www.fbi.gov/services/laboratory
10. https://www.ncbi.nlm.nih.gov
11. www.genome.jp/kegg
12. www.string-db.org
13. www.scholar.google.com

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	1	2	3	2	3	2	2	2	3	3	3	3
CO 2	3	2	3		2	3	2	3	2	2	2	3	3	2	3
CO 3	3	2			2	3	2	3	1	2	2	3	3		3
CO 4	3	2	2	1	3	3	2	3	2	2	2	1	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3	1	3
CO 6	3	2			2	3	2	3	1	2	2	3	3		3

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SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: I-VAC-I: Advanced Artificial Intelligence Applications in Biochemistry
Ins. Hrs. /Week: 2 **Credit: 2** **Course Code: P26BCVA11**

COURSE OBJECTIVES

- To introduce the fundamental concepts of Artificial Intelligence (AI), Machine Learning (ML), and their applications in biochemistry and molecular biosciences.
- To develop knowledge of AI-assisted approaches in clinical biochemistry, omics technologies, and biomedical data analysis.
- To provide practical exposure to AI tools and databases used for sequence analysis, pathway mapping, structural biology, and drug discovery.
- To familiarize students with AI-driven healthcare applications, including disease diagnosis, precision medicine, and healthcare analytics.
- To cultivate awareness of ethical, legal, and responsible use of AI in biomedical research, healthcare, and scientific communication.

UNIT I: Foundations of Artificial Intelligence in Biochemistry (6 Hours)
Introduction to Artificial Intelligence (AI), Machine Learning, and Deep Learning in biochemistry and molecular biosciences. Applications of AI in biochemical laboratories, molecular biology, omics research, and biomedical databases. Practical training includes AI-assisted literature review, scientific report preparation, concept mapping, and presentation development using tools such as ChatGPT, Google Gemini, PubMed, and NCBI.

UNIT II: AI in Clinical Biochemistry and Omics Research (6 Hours)
Applications of AI in clinical biochemistry, biomarker discovery, metabolic disorder prediction, genomics, proteomics, metabolomics, and systems biology. Practical exercises include biochemical data interpretation, sequence analysis, pathway visualization, and omics database exploration using BLAST, KEGG, and STRING.

UNIT III: AI in Structural Biology and Drug Discovery (6 Hours)
Role of AI in protein structure prediction, molecular docking, enzyme engineering, therapeutic target identification, and drug discovery. Practical sessions include protein structure visualization, comparative analysis, and computational drug design using AlphaFold and Protein Data Bank (PDB).

UNIT IV: AI Ethics and Research Analytics in Biomedical Sciences (6 Hours)
Ethical aspects of AI in biomedical research, including data privacy, bias, biosafety, responsible AI practices, scientific publishing, systematic reviews, and research analytics. Practical activities include publication analysis, grant proposal drafting, ethics discussions, and evaluation of AI-generated scientific content.

UNIT V: Artificial Intelligence in Healthcare (6 Hours)
Introduction to AI applications in healthcare, including disease diagnosis, medical imaging, clinical decision support systems, electronic health records, telemedicine, personalized medicine, and healthcare management. Students learn how AI improves patient care, disease

prediction, treatment planning, and public health monitoring. Practical sessions include AI-assisted healthcare data analysis, clinical case studies, healthcare workflow demonstrations, and evaluation of AI-based healthcare technologies.

UNIT VI (CIA Only): Self-Learning and Research Exploration (6 Hours)

AI applications in biochemistry through literature reviews, seminars, mini-projects and case studies. Students prepare research portfolios, AI-assisted presentations and comparative evaluations of different biochemical AI tools using platforms such as PubMed, NCBI and AlphaFold Database.

Total Lecture Hours: 30

COURSE OUTCOME

The students are able to

1. Explain the principles of AI, ML, and their relevance to biochemistry, molecular biology, and healthcare.
2. Apply AI-assisted tools for biochemical data interpretation, omics analysis, and biomedical research.
3. Analyze protein structures, molecular interactions, and drug discovery workflows using AI-based platforms.
4. Utilize AI technologies for healthcare applications, disease prediction, diagnostic support, and personalized medicine.
5. Evaluate ethical, privacy, and regulatory considerations associated with AI applications in biomedical sciences and healthcare.

TEXT BOOK(S)

1. Brown, T. A. (2024). *Genomes 5* (5th ed.). Garland Science.
2. Alpaydin, E. (2021). *Machine learning* (Revised and updated edition). MIT Press.
3. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT Press.
4. Lesk, A. M. (2023). *Introduction to bioinformatics* (6th ed.). Oxford University Press.
5. Zou, J., & Schiebinger, L. (2023). *AI and healthcare: Opportunities and challenges*. Academic Press.

REFERENCE BOOK(S)

1. Bishop, C. M., & Bishop, H. (2024). Deep learning: Foundations and concepts. Springer.
2. Baldi, P. (2018). Bioinformatics: The machine learning approach (3rd ed.). MIT Press.
3. Mount, D. W. (2021). Bioinformatics: Sequence and genome analysis (2nd ed.). Cold Spring Harbor Laboratory Press.
4. Baxevanis, A. D., & Bader, G. D. (2020). Bioinformatics: A practical guide to the analysis of genes and proteins (4th ed.). Wiley.
5. Topol, E. J. (2019). Deep medicine: How artificial intelligence can make healthcare human again. Basic Books.

E-RESOURCES

1. http://pubmed.ncbi.nlm.nih.gov
2. http://www.ncbi.nlm.nih.gov
3. http://blast.ncbi.nlm.nih.gov/Blast.cgi
4. http://alphafold.ebi.ac.uk
5. http://www.rcsb.org

6. www.ncbi.nlm.nih.gov
7. www.ncbi.nlm.nih.gov/pubmed
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CO 3	3	2			2	3	2	3	1	2	2	3	3		3
CO 4	3	2	2	1	3	3	2	3	2	2	2	1	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3	1	3
CO 6	3	2			2	3	2	3	1	2	2	3	3		3

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SEMESTER - II

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: II- CC- III: Advanced Enzymology

Ins. Hrs./Week: 6 **Course Credit: 4** **Course Code: P26BC204**

COURSE OBJECTIVES

- To provide fundamental knowledge on the structure, classification, nomenclature, and catalytic properties of enzymes.
- To impart understanding of enzyme kinetics, enzyme–substrate interactions, and factors influencing enzymatic reactions.
- To explain the mechanisms of enzyme action, enzyme inhibition, and their biological, therapeutic, and industrial significance.
- To develop knowledge on coenzymes, allosteric regulation, isozymes, and multienzyme complexes involved in metabolic processes.
- To familiarize students with modern concepts and industrial applications of enzymes, including immobilized enzymes, biosensors, ribozymes, and enzyme engineering.

UNIT – I: Introduction of Enzymes (20 Hours)

Definitions (catalytic power, specificity, reactivity, regulation, Holoenzyme, Apoenzyme, coenzymes and cofactors). Enzyme Nomenclature and IUB system of enzyme classification. Active site- Fisher and Koshland models. Formation of enzyme substrate complex evidence. Basic concepts of bioenergetics: The collision theory, activation energy and transition state theory. Measurement and expression of enzyme activity – enzyme assays, Enzyme units.

UNIT – II: Enzyme Kinetics (20 Hours)

Pre-Steady state and Steady state kinetics,. Kinetics of single substrate enzyme catalyzed reaction - Michaelis-Menten (Briggs- Haldane) equation, Double- Reciprocal Plot, Lineweaver Burk plot, and Eadie-Hofstee plot. Determination of Vmax, Km, Kcat, Specificity constant (Kcat/Km) and their significance. Factors influencing enzymatic activity. Kinetics of enzyme reactions having two or more substrates. Single displacement and double displacement reactions.

UNIT–III: Mechanism of Enzyme Action and Enzyme Inhibition (18Hours)

Mechanism of enzyme action: Factors contributing to the catalytic efficiency - proximity and orientation, covalent catalysis, acid-base catalysis, metal ion catalysis, strain and distortion theory. Mechanism of action of Lysozyme, Carboxypeptidase, Chymotrypsin and Ribonuclease. Reversible and Irreversible inhibition - Competitive, Non-competitive and mixed inhibition. Substrate inhibition and Feedback inhibition. Therapeutic, diagnostic and industrial applications of enzyme inhibitors.

UNIT – IV: Introduction of Co-Enzymes (16 Hours)

Structure and functions – Pyridine and flavin nucleotides, coenzyme A, Pyridoxal phosphate

and thiamine pyrophosphate, tetrahydrofolate and B12 Coenzymes. Allosteric Interactions: Enzyme regulation, allosteric enzymes. Allosteric kinetics (MWC and KNF models), symmetry and sequential models. Hill's equation and Hill's coefficient. Isozymes.

UNIT – V: Multienzyme System **(16 Hours)**

Multifunctional enzymes. Multi-enzyme complexes (Pyruvate dehydrogenase complex, fatty acid synthase and Na - K ATPase), Metalloenzymes. Modern concepts of evolution of catalysts: Catalytic RNA (Ribozymes), abzymes. Immobilized enzymes and their industrial applications. Chemical modification and site-directed mutagenesis of enzymes. Industrial applications of enzymes - food and pharmaceutical enzymes. Biosensors.

UNIT-VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Recent advancement in enzyme technology and its applications. Influence of covid-19 infections on the level of enzymes.

Total lecture hours - 90

COURSE OUTCOMES

The students are able to

1. Describe the catalytic mechanisms employed by enzymes
2. Choose and use the appropriate methods to isolate and purify enzymes and check the purity of the enzyme
3. Analyse 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
4. Explain 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.
5. Highlight the use of enzymes in industries and biomedicine

TEXT BOOK(S)

1. Barrett, A. J., Woessner, J. F., & Rawlings, N. D. (2022). *Handbook of proteolytic enzymes* (3rd ed.). Rawlings Publishers.
2. Jain, J. L. (2005). *Fundamentals of biochemistry* (6th ed.). S. Chand Publishers.
3. Nicholas, C. (2009). *Fundamentals of enzymology* (2nd ed.). Oxford Science Publishers.
4. Palmer, T., & Bonner, P. (2023). *Enzymes: Biochemistry, biotechnology, clinical chemistry* (2nd ed.). Horwood Publishers.
5. Satyanarayana, U. (2019). *Fundamentals of biochemistry*. Allied & Books Pvt. Ltd.

REFERENCE BOOK(S)

1. Palmer, T., & Bonner, P. (2007). *Enzymes: Biochemistry, biotechnology, and clinical chemistry* (2nd ed.). Affiliated East West Press Pvt. Ltd.
2. Price, N. C., & Stevens, L. (2003). *Fundamentals of enzymology* (3rd ed.). Oxford University Press.
3. Voet, D., & Voet, J. G. (2011). *Voet's biochemistry* (Adapted ed.). Wiley.
4. Nelson, D. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry* (8th ed.). W. H. Freeman & Co.
5. Berg, J. M., Stryer, L., & Gatto, G. (2015). *Biochemistry* (8th ed.). W. H. Freeman & Co.

E-RESOURCES

1. https://ocw.mit.edu/high-school/biology/exam-prep/chemistry-of-life/enzymes/
2. https://onlinecourses.swayam2.ac.in/cec20_bt20/preview
3. https://mooc.es/course/enzymology/
4. https://dth.ac.in/medical/courses/biochemistry/block-1/1/index.php
5. https://www.lecturio.com/medical-courses/enzymes-and-enzymekinetics.course#/
6. https://www.nature.com/articles/nrd.2017.219
7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4934206/
8. www.ncbi.nlm.nih.gov/books/NBK22430/
9. www.expasy.org/enzyme
10. www.brenda-enzymes.org
11. www.kegg.jp/kegg/
12. www.rcsb.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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CO 2	3				2	2	2	2			2	3	3		3
CO 3	3			2	3	2		2			3	2	1		3
CO 4	3			1	2	3	2	3	2		2	3	3	2	3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1	2	1	2	2	2	3	2	2	2	3	3	3	3

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: II- CC- IV: Intermediary Metabolism and Regulation

Ins. Hrs./Week: 6 **Course Credit: 4** **Course Code: P26BC205**

COURSE OBJECTIVES

- To provide fundamental knowledge on the structure, function, and metabolism of major biomolecules and bioenergetics.
- To explain the metabolic pathways of carbohydrates and their regulation in maintaining energy balance and blood glucose homeostasis.
- To develop understanding of amino acid metabolism, nitrogen balance, transamination, deamination, and urea cycle regulation.
- To impart knowledge on lipid metabolism, including synthesis, degradation, cholesterol metabolism, ketogenesis, and lipoprotein metabolism.
- To familiarize students with nucleic acid metabolism, including biosynthesis and catabolism of purines and pyrimidines and their metabolic regulation.

UNIT – I: Introduction **(20 Hours)**

Overview of major classes of biomolecules, forces stabilizing biomolecules. General scheme of metabolism, historical and experimental details in derivation of a metabolic pathway, catabolic, anabolic and amphibolic pathways. Oxidative phosphorylation. Electron transport chain. Standard free energy change of a chemical reaction, redox potentials, ATP and high energy phosphate compounds.

UNIT – II: Carbohydrates Metabolism **(20 Hours)**

Glycolysis and gluconeogenesis – pathway, key enzymes and co-ordinate regulation. The citric acid cycle and its regulation. The pentose phosphate pathway. Metabolism of glycogen and regulation. Key junctions in metabolism– glucose-6-phosphate, pyruvate and acetyl CoA. Blood glucose homeostasis– role of tissues and hormones.

UNIT – III: Amino Acid Metabolism **(18 Hours)**

Biosynthesis and degradation of amino acids and their regulation. Transamination and deamination, ammonia formation, the urea cycle and regulation of ureogenesis.

UNIT – IV: Lipids Metabolism **(16 Hours)**

Lipogenesis: biosynthesis of fatty acid, triglycerides, phospholipids, and cholesterol. Regulation of triacylglycerol, phospholipids and cholesterol biosynthesis. Oxidation of lipids. Role of carnitine cycle in the regulation of β - oxidation. Cholesterol Catabolism, Ketogenesis and its control. Lipoprotein metabolism - exogenous and endogenous pathways.

UNIT – V: Nucleic Acid Metabolism **(16 Hours)**

Biosynthesis and catabolism of purines and pyrimidines and their regulation.

(https://www.slideshare.net/senchiy/nucleic-acids-and-nucleotide)

UNIT–VI: Current Contours (For Continuous Internal Assessment Only-Self Study)
Current aspects on metabolism: metabolic changes after covid-19 infections.

Total Lecture Hours - 90

COURSE OUTCOMES

The students are able to

1. To learn the metabolism and integration of biomolecules that takes place in human system.
2. Integrate the various aspects of metabolism & their regulatory pathways
3. Students can understand the fundamental energetics of biochemical processes
4. To understand the relation between biochemical defects and metabolic disorders.
5. To understand the organization of signaling pathways.
6. To understand the role of membrane processes in metabolism
7. Overall, gainingan understanding of the processes of metabolic transformation at the molecular level and how these processes are studied.
8. Afford students opportunity to appreciate the relevance/applications of biochemistry in our daily activities.

TEXT BOOK(S)

1. Nelson, David L., and Michael M. Cox. (2012) Lehninger Principles of Biochemistry. (6th ed.) W.H. Freeman & Co.
2. Nelson, David L., and Michael M. Cox (2021). Lehninger Principles of Biochemistry (8th ed.).W.H. Freeman & Co.
3. Voet, Donald, and Judith G. (2010) Voet. Biochemistry. (4th ed.). John Wiley & Sons.
4. Metzler, David E (2003). The Chemical Reactions of Living Cells. (2nd ed.). Academic Press,.
5. Zubay, Geoffrey L. (1999) Biochemistry. (4th ed.). McGraw-Hill.
6. Devlin, Thomas M., editor. Textbook of Biochemistry with Clinical Correlations. (7th ed.). Wiley, 2010.
7. Orten, James M., and Otto W. (2013) Human Biochemistry. (10th ed.). C.V. Mosby Company.

REFERENCE BOOK(S)

1. Berg, Jeremy M., John L.(2012) Tymoczko, and Lubert Stryer. *Biochemistry*. (7th ed.). W.H. Freeman and Company.
2. Bender, David A., and Shauna M.C. Cunningham. *Introduction to Nutrition and Metabolism*. (6th ed.). CRC Press.
3. Nelson, David L., and Michael M. Cox. (2021) *Lehninger Principles of Biochemistry*. 8th ed., W.H. Freeman & Co.
4. Gropper, Sareen S., Jack L. Smith, and Timothy P(2018). Carr. *Advanced Nutrition and Human Metabolism*. 7th ed., Cengage Learning.
5. Rodwell, Victor, and David Bender (2018). *Harper's Illustrated Biochemistry*. (31st ed.) McGraw-Hill Education.

E RESOURCES

1. https://www.embopress.org/doi/full/10.1038/msb.2013.19

2. https://people.wou.edu/~guralnl/450Glycogen%20metabolism.pdf
3. https://www.pdfdrive.com/lippincotts-biochemistry-6th-edition-e41485405.html
4. https://www.pdfdrive.com/biochemistrystrayer-e25312085.html
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3243375/
6. https://www.researchgate.net/publication/334458898_Urea_Cycle
7. www.ncbi.nlm.nih.gov/books/
8. www.kegg.jp
9. www.biochemistry.org

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CO 3	3	1	2	3					1	2	2	3	1		3
CO 4	2	2	2	3					2	2	2	1	3		3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1	2	3	2	2	2	3	2	2	2				3

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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: II- CP- II: Advanced Enzymology (P)

Ins. Hrs./Week: 6 **Course Credit: 4** **Course Code: P26BC206P**

COURSE OBJECTIVES

- To develop practical skills in the estimation of enzyme activity and determination of total and specific activity of enzymes.
- To understand the influence of physical factors such as pH, temperature, and substrate concentration on enzyme activity and kinetics.
- To determine important kinetic parameters such as activation energy and Michaelis constant (Km) through experimental approaches.
- To study the effects of enzyme inhibitors and activators on catalytic activity and enzyme regulation.
- To acquire hands-on training in protein purification techniques such as gel filtration chromatography using Sephadex.

EXPERIMENTS

1. Determination of total and specific activity of salivary amylase.
2. Effect of pH on enzyme activity (Acid phosphatase/Alkaline phosphatase).
3. Effect of temperature on enzyme activity (Urease/ALP) and determination of activation energy (Urease/ALP).
4. Effect of substrate concentration on enzyme activity (Salivary Amylase) and determination of Km value.
5. Effect of inhibitor on activity of any one enzyme.
6. Effect of activator on activity of any one enzyme.
7. Purification of protein by gel filtration chromatography using Saphadex

Total Hours - 90

COURSE OUTCOMES

The students are able to

1. Employ the relevant techniques for isolation and purification of enzymes and gain skill in kinetic studies which is essential for research activity
2. Acquire ability in performing enzyme assay, and explicate the methods that form the basis of enzyme characterization
3. Learn the Basic concepts in microbiology and cell biology which will be helpful for interdisciplinary research work
4. Trained in separation techniques used in molecular Biology which will be supportive in their future research
5. Learn practically through interaction, working methods and employment practices through Industrial visits.

TEXT BOOK(S)

1. Plummer, D. (2021). *An introduction to practical biochemistry* (3rd ed.). McGraw-Hill Education (India) Pvt. Ltd.
2. Jayaraman, J. (2011). *Laboratory manual in biochemistry*. New Age Publishers.
3. Berg, J. M., Stryer, L., & Gatto, G. (2015). *Biochemistry* (8th ed.). W. H. Freeman & Co.
4. Cook, P. F., & Cleland, W. (2007). *Enzyme kinetics and mechanism*. Garland Science.
5. West, E. S., Todd, W. R., & Mason, H. S. (2023). *Textbook of biochemistry* (4th ed.). Oxford IBH Publishers.

REFERENCE BOOK(S)

1. Price, N. C., & Stevens, L. (2022). *Fundamentals of enzymology* (3rd ed.). Oxford University Press.
2. Copeland, R. A. (2000). *Enzymes: A practical introduction to structure, mechanism, and data analysis*. Wiley-VCH.
3. Cappuccino, J. G., & Sherman, N. (2005). *Microbiology: A laboratory manual*. Pearson Education.
4. Bisswanger, H. (2011). *Practical enzymology* (2nd ed.). Wiley-Blackwell.
5. Price, N. C., & Stevens, L. (2023). *Fundamentals of enzymology* (3rd ed.). Oxford University Press.

E-RESOURCES

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846332/
2. https://www.ijsr.net/archive/v3i8/MDIwMTU0MDk=.pdf
3. https://www.researchgate.net/publication/349318898_ABC_of_Periheral_smear
4. https://ncdc.gov.in/WriteReadData/l892s/File608.pdf
5. https://www.ncbi.nlm.nih.gov/books/NBK562156/
6. www.ncbi.nlm.nih.gov/books/
7. www.khanacademy.org/science/biology/energy-and-enzymes
8. www.sigmaaldrich.com/IN/en/technical-documents/technical-article/protein-
9. www.thermofisher.com/in/en/home/life-science/protein-biology/protein-assays-

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CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
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DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: II- DGEC- II: Human Physiology

Ins. Hrs./Week: 4 **Course Credit: 4** **Course Code: P26BCDE22A**

COURSE OBJECTIVES

- To provide knowledge on the anatomy and physiology of the digestive system, including digestion, absorption, and gastrointestinal secretions.
- To develop understanding of body fluids, blood composition, haemopoiesis, blood coagulation, and maintenance of fluid and electrolyte balance.
- To explain the structure and functions of the circulatory and respiratory systems, including cardiac physiology, blood pressure regulation, and gas exchange.
- To impart knowledge on renal physiology, urine formation, acid–base balance, and the biochemical basis of muscle contraction.
- To familiarize students with the organization and functions of the nervous system, neurotransmission, brain metabolism, learning, memory, and neurochemical regulation.

Unit I: Digestive system **(12 Hours)**

Anatomy of the digestive system, Salivary, Gastric and Biliary Secretions composition and functions. Intestinal hormones, movements in Gastro intestinal tract, Secretion, digestion and absorption in the small intestine. Absorption in the large intestine; Digestion and absorption of carbohydrates, lipids and proteins.

Unit II: Body fluids **(12 Hours)**

Extracellular fluid-plasma, interstitial fluid and transcellular fluid. Intracellular fluid: Lymph & Blood-composition, functions, osmolarity of the body fluids, ionic composition, electrolytes, body buffers. Blood cells, haemoglobin, haemopoiesis, blood coagulation and blood groups.

Unit 3 Circulation **(12 Hours)**

Structure of Heart and blood vessels, cardiac cycles, cardiac factors controlling blood pressure, electrocardiogram. Functions of heart. Respiration: Anatomy, and physiology of respiration, pulmonary surfactant, exchange of gases between lung and blood and between blood and tissues. Role of lung in acid-base balance.

Unit 4 Excretory system **(12 Hours)**

Structure and functions of kidney. Urine- composition and formation. Renal regulation of acid-base balance. Muscle: Kinds of muscle, structure. Mechanism and theories of muscle contraction.

Unit 5 Central nervous system **(12 Hours)**

General organisation. Functional units. Resting and action potential- conduction of nerve impulse. Synaptic transmission. Brain- chemical composition, metabolism, metabolic

adaptation, neurotransmitters and cAMP. Biochemical aspects of learning and memory. Enkephalins and endorphins.

Unit VI – Current Contours (For Continuous Internal Assessment Only-Self Study)
Organization of endocrine glands, hormones and their chemical nature. Functions of major endocrine glands: pituitary, thyroid, parathyroid, pancreas, adrenal and gonads. Hormonal regulation of metabolism, growth, stress and reproduction.

Total Lecture Hours - 60

COURSE OUTCOMES

The student are able to

1. **E**xplain the anatomy and physiological functions of the digestive system and describe the processes of digestion and absorption of nutrients in the gastrointestinal tract.
2. Understand the composition, functions, and regulation of body fluids including blood, lymph, and intracellular and extracellular fluids along with their buffering systems.
3. Analyze the structure and function of the cardiovascular and respiratory systems, including cardiac cycle, blood pressure regulation, gas exchange, and acid–base balance.
4. Describe the structure and physiological roles of the excretory system and muscle system, including urine formation, renal regulation, and muscle contraction mechanisms.
5. Understand the organization and functions of the nervous system, including nerve impulse conduction, synaptic transmission, brain metabolism, and neurochemical basis of learning and memory

TEXT BOOK(S)

1. Guyton, A. C., & Hall, J. E. (2021). *Textbook of medical physiology* (14th ed.). Elsevier.
2. Tortora, G. J., & Derrickson, B. H. (2021). *Principles of anatomy and physiology* (16th ed.). Wiley.
3. Silverthorn, D. U. (2019). *Human physiology: An integrated approach* (8th ed.). Pearson.
4. Widmaier, E. P., Raff, H., & Strang, K. T. (2019). *Vander's human physiology: The mechanisms of body function* (15th ed.). McGraw Hill Education.
5. Barrett, K. E., Barman, S. M., Brooks, H. L., & Yuan, J. X.-J. (2019). *Ganong's review of medical physiology* (26th ed.). McGraw Hill Education.

REFERENCE BOOK(S)

1. Boron, W. F., & Boulpaep, E. L. (2017). *Medical physiology* (3rd ed.). Elsevier.
2. Sherwood, L. (2016). *Human physiology: From cells to systems* (9th ed.). Cengage Learning.
3. Hall, J. E. (2016). *Guyton and Hall textbook of medical physiology: Study guide*. Elsevier.
4. Koeppen, B. M., & Stanton, B. A. (2018). *Berne & Levy physiology* (7th ed.). Elsevier.
5. Costanzo, L. S. (2020). *Physiology* (6th ed.). Elsevier.

E-RESOURCES

1. https://openstax.org/details/books/anatomy-and-physiology
2. https://www.ncbi.nlm.nih.gov/books/
3. https://nptel.ac.in/courses/102/104/102104042/

4. https://www.khanacademy.org/science/health-and-medicine
5. https://teachmephysiology.com/
6. www.ncbi.nlm.nih.gov/books/
7. www.merckmanuals.com/professional
8. www.khanacademy.org/science/health-and-medicine
9. WWW. openstax.org/details/books/anatomy-and-physiology

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	1	2	3	2	2	2	3	2	2	2				3
CO 2	3	2	1	3	2	2	2	3	2	2	2	3	3		2
CO 3	3	1	2	3					1	2	2	3	1		3
CO 4	2	2	2	3					2	2	2	1	3		3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1	2	3	2	2	2	3	2	2	2				3

S-Strong (3) M-Medium (2) L-Low (1)

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: II - DCEC- II: Biotechnology and Genetic Engineering
Ins. Hrs./Week: **4** **Course Credit**: **4** **Course Code**: **P26BCDE22B**

COURSE OBJECTIVES

- To provide fundamental knowledge of recombinant DNA technology, cloning vectors, DNA libraries, and screening of recombinant molecules.
- To develop understanding of transgenic plants and animals, gene transfer methods, tissue culture techniques, and their biotechnological applications.
- To impart knowledge on molecular biology techniques such as PCR, DNA sequencing, DNA fingerprinting, microarray technology, and mutagenicity testing.
- To explain the principles and applications of gene therapy, stem cell technology, antisense therapy, and cell-based therapeutic approaches.
- To familiarize students with human genome projects, genetically modified organisms, biosafety, bioethics, intellectual property rights, and ethical issues in biotechnology and stem cell research.

UNIT – I: Introduction to Gene Cloning **(12 Hours)**

Restriction and modification enzymes. Cloning vectors: Characteristics, Natural & artificial plasmids as vectors) pBR322, pUC, shuttle vector and cosmids - advantages and disadvantages. Vectors used for cloning in E.coli., yeast, higher plants (Ti plasmid derivatives, caulimovirus) and animal cells (constructs of SV40 and retroviruses). Expression vectors. Screening of recombinants. Construction of DNA libraries - genomic and cDNA libraries.

UNIT – II: Transgenics **(12 Hours)**

Transgenic animals - Gene transfer methods in animals. Totipotency, haploids, growth of animal cell lines. Competent cells preparation, electroporation, microinjection and particle bombardment method, and applications. Transgenic plants - Use of agrobacterium for genetic engineering in plants. Plant cell cultures for the production of important compounds. Plant tissue culture – Micropropagation, protoplast isolation, somatic hybrids. Identification of transformed cells into callus and regeneration of transgenic plants and applications.

UNIT – III Molecular Techniques **(12 Hours)**

Polymerase chain reaction – principle, types and applications. Sanger's and Maxam-Gilbert's method for DNA sequencing. DNA Fingerprinting - RAPD, RACE (Rapid Amplification of cDNA Ends), RFLP and AFLP analysis and its application in forensic science. DNA footprinting. Chromosome walking, chromosome jumping. Mutagenicity test – Ames test. Markers linked to drug and disease resistant genes. Antisense technology and its application. Microarray technology: genomic and cDNA arrays.

UNIT – IV: Gene Therapy **(12 Hours)**

Ex-vivo, Invivo, Insitu gene therapy Strategies of gene therapy: Gene augmentation – ADA deficiency, CFTR, Antisense therapy, Ribozymes, Protein Aptamers, Intrabodies. Stem cell therapy - Embryonic and adult Stem Cells, Totipotent, Pluripotent and Multipotent Cells.

Testing and generation of embryonic stem cells, Testing for adult stem cells and differentiation, Potential use of stem cells – Cell based therapies.

UNIT – V: Genome Project and Bioethics (12 Hours)

Human genome projects, gene bank. Genetically modified organisms (GMOs) in developed and developing countries. Genetically modified foods – benefits and risks. Bioethics: Laws and regulations in biotechnology, patent laws, and Intellectual property rights (IPR). Biosafety, types of biosafety, advantages and disadvantages. Ethics in cloning and stem cell research.

UNIT– VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Therapeutic application of genetic engineering tools: Discuss on recent techniques in genetic engineering that help understand diseases and treating the same.

Total Lecture Hours - 60

COURSE OUTCOMES

The students are able to

1. Explain the principles of gene cloning, cloning vectors, DNA libraries, and recombinant DNA technology.
2. Describe methods involved in the development of transgenic plants and animals and evaluate their applications in biotechnology.
3. Apply molecular biology techniques such as PCR, DNA sequencing, fingerprinting, and microarray technology for research and diagnostic purposes.
4. Analyze the concepts and therapeutic applications of gene therapy and stem cell technology in modern medicine.
5. Evaluate the significance of genome projects, genetically modified organisms, biosafety regulations, and ethical issues in biotechnology.
6. Apply the ethical considerations and future prospects of genetic engineering in healthcare and medicine.

TEXT BOOK(S)

1. Brown, T. A. (2016). Gene cloning and DNA analysis: An introduction (7th ed.). Wiley-Blackwell.
2. Primrose, S. B., & Twyman, R. M. (2014). Principles of gene manipulation and genomics (8th ed.). Wiley-Blackwell.
3. Glick, B. R., Pasternak, J. J., & Patten, C. L. (2017). Molecular biotechnology: Principles and applications of recombinant DNA (5th ed.). ASM Press.
4. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., & Losick, R. (2014). *Molecular biology of the gene* (7th ed.). Pearson Education.
5. Lewin, B. (2017). *Lewin's genes XII*. Jones & Bartlett Learning.

REFERENCE BOOK(S)

1. Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K., & Walter, P. (2022). *Molecular biology of the cell* (7th ed.). Garland Science.
2. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2018). *Lewin's genes XII*. Jones & Bartlett Learning.
3. Snustad, D. P., & Simmons, M. J. (2018). *Principles of genetics* (7th ed.). Wiley.
4. Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2019). *Concepts of genetics* (12th ed.). Pearson.
5. Weaver, R. F. (2020). *Molecular biology* (6th ed.). McGraw-Hill Education.

E-RESOURCES

1. http://www.ncbi.nlm.nih.gov
2. http://pubmed.ncbi.nlm.nih.gov
3. http://www.dnalc.org
4. http://www.nature.com/nbt
5. http://www.khanacademy.org/science/biology/biotech-dna-tech
6. https://www.slideshare.net/drmalathi13/molecular- techniques
7. www.genome.gov/human-genome-project
8. www.addgene.org
9. www.ebi.ac.uk
10. www.who.int
11. www.dnalc.cshl.edu

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 3	3	1	2	3					1	2	2	3	1		3
CO 4	2	2	2	3					2	2	2	1	3		3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1	2	3	2	2	2	3	2	2	2				3

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SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI – 614 016
(For the Candidates admitted in the academic year 2026–2027)
DEPARTMENT OF BIOCHEMISTRY
M.Sc., BIOCHEMISTRY

Semester: II- DCEC- II: Cancer Biology

Ins. Hrs./Week:**4** **Course Credit**:**4** **Course Code**: **P26BCDE22C**

COURSE OBJECTIVES

- To provide fundamental knowledge on the history, types, classification, and molecular basis of cancer development and metastasis.
- To explain the role of oncogenes, tumour suppressor genes, DNA repair mechanisms, and genetic instability in tumourigenesis.
- To develop understanding of molecular events involved in human cancers, including oncogene activation, chromosomal rearrangements, and cell cycle dysregulation.
- To impart knowledge on chromosomal abnormalities and hematological malignancies such as leukemia, lymphoma, and myeloproliferative disorders.
- To familiarize students with familial cancers, cancer biomarkers, TNM classification, and modern approaches in cancer diagnosis and therapy.

UNIT -I: Cancer History and Types **(12Hours)**

Scope and current scenario of cancer research. Cancer: Types and their prevalence, Carcinoma, Lymphoma and Malignancy. Classification based on tissue types. Molecular biology of tumor invasion and metastasis.

UNIT-II: Cell Transformation and Tumourigenesis **(12 Hours)**

Oncogenes, tumour suppressor genes, DNA repair genes and genetic instability, epigenetic & Post translational modifications, telomerase activity, centrosome malfunction. Tumour progression: angiogenesis and metastasis.

UNIT-III: Oncogenes and Human Cancers **(12 Hours)**

Role of proto- oncogenes in regulating cell growth and survival, mechanisms of activation of oncogenes, retro viral activation , point mutations, fusion genes, gene amplification, chromosome rearrangements, promoter insertion, tumour suppressor genes. Cell cycle and Cancer, Knudson's two hit hypothesis.

UNIT-IV: Chromosome Abnormalities **(12 Hours)**

Chronic myeloid leukemia, Chronic lymphocytic leukemia, Acute myeloid leukemia, Acute lymphoblastic leukemia, Myelodysplastic syndromes, Myeloproliferative disorders, Hodgkin's disease, non Hodgkin's lymphoma,

UNIT-V: Familial Cancers, Biomarkers and Therapy **(12 Hours)**

Familial cancers, Biomarkers and Therapy: Retinoblastoma, Wilm's tumour, Li- Fraumeni syndrome, Colorectal cancer and Breast cancer. Cancer therapy: At cellular, gene and protein level. Stages of cancer - TNM classification. Principles of cancer biomarker and their applications, chemotherapeutics for cancer.

UNIT – VI: (For Continuous Internal Assessment Only – Self Study)

Recent developments in cancer biology and therapeutics: Applications of nanotechnology and artificial intelligence in cancer diagnosis and therapy. Emerging trends in personalized oncology and liquid biopsy.

Total Lecture Hours-60

COURSE OUTCOMES

The students are able to,

1. Understanding of the molecular and cellular mechanisms that lead to cancer.
2. Describe the fundamental mechanistic principles behind cancer diagnosis and prevention
3. Explain the basic principles behind personalized medicine and therapeutic cancer management
4. Illustrate the positive and challenging sides of using model organisms in cancer
5. Understanding of the importance of bioinformatic tools in cancer research
6. Evaluate recent developments in cancer biology and therapeutics.

TEXT BOOK(S)

1 Weinberg, R.A Garland Science, Taylor and Francis Group, 2007. The Biology of Cancer,
1. Francesco Pezzella, Mahvash Tavassoli, David Kerr 2019 - Oxford Textbook of Cancer Biology Oxford University Press.
2. Lewis J Kleinsmith, Pearson 2016 Principles Of Cancer Biology.
3. Paperback, Dr. Pradeep Kumar 2022 The Textbook Of Cancer Biology .
4. Devita V.T.2021 Principles and Practice of Oncology Primer of Molecular Biology in Cancer

REFERENCE BOOK(S)

1. King R.J.B and. Robbins M.W, 2006. Cancer Biology,3rd ed.,.Pearson Education Ltd.,
2 Heim S. and. Mitelman, F 2009 Cancer cytogenetics, chromosomal and molecular genetic aberrations of tumor cells,3rd ed., Wiley, Blackwell Inc.,
3 Rooney D.E, Oxford University Press, 2001. Human cytogenetics: malignancy and acquired abnormalities, a practical approach,3rd ed.,.
4 Shaffer, L.G Gowan J. Mc, Jordan and.Schmid,. Karger, M S 2013.Recommendations of the International Standing Committee on Human Cytogenetic Nomenclature,.
5 Press Knowles M.A and Selby P.J., , 2005. Introduction to the Cellular and Molecular Biology of Cancer,4th ed.,. Oxford University

E-RESOURCES

1. http://www.cancer.gov/about-nci/organization/dcb
2. http://www.cancer.gov/research/nci-role/cancer-research
3. http://www.cancer.gov/about-nci/budget
4. http://www.cancer.gov/research/key-initiatives/precision-medicine
5. http://www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative
6. http://www.cancer.gov/news-events/cancer-currents-blog/cancer-biology
7. www.cancer.gov
8. www.cancer.org
9. www.iarc.who.int
10. www.cancerresearchuk.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 2	3	2	1	3	2	2	2	3	2	2	2	3	3		2
CO 3	3	1	2	3					1	2	2	3	1		3
CO 4	2	2	2	3					2	2	2	1	3		3
CO 5	3	3	2	3	2	2	2	3	2	2	2	3	3		3
CO 6	3	1	1	3	2	2	2	3	1	2	2				3

S-Strong (3) M-Medium (2) L-Low (1)

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF BIOCHEMISTRY
M.SC., BIOCHEMISTRY

Semester: II- GEC- II: Developmental Biology

Ins. Hrs./Week:**4** **Course Credit**:**4** **Course Code**: **P26BCGE22A**

COURSE OBJECTIVES

1. To provide knowledge on the origin and evolution of life, evolutionary theories, and the emergence of prokaryotic and eukaryotic cells.
2. To explain the fundamental concepts of developmental biology, including cell potency, differentiation, induction, stem cells, and genomic equivalence.
3. To develop understanding of gametogenesis, fertilization, embryogenesis, and early developmental processes in animals and plants.
4. To impart knowledge on morphogenesis, organogenesis, pattern formation, regeneration, and post-embryonic development in animals.
5. To familiarize students with plant developmental processes including meristem organization, root and shoot development, flowering, and floral pattern formation.

UNIT – I: Introduction to Evolution (12 Hours)

Emergence of evolutionary thoughts: Lamarks; Darwin – concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; the evolutionary synthesis, Origin of cells and unicellular evolution; Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.

UNIT – II: Concepts of Development (12 Hours)

Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting.

UNIT – III: Fertilization in Animals and Plants (12 Hours)

Gametogenesis, Fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

UNIT – IV: Development of Animals (12 Hours)

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, organogenesis – vulva formation in Caenorhabditiselagans; eye lense induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation,

metamorphosis; environmental regulation of normal development; sex determination.

UNIT – V: Development of Plants **(12 Hours)**

Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; lead development and phyllotaxy; transition to flowering, floral development in Arabidopsis and Antirrhinum.

UNIT– VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Recent advances in Developmental Biology. Short talk presenters and detailed discussion of original research articles in class.

Total Lecture Hours-60

COURSE OUTCOME

The students are able to

1. Explain the principles of evolution, origin of life, and major evolutionary theories proposed by Lamarck, Darwin, Mendel, Oparin, and Haldane.
2. Describe the fundamental concepts and molecular mechanisms involved in developmental biology, including cell differentiation, induction, stem cells, and morphogenesis.
3. Analyze the processes of gametogenesis, fertilization, embryogenesis, and early developmental stages in plants and animals.
4. Interpret the mechanisms of organogenesis, pattern formation, regeneration, and post-embryonic development in model organisms and vertebrates.
5. Evaluate developmental processes in plants and recent advances in Developmental Biology through scientific literature and research-oriented learning.
6. Critically analyze recent advances in developmental biology

TEXT BOOK(S)

1. Balinsky, B. I., & Fabian, B. C. (2018). *An introduction to embryology* (5th ed.). CBS Publishers & Distributors.
2. Gilbert, S. F., & Barresi, M. J. F. (2020). *Developmental biology* (12th ed.). Sinauer Associates.
3. Rastogi, V. B. (2019). *Developmental biology*. MedTech Science Press.
4. Verma, P. S., & Agarwal, V. K. (2021). *Cell biology, genetics, molecular biology, evolution and ecology*. S. Chand Publishing.
5. Wolpert, L., Tickle, C., & Arias, A. M. (2019). *Principles of development* (6th ed.). Oxford University Press.

REFERENCE BOOK(S)

1. Carlson, B. M. (2019). *Human embryology and developmental biology* (6th ed.). Elsevier.
2. Hall, B. K., & Hallgrímsson, B. (2020). *Strickberger's evolution* (5th ed.). Jones & Bartlett Learning.
3. Lewin, B. (2018). *Genes XII*. Jones & Bartlett Learning.
4. Minelli, A. (2019). *Perspectives in animal phylogeny and evolution*. Oxford University Press.
5. Slack, J. M. W. (2021). *Essential developmental biology* (4th ed.). Wiley-Blackwell.

E-RESOURCES

1. http://www.ncbi.nlm.nih.gov
2. http://www.devbiointeractive.org
3. http://www.sdbonline.org
4. http://www.nature.com/nrg

5. http://pubmed.ncbi.nlm.nih.gov
6. www.ncbi.nlm.nih.gov
7. www.nature.com/nrg
8. www.devbiointeractive.org
9. embryo.asu.edu
10. www.embl.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	3	2	2	1	2	3	2	3	2	2	2	3	3	3	3
CO 2	1	2			2	2	2	2	2	2	2	3	3		2
CO 3	3	2			2	3		2	1	2	2	3	2		3
CO 4	2	2	2	1	3	2	2	3	2	2	2	1	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3		3
CO 6	2	2	2	1	3	2	2	3	2	2	2	1	3	2	3

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SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF BIOCHEMISTRY
M.SC., BIOCHEMISTRY

Semester: II- GEC- II: Bioinformatics

Ins. Hrs./Week: 4 **Course Credit**: 4 **Course Code**: **P26BCGE22B**

COURSE OBJECTIVES

- To provide fundamental knowledge of bioinformatics, biological databases, and computational tools used in molecular biology research.
- To develop understanding of protein structure, structure prediction methods, and computational approaches for protein modeling.
- To impart knowledge on biological sequence analysis, sequence alignment algorithms, scoring matrices, and phylogenetic analysis.
- To familiarize students with protein structure visualization and classification tools used in structural bioinformatics.
- To explain the applications of functional genomics, genome databases, microarray analysis, and bioinformatics approaches in drug discovery and systems biology.

UNIT- I: Bioinformatics (12 Hours)

An overview, Definition & History; Bioinformatics databases & tools on the Internet- NCBI, EBI, PIR, Swiss-Prot, GenBank ; pattern and motif searches- BLOCKS, PRINTS, PFAM

UNIT-II: Proteins Amino Acids Forensic Applications of Biochemistry (12 Hours)

Levels of protein structure – Ramachandran Plot. Protein Secondary structure prediction - Chou-Fasman rules, Gamier-Osguthorpe-Robson (GOR) methods; Predicting 3D structure – homology modeling, threading - fold recognition and ab initio methods -- Rosetta – CASP.

UNIT-III: Biological Sequence Analysis (12 Hours)

Pairwise sequence comparison – Sequence queries against biological databases – BLAST and FASTA - Multiple sequence alignments –Phylogenetic alignment. Algorithms and Matrices: Scoring matrices- PAM and BLOSUM; dynamic programming Algorithms, Needleman and Wunsch, Smith-Waterman;

UNIT-IV: Protein Structure Visualization Tools (12 Hours)

Ras Mol, HEX, Argus Lab Swiss PDB Viewer - Structure –Classification, alignment and analysis – SCOP, CATH, FSSP, UNIX.

UNIT-V: Functional Genomics (Metabolism and Regulation) (12 Hours)

Sequencing genomes– Genome databases on the web, Prokaryotic Genome Database with comparison with Human genome, HGP, GENE CLUSTER, DNA Microarray, SWISS-2DPAGE Database, TIGR, WIT, CYTOSCAPE and DRUG DISCOVERY.

UNIT-VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Model Predictions: Using Bioinformatics tools to predict protein models in disease related pathways.

Total Lecture Hours-60

COURSE OUTCOMES

The students are able to

1. Explain the fundamentals, history, databases, and online tools used in Bioinformatics and biological data analysis.
2. Analyze protein structure, sequence alignment, phylogenetic relationships, and structural prediction methods using computational approaches.
3. Apply bioinformatics algorithms, scoring matrices, and sequence analysis tools for interpretation of genomic and proteomic data.
4. Utilize protein visualization software, genome databases, and functional genomics resources in biological and biomedical research.
5. Demonstrate practical knowledge in computational modeling, drug discovery, and disease-related protein prediction using modern bioinformatics tools.
6. Understand molecular mechanisms and apply computational approaches in biomedical research.

TEXT BOOK(S)

1. Attwood, T. K., & Parry-Smith, D. J. (2019). *Introduction to bioinformatics* (2nd ed.). Pearson Education.
2. Lesk, A. M. (2021). *Introduction to bioinformatics* (6th ed.). Oxford University Press.
3. Rastogi, S. C., Mendiratta, N., & Rastogi, P. (2020). *Bioinformatics: Methods and applications* (5th ed.). PHI Learning Pvt. Ltd.
4. Mount, D. W. (2019). *Bioinformatics: Sequence and genome analysis* (2nd ed.). Cold Spring Harbor Laboratory Press.
5. Pevsner, J. (2023). *Bioinformatics and functional genomics* (4th ed.). Wiley-Blackwell.

REFERENCE BOOK(S)

1. Baxevanis, A. D., & Ouellette, B. F. F. (Eds.). (2020). *Bioinformatics: A practical guide to the analysis of genes and proteins* (4th ed.). Wiley-Interscience.
2. Bourne, P. E., & Weissig, H. (Eds.). (2019). *Structural bioinformatics* (2nd ed.). Wiley-Liss.
3. Campbell, A. M., & Heyer, L. J. (2021). *Discovering genomics, proteomics and bioinformatics* (3rd ed.). Pearson.
4. Jones, N. C., & Pevzner, P. A. (2018). *An introduction to bioinformatics algorithms*. MIT Press.
5. Xiong, J. (2022). *Essential bioinformatics*. Cambridge University Press.

E-RESOURCES

1. http://www.ncbi.nlm.nih.gov
2. http://www.ebi.ac.uk
3. http://www.uniprot.org
4. http://www.rcsb.org
5. http://www.genome.jp/kegg/
6. www.ncbi.nlm.nih.gov
7. www.ebi.ac.uk
8. www.uniprot.org

9. www.rcsb.org
10. www.cytoscape.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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CO 2	1	2			2	2	2	2	2	2	2	3	3		2
CO 3	3	2			2	3		2	1	2	2	3	2		3
CO 4	2	2	2	1	3	2	2	3	2	2	2	1	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3		3
CO 6	2	2	2	1	3	2	2	3	2	2	2	1	3	2	3

S-Strong (3) M-Medium (2) L-Low (1)

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF BIOCHEMISTRY

Semester: II- GEC- II: Bioethics and IPR

Ins. Hrs./Week: 4 **Course Credit**: 4 **Course Code**: **P26BCGE22C**

COURSE OBJECTIVES

- To provide knowledge on biosafety regulations, national and international biosafety policies, and risk assessment procedures in biotechnology.
- To develop understanding of laboratory and environmental biosafety issues related to genetically modified organisms and recombinant DNA technology.
- To explain the ecological impact of GMOs, biodiversity conservation, monitoring strategies, and radiation safety measures.
- To impart knowledge on intellectual property rights, patents, copyrights, trademarks, and international agreements related to biotechnology.
- To familiarize students with patent filing procedures, protection of plant varieties, biodiversity conventions, and commercialization aspects of biotechnology products.

UNIT-I: Biosafety and Risk Assessment Issues (12 Hours)

Regulatory framework; National biosafety policies and law, The Cartagena protocol on biosafety, WTO and other international agreements related to biosafety, Cross border movement of germplasm; Risk management issues - containment.

UNIT-II:Laboratory and Environmental Biosafety (12 Hours)

Health aspects; toxicology, allergenicity, antibiotic resistance, etc; Impact on environment: gene flow in natural and artificial ecologies; Sources of gene escape, tolerance of target organisms, creation of superweeds/superviruses, etc.

UNIT -III: Ecological Impact of GMOs and Biodiversity (12 Hours)

Monitoring strategies and methods for detecting transgenics; Radiation safety and non-isotopic procedure; Benefits of transgenics to human health, society and the environment.

UNIT – IV: The Wto and other International Agreements (12 Hours)

Intellectual properties, copyrights, trademarks, trade secrets, patents, geographical indications, etc; Protection of plant variety and farmers right act; Indian patent act and amendments.

UNIT – V: Patent Filing; Convention on Biological Diversity (12 Hours)

Implications of intellectual property rights on the commercialization of biotechnology products.

UNIT-VI: Current Contours (For Continuous Internal Assessment Only-Self Study)

Study the philosophical, social, and legal issues arising in medicine and the life sciences. Discuss on the rights given to persons over the creations of their minds.

Total Lecture Hours-60

COURSE OUTCOMES

The students are able to,

1. Implement various aspects of biosafety and carry out risk assessment of products in biological research
2. Understand 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.
3. Appreciate the intellectual property rights and its implementation of on the invention related to biological research.
4. Understand the statutory bodies that regulate the property rights and its validity in various countries.
5. Critique the ethical concerns associated with modern biotechnology processes and plan accordingly.
6. Analyze philosophical, social, and legal issues in medicine and life sciences

TEXT BOOK(S)

1. Krishna, V. Shree. (2007). *Bioethics and biosafety in biotechnology*. New Age International Pvt. Ltd. Publishers.
2. Goel, D., & Parashar, S. (2013). *IPR, biosafety and bioethics*. Pearson.
3. Freshney, R. I. (2016). *Culture of animal cells: A manual of basic technique and specialized applications* (6th ed.). John Wiley & Blackwell.
4. Indian Patent Act 1970: Acts & rules (Bare Act). (2024). Universal Law Publishing Co. Pvt. Ltd.
5. Yadav, P. K., & Mishra, S. R. (n.d.). *Environmental biology*. Discovery Publishing House.

REFERENCE BOOK(S)

1. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC). (2020). *Biosafety in microbiological and biomedical laboratories* (6th ed.).
2. Kankanala, C. (2007). *Genetic patent law & strategy* (1st ed.). Manupatra Information Solution Pvt. Ltd.
3. Negi, S. S. (2008). *A handbook of environmental science*.
4. Panday, P. (2010). *A textbook of environmental pollution*.
5. Gould, G. W. (1995). *New methods of food preservation* (1st ed.). Springer.
6. Baltz, R. H., et al. (Eds.). (2010). *Manual of industrial microbiology and biotechnology* (3rd ed.). ASM Press.

E-RESOURCES

1. http://online.sfsu.edu/~rone/GEessays/gedanger.html
2. http://www.actahort.org/members/showpdf?booknrarnr=447_125
3. http://www.cordis.lu/elsa/src/about.html
4. http://books.cambridge.org/0521384737.html
5. http://www.csmt.ewu.edu/csmt/chem/jcorkill/bioch480/bioLN98.html
6. http://www.accessexcellence.org/AE/AEPC/BE02/ethics/ethintro.html
7. www.cbd.int
8. bch.cbd.int/protocol

9. www.wto.org
10. www.wipo.int
11. www.ipindia.gov.in

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	1	2	3	2	3	2	2	2	3	3	3	3
CO 2	3	2			2	2	2	3	2	2	3	2	3		3
CO 3	2	2			3	2		2	1	1	2	3	2		3
CO 4	3	2	2	2	2	3	2	3	2	2	2	3	3	2	3
CO 5	3	2	2	1	2	3	2	1	2	2	2	3	3		3
CO 6	2	2			3	2		2	1	1	2	3	2		3

S-Strong (3) M-Medium (2) L-Low (1)

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI – 614 016
(For the Candidates admitted in the academic year 2026–2027)
DEPARTMENT OF BIOCHEMISTRY

Semester: II-SEC- II: **Medical Coding and Healthcare Documentation**
Ins. Hrs./Week:2 **Course Credit**:2 **Course Code**: **P26SEBC22**

COURSE OBJECTIVES

- To provide fundamental knowledge of healthcare delivery systems, medical coding principles, healthcare documentation, and ethical practices in medical coding.
- To develop understanding of human anatomy, physiology, medical terminology, and clinical laboratory terminology relevant to coding practices.
- To impart knowledge on ICD-10-CM coding systems, disease classification, and coding guidelines for major disorders and clinical conditions.
- To familiarize students with CPT and HCPCS coding systems, laboratory procedure coding, billing processes, and insurance claim management.
- To develop practical skills in medical coding workflow, coding software usage, clinical case analysis, audit procedures, and career preparation in healthcare and medical coding industries.

UNIT I – Introduction to Medical Coding and Healthcare System (6 Hours)

Introduction to healthcare delivery systems, Medical coding: definition, importance, and scope, Role of medical coders in hospitals and insurance sectors, Electronic Health Records (EHR) and healthcare documentation, Overview of medical terminology, abbreviations, and symbols, Ethics, confidentiality, and HIPAA basics

UNIT II – Human Anatomy, Physiology and Medical Terminology (6 Hours)

Basic anatomy and physiology relevant to coding, Organization of the human body and body systems, Common pathological conditions and disease terminology, Diagnostic and laboratory terminology in biochemistry, Prefixes, suffixes, root words, and pronunciation of medical terms, Clinical laboratory reports and interpretation basics

UNIT III – ICD Coding System and Disease Classification (6 Hours)

Introduction to ICD-10-CM coding system, Structure and conventions of ICD coding, Coding guidelines for infectious diseases, metabolic disorders, and endocrine diseases Coding of diabetes mellitus, liver disorders, cardiovascular diseases, and cancers Use of coding manuals and indexing techniques, Case studies in disease coding

UNIT IV – CPT, HCPCS and Laboratory Procedure Coding (6 Hours)

Introduction to CPT coding system, Categories of CPT codes, HCPCS Level I and Level II coding, Coding for biochemical laboratory investigations and diagnostic procedures
Billing and reimbursement process, Insurance claims and denial management, Practical exercises in laboratory procedure coding

UNIT -V: Practical Training and Career Development in Medical Coding (6 Hours)

Medical coding workflow and software tools, Clinical case analysis and coding practice

Audit and quality assurance in coding, Resume preparation and interview skills for medical coding jobs, Career opportunities in hospitals, CROs, insurance, and healthcare IT sectors, Emerging trends: AI in medical coding and digital health informatics

UNIT -VI: Current Contours (For Continuous Internal Assessment Only – Self Study)
Recent advances in medical coding and health informatics: AI-assisted medical coding, electronic health information systems, telemedicine documentation, robotic process automation in healthcare billing, predictive analytics in healthcare management and emerging career opportunities in healthcare informatics.

Total Lecture Hours-60

COURSE OUTCOMES
The students are able to

1. Understand the principles of healthcare systems, medical coding, healthcare documentation, and ethical practices in medical records management.
2. Apply knowledge of human anatomy, physiology, medical terminology, and biochemical laboratory concepts in interpreting clinical documents.
3. Demonstrate competency in ICD-10 coding and disease classification for common clinical and biochemical disorders.
4. Perform CPT and HCPCS coding for laboratory procedures, diagnostic investigations, billing, and insurance claim processing.
5. Analyze clinical cases using medical coding software tools and develop employability skills for careers in healthcare documentation and medical coding industries.
6. Understand recent advances in medical coding and health informatics and identify emerging career opportunities in the field.

TEXT BOOK(S)

1. Carol J. Buck. *Step-by-Step Medical Coding*. Elsevier Publications.
2. Mary Jo Bowie. *Understanding ICD-10-CM and ICD-10-PCS*. Cengage Learning.
3. Jane Rice. *Medical Terminology for Health Professions*. Cengage Learning.
4. Beverley Henderson and Kathy Dorsey. *Medical Terminology for Dummies*. Wiley Publications.
5. Ingenix. *CPT Professional Edition*. American Medical Association.

REFERENCE BOOK(S)

1. Elsevier. *ICD-10-CM Expert for Physicians*. Elsevier Health Sciences.
2. American Medical Association. *Current Procedural Terminology (CPT) Manual*.
3. F.A. Davis. *Comprehensive Medical Assisting*. F.A. Davis Company.
4. Patricia T. Aalseth. *ICD-10 Coding Handbook*. American Health Information Management Association.
5. AHIMA. *Medical Coding Training Workbook*. AHIMA Publications.

E-RESOURCES

1. http://www.who.int/classifications/icd/en/
2. http://www.ahima.org
3. http://www.aapc.com
4. http://www.ncbi.nlm.nih.gov
5. http://www.cdc.gov/nchs/icd.html
6. www.who.int/classifications/icd
7. www.aapc.com

8. www.ahima.org
9. www.cms.gov
10. www.nlm.nih.gov

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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CO 2	1	2			2	2	2	2	2	2	2	3	3		2
CO 3	3	2			2	3		2	1	2	2	3	2		3
CO 4	2	2	2	1	3	2	2	3	2	2	2	1	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3		3
CO 6	2	2	2	1	3	2	2	3	2	2	2	1	3	2	3

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SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
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DEPARTMENT OF BIOCHEMISTRY

Semester: II-NME I: Biochemistry of Lifestyle Disorders
Ins. Hrs./Week:2 Course Credit:2 Course Code: P26NMEBC21

COURSE OBJECTIVES

- To provide fundamental knowledge on lifestyle diseases, their causes, risk factors, and biochemical basis.
- To develop understanding of the biochemical mechanisms, biomarkers, complications, and management of Type 2 Diabetes Mellitus.
- To explain the metabolic and hormonal changes associated with obesity and metabolic syndrome and their preventive measures.
- To impart knowledge on the biochemical aspects of cardiovascular diseases, lipoprotein metabolism, and public health significance.
- To familiarize students with women's lifestyle diseases including PCOD, infertility, osteoporosis, breast cancer, and cervical cancer, along with their diagnosis and management.

UNIT- I: Introduction to Lifestyle Diseases (6 Hours)
Definition and classification of lifestyle diseases, Factors contributing to lifestyle diseases: diet, physical inactivity, stress, smoking, alcohol, Role of biochemistry in understanding lifestyle disorders.

UNIT- II: Biochemistry of Type 2 Diabetes Mellitus (6 Hours)
Biochemical basis and progression of T2DM, Role of lifestyle in onset and management, Complications: neuropathy, nephropathy, retinopathy, Biomarkers: fasting glucose, HbA1c, insulin levels. Role of diet- Functional foods and natural supplements, exercise and weight management.

UNIT- III: Biochemistry of Obesity and Metabolic Syndrome (6 Hours)
Causes, symptoms, types, preventive measures and treatment of obesity, Hormonal regulation: insulin, leptin, adiponectin, Biomarkers of obesity: lipid profile, inflammatory cytokines-TNF-α and IL-6.

UNIT- IV: Biochemistry of Cardiovascular Diseases (6 Hours)
Role of lipoproteins (LDL, HDL, VLDL), Overview and types: coronary artery disease, stroke, atherosclerosis, hypertension, Prevalence and impact on public health.

UNIT- V: Women's lifestyle diseases (6 Hours)
Causes, symptoms, diagnosis and treatment of Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis.

UNIT – VI: Current Contours (For Continuous Internal Assessment Only-Self Study)
Public health strategies, awareness programmes and screening methods for early detection of lifestyle disorders. Role of nutrigenomics and personalized nutrition in lifestyle disease management.

Total Lecture Hours-30

COURSE OUTCOMES
The students are able to,

1. Explain the definition, classification, and contributing factors of lifestyle diseases.
2. Analyze the biochemical mechanisms underlying Type 2 Diabetes Mellitus and evaluate the role of lifestyle modifications in its prevention and management.
3. Interpret the biochemical and hormonal basis of obesity.
4. Describe the biochemical basis of cardiovascular diseases.
5. Identify and explain women-specific lifestyle diseases.
6. Understand public health strategies, screening methods for early detection of lifestyle diseases, and the role of nutrigenomics and personalized nutrition in disease management.

TEXT BOOK(S)

1. Satyanarayana, U., & Chakrapani, U. (2020). Biochemistry (5th ed.). Elsevier.
2. Nelson, D. L., & Cox, M. M. (2021). Lehninger Principles of Biochemistry (8th ed.). W.H. Freeman.
3. Chatterjea, M. N., & Shinde, R. (2018). Textbook of Medical Biochemistry (9th ed.). Jaypee Brothers Medical Publishers.
4. Rolfes, S. R., Pinna, K., & Whitney, E. (2020). Understanding Normal and Clinical Nutrition (11th ed.). Cengage Learning.
5. Guyton, A. C., & Hall, J. E. (2021). Textbook of Medical Physiology (14th ed.). Elsevier.

REFERENCE BOOK(S)

1. Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W., & Weil, P. A. (2018). Harper's Illustrated Biochemistry (31st ed.). McGraw-Hill Education.
2. Powers, A. C. (2021). Diabetes Mellitus: Pathophysiology and Clinical Guidelines. Elsevier.
3. Bray, G. A., & Bouchard, C. (Eds.). (2014). Handbook of Obesity: Clinical Applications (4th ed.). CRC Press.
4. Libby, P., Bonow, R. O., Mann, D. L., & Zipes, D. P. (2018). Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine (11th ed.). Elsevier.
5. Misra, A. (2017). Nutrition and Cardiometabolic Health. Springer.

E- RESOURCES

1. https://ccrum.res.in/writereaddata/UploadFile/Lifestyle0Diseases0English0Folder_1104
2. https://www.indushealthplus.com/corporate-checkups/lifestyle-diseases-emerging-issue-
3. https://youtu.be/jDdL2bMQXfE
4. https://youtu.be/7WnpSB14nDM
5. https://ebooks.inflibnet.ac.in/antp16/chapter/lifestyle-diseases-quality-of-life/
6. www.who.int/health-topics/noncommunicable-diseases
7. www.diabetes.org
8. www.cdc.gov/heartdisease
9. www.nih.gov
10. ww.wcrf.org

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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CO 2	3	2	3		2	3	2	3	2	2	2	3	3	2	3
CO 3	3	2			2	3	2	3	1	2	2	3	3		3
CO 4	3	2	2	1	3	3	2	3	2	2	2	1	3	2	3
CO 5	3	2	2	1	2	3	2	3	2	2	2	3	3	1	3
CO 6	3	2			2	3	2	3	1	2	2	3	3		3

S-Strong (3) M-Medium (2) L-Low (1)