

# M.Sc., BIOCHEMISTRY

## Syllabus

**Programme Code: 2PSBIC**

**2025-2027**

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**SENGAMALA THAYAR EDUCATIONAL TRUST  
WOMEN'S COLLEGE (AUTONOMOUS)**

(Affiliated to Bharathidasan University, Tiruchirappalli)  
(Accredited by NAAC)

**Sundarakkottai, Mannargudi – 614016,  
Thiruvarur (Dt.), Tamil Nadu, India.**



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**SUNDARAKKOTTAI, MANNARGUDI – 614016**

**TAMIL NADU, INDIA**

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## **M.Sc., BIOCHEMISTRY**

### **CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS–LOCF)**

*(For the candidates admitted in the academic year 2025–2026)*

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#### **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 within 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 Specific Elective Courses (DSE):** Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). 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 opt Generic 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 (NME):** 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 a report 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

### **Postgraduate Programme:**

**Programme Pattern:** The Post Graduate degree programme consists of **FIVE** vital components.

They are as follows:

|               |   |                                                                              |
|---------------|---|------------------------------------------------------------------------------|
| Part –A       | : | Core Course (Theory, Practical) Core Industry Module, Core Project           |
| Part-B (i)    | : | Elective courses                                                             |
| Part-B (ii)   | : | Non Major Elective, Skill Enhancement course, Professional Competency course |
| Part-B (iii): |   | Internship                                                                   |
| Part –C       | : | Extension activity                                                           |

## **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**

**Part A:** includes two sub sections

**Part A1** (10X1=10 marks)

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

Two Questions from Each unit

**Part A2** (5X2=10 marks)

Match the following/ Short Answers

One question from each unit

**Total Marks-20**

**Part B:** (5X5=25 marks)

Paragraph Answers either/or type,

One Question from each unit

**Part C:** (10X3=30 marks)

Essay Type Answers Answer 3 out of 5 Questions

One Question from each unit

**Part A:** K1 Level

**Part B:** K2, K3 and K4 Level

**Part 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/<br>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)<br>K-LEVELS →             | Lower Order Thinking |    |    | Higher Order Thinking |    |    | Total     |
|---------------------------------------------|----------------------|----|----|-----------------------|----|----|-----------|
|                                             | K1                   | K2 | K3 | K4                    | K5 | K6 |           |
| <b>END SEMESTER EXAMINATIONS (ESE)</b>      | 20                   | 25 |    |                       | 30 |    | <b>75</b> |
| <b>Continuous Internal Assessment (CIA)</b> | 20                   | 25 |    |                       | 30 |    | <b>75</b> |

### QUESTION PATTERN FOR END SEMESTER EXAMINATION / Continuous Internal Assessment

| PART                                                                                 | MARKS     |
|--------------------------------------------------------------------------------------|-----------|
| <b>PART–A I.</b> (No choice, One Mark) <b>TWO</b> questions from each unit (10x1=10) | <b>20</b> |
| <b>II.</b> (No choice, Two Mark) <b>ONE</b> question from each unit (5x2=10)         |           |
| <b>PART–B</b> (Either/or type, 5-Marks) <b>ONE</b> question from each unit (5x5=25)  | <b>25</b> |
| <b>PART–C</b> (3 out of 5)(10 Marks) <b>ONE</b> question from each unit (3x10=30)    | <b>30</b> |
| <b>Total</b>                                                                         | <b>75</b> |

### BLUE PRINT OF QUESTION PAPER FOR END SEMESTER EXAMINATION

| DURATION: 3.00 Hours.                                                                                                            |  |           |           |           |           |    |    | Max Mark:75 |
|----------------------------------------------------------------------------------------------------------------------------------|--|-----------|-----------|-----------|-----------|----|----|-------------|
| K-LEVELS                                                                                                                         |  | K1        | K2        | K3        | K4        | K5 | K6 | Total Marks |
| <b>PART</b>                                                                                                                      |  |           |           |           |           |    |    |             |
| <b>PART–A</b> (One Mark, No choice) (10x1=10)                                                                                    |  | 10        |           |           |           |    |    | <b>10</b>   |
| (2-Marks, No choice) (5x2=10)                                                                                                    |  | 10        |           |           |           |    |    | <b>10</b>   |
| <b>PART–B</b> (5-Marks) (Either/or type) (5x5=25)                                                                                |  |           | 5         | 10        | 10        |    |    | <b>25</b>   |
| <b>PART –C</b> (10 Marks) (3 out of 5) (3x10=30)                                                                                 |  |           |           |           |           | 20 | 10 | <b>30</b>   |
| Courses having only <b>K5, K6</b> levels, K5 level- 3 Questions, K6 level - 2 Questions<br>(One K6 level question is compulsory) |  |           |           |           |           |    |    |             |
| <b>Total</b>                                                                                                                     |  | <b>20</b> | <b>05</b> | <b>10</b> | <b>10</b> | 20 | 10 | <b>75</b>   |

## 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:

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

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 in Table-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**

| <b>CGPA</b>    | <b>Corresponding Grade</b> | <b>Classification of Final Result</b> |
|----------------|----------------------------|---------------------------------------|
| 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.

## PROGRAMME OUTCOME

| PO. No | Programme Outcomes<br>(Upon completion of the M.Sc., Degree Programme, the Post graduate will be able to)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PO-1   | <b>Disciplinary Knowledge:</b> 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   | <b>Critical Thinking and Problem Solving:</b> 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   | <b>Information/digital literacy and Communication Skills:</b> 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   | <b>Research-related skills:</b> 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   | <b>Scientific reasoning and Reflective Thinking:</b> 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   | <b>Multidisciplinary Approach, Innovation and Entrepreneurship:</b> 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   | <b>Moral and ethical awareness/reasoning:</b> 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   | <b>Self directed Learning:</b> work independently, identify appropriate resources required for a project, and manage a project till completion.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| PO-9   | <b>Lifelong Learning:</b> 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  | <b>Multicultural Competence, Social Interaction and Effective Citizenship:</b> 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                                                                                                                                                                                                    |

## PROGRAMME SPECIFIC OUTCOME

| <b>PSO.<br/>No</b> | <b>Programme Specific Outcomes</b><br><i>(Upon completion of the M.Sc., Degree Programme, the Post graduate will be able to)</i>                                                                                                                                                                                         |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PSO1</b>        | 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.    |
| <b>PSO2</b>        | 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  |
| <b>PSO3</b>        | 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. |
| <b>PSO4</b>        | 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.                                                                                                                               |
| <b>PSO5</b>        | 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.                          |



# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE (AUTONOMOUS)

(Affiliated to Bharathidasan University, Tiruchirappalli)

(Accredited by NAAC)

SUNDARAKKOTTAI, MANNARGUDI – 614 016

TAMIL NADU, INDIA

## M.Sc., BIOCHEMISTRY COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM (CBCS-LOCF)

(For the candidates admitted from the academic year 2025-2026)

**ELIGIBILITY:** 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

| Semester | Part         | Course                         | Course Code                           | Title of the Paper                                                            | Ins. Hours / Week | Ins. Hours/ Week |          |          |          | Credit    | Exam Hours | Marks |     | Total      |
|----------|--------------|--------------------------------|---------------------------------------|-------------------------------------------------------------------------------|-------------------|------------------|----------|----------|----------|-----------|------------|-------|-----|------------|
|          |              |                                |                                       |                                                                               |                   | L                | T        | P        | S        |           |            | CIA   | ESE |            |
| I        | Part A       | Core Course–I                  | P25BC101                              | Advanced Biochemistry                                                         | 6                 | 4                | 1        | -        | 1        | 5         | 3          | 25    | 75  | 100        |
|          |              | Core Course–II                 | P25BC102                              | Bioanalytical Techniques                                                      | 6                 | 4                | 1        | -        | 1        | 5         | 3          | 25    | 75  | 100        |
|          |              | Core Practical-I               | P25BC103P                             | Bioanalytical Techniques (P)                                                  | 6                 | -                | -        | 6        | -        | 3         | 3          | 25    | 75  | 100        |
|          | Part B (i)   | Elective Course–I              | P25BCE11A/<br>P25BCE11B/<br>P25BCE11C | Microbiology and Immunology/<br>Nanotechnology/<br>Biochemical Toxicology     | 5                 | 4                | 1        | -        | -        | 3         | 3          | 25    | 75  | 100        |
|          |              | Elective Course–II             | P25BCE12A/<br>P25BCE12B/<br>P25BCE12C | Energy and Drug Metabolism/ Genetics/<br>Biotechnology                        | 5                 | 4                | 1        | -        | -        | 3         | 3          | 25    | 75  | 100        |
|          | Part B (ii)  | Non Major Elective-I           | -                                     | -                                                                             | 2                 | 2                | -        | -        | -        | 2         | 3          | 25    | 75  | 100        |
|          |              | <b>TOTAL</b>                   |                                       |                                                                               | <b>30</b>         | <b>18</b>        | <b>4</b> | <b>6</b> | <b>2</b> | <b>21</b> | -          | -     | -   | <b>600</b> |
| II       | Part A       | Core Course–III                | P25BC204                              | Physiology and Cell Biology                                                   | 6                 | 4                | 1        | -        | 1        | 5         | 3          | 25    | 75  | 100        |
|          |              | Core Course–IV                 | P25BC205                              | Enzymology                                                                    | 6                 | 4                | 1        | -        | 1        | 5         | 3          | 25    | 75  | 100        |
|          |              | Core Practical-II              | P25BC206P                             | Enzymology, Microbiology and Cell Biology (P)                                 | 6                 | -                | -        | 6        | -        | 3         | 3          | 25    | 75  | 100        |
|          | Part B (i)   | Elective Course –III           | P25BCE23A/<br>P25BCE23B/<br>P25BCE23C | Ecology and Environmental Sciences/Industrial Microbiology/Plant Biochemistry | 5                 | 4                | 1        | -        | -        | 3         | 3          | 25    | 75  | 100        |
|          |              | Elective Course-IV             | P25BCE24A/<br>P25BCE24B/<br>P25BCE24C | Biosafety, Lab Safety and IPR /Genomics and Proteomics/ Cancer Biology        | 5                 | 4                | 1        | -        | -        | 3         | 3          | 25    | 75  | 100        |
|          | Part B (ii)  | Non Major Elective-II          | -                                     | -                                                                             | 2                 | 2                | -        | -        | -        | 2         | 3          | 25    | 75  | 100        |
|          | Part B (iii) | Internship/Industrial Activity |                                       |                                                                               | -                 | -                | -        | -        | -        | -         | -          | -     | -   | -          |
|          |              | <b>TOTAL</b>                   |                                       |                                                                               | <b>30</b>         | <b>18</b>        | <b>4</b> | <b>6</b> | <b>2</b> | <b>21</b> | -          | -     | -   | <b>600</b> |

| Semester     | Part         | Course                                                 | Course Code                           | Title of the Paper                                                                                      | Ins. Hours/<br>Week | Ins. Hours/<br>Week |    |    |   | Credit | Exam Hours | Marks |     | Total |
|--------------|--------------|--------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------|---------------------|----|----|---|--------|------------|-------|-----|-------|
|              |              |                                                        |                                       |                                                                                                         |                     | L                   | T  | P  | S |        |            | CIA   | ESE |       |
| III          | Part A       | Core Course –V                                         | P25BC307                              | Cellular Metabolism                                                                                     | 6                   | 4                   | 1  | -  | 1 | 5      | 3          | 25    | 75  | 100   |
|              |              | Core Course –VI                                        | P25BC308                              | Clinical Biochemistry                                                                                   | 6                   | 4                   | 1  | -  | 1 | 5      | 3          | 25    | 75  | 100   |
|              |              | Core Practical-III                                     | P25BC309P                             | Clinical Biochemistry (P)                                                                               | 6                   | -                   | -  | 6  | - | 3      | 3          | 25    | 75  | 100   |
|              |              | Core Industry Module                                   | P25BCI31                              | Pharmaceutical Biochemistry                                                                             | 5                   | 4                   | 1  | -  | - | 3      | 3          | 25    | 75  | 100   |
|              | Part B (i)   | Elective Course - V                                    | P25BCE35A/<br>P25BCE35B/<br>P25BCE35C | Research Methodology/<br>Biostatistics and<br>Data sciences / Gene<br>Editing, Cell<br>and Gene therapy | 5                   | 4                   | 1  | -  | - | 3      | 3          | 25    | 75  | 100   |
|              | Part B (ii)  | Skill Enhancement Course                               | P25SEBC31                             | Clinical Lab Technology                                                                                 | 2                   | 2                   | -  | -  | - | 2      | 3          | 25    | 75  | 100   |
|              | Part B (iii) | Internship/<br>Industrial Activity                     | P25BCIA31                             | Internship/Industrial Activity                                                                          | -                   | -                   | -  | -  | - | 2      | -          | -     | -   | -     |
|              |              | TOTAL                                                  |                                       |                                                                                                         | 30                  | 18                  | 4  | 6  | 2 | 23     | -          | -     | -   | 600   |
| IV           | Part A       | Core Course – VII                                      | P25BC410                              | Molecular Biology                                                                                       | 5                   | 3                   | 1  | -  | 1 | 5      | 3          | 25    | 75  | 100   |
|              |              | Core Course- VIII                                      | P25BC411                              | Developmental Biology                                                                                   | 5                   | 3                   | 1  | -  | 1 | 5      | 3          | 25    | 75  | 100   |
|              |              | Core Practical- IV                                     | P25BC412P                             | Molecular Biology Techniques (P)                                                                        | 6                   | -                   | -  | 6  | - | 3      | 3          | 25    | 75  | 100   |
|              |              | Core Project                                           | P25BCPW                               | Project with VivaVoce                                                                                   | 8                   | -                   | 2  | 6  | - | 7      | 3          | 25    | 75  | 100   |
|              | Part B (i)   | Elective Course –VI<br>(Industry/<br>Entrepreneurship) | P25BCE46A/<br>P25BCE46B/<br>P25BCE46C | Forensic Science /<br>Drug Design &<br>Development /<br>Advances in Clinical<br>Research                | 4                   | 3                   | 1  | -  | - | 3      | 3          | 25    | 75  | 100   |
|              | Part B (ii)  | Professional Competency Course                         | P25PCBC41                             | Life Sciences for Competitive Examination                                                               | 2                   | 2                   | -  | -  | - | 2      | 3          | 25    | 75  | 100   |
|              | Part C       | Extension Activity                                     | P25BCEA                               | Extension Activity                                                                                      | -                   | -                   | -  | -  | - | 1      | -          | -     | -   | -     |
|              | TOTAL        |                                                        |                                       |                                                                                                         | 30                  | 11                  | 5  | 12 | 2 | 26     | -          | -     | -   | 600   |
| GRAND TOTAL  |              |                                                        |                                       |                                                                                                         | 120                 | 65                  | 17 | 30 | 8 | 91     |            |       |     | 2400  |
| Extra Credit |              |                                                        |                                       | MOOC/ SWAYAM/<br>NPTEL                                                                                  | -                   | 2                   | -  | -  | - | -      |            |       |     |       |
|              |              |                                                        |                                       | Value Added Courses<br>(At least One Per Year)                                                          | -                   | 2                   | -  | -  | - | -      |            |       |     |       |

**CREDIT DISTRIBUTION FOR PGPROGRAMME**

| <b>S. No.</b>                                                                                                    | <b>Subject</b>                 | <b>No. of Courses</b> | <b>Total Credits</b> |
|------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------|----------------------|
| <b>Part A</b>                                                                                                    | Core Course                    | 8                     | 40                   |
|                                                                                                                  | Core Practical                 | 4                     | 12                   |
|                                                                                                                  | Project Work with Viva Voce    | 1                     | 7                    |
|                                                                                                                  | Core Industry Module           | 1                     | 3                    |
| <b>Part B (i)</b>                                                                                                | Elective Course                | 6                     | 18                   |
| <b>Part B (ii)</b>                                                                                               | Non Major Elective             | 2                     | 4                    |
|                                                                                                                  | Skill Enhancement Course       | 1                     | 2                    |
|                                                                                                                  | Professional Competency Course | 1                     | 2                    |
| <b>Part B (iii)</b>                                                                                              | Internship                     | 1                     | 2                    |
| <b>Part C</b>                                                                                                    | Extension Activity             | 1                     | 1                    |
|                                                                                                                  | <b>Total</b>                   | <b>26</b>             | <b>91</b>            |
| <b>L-Lecture                      T-Tutorial                      P-Practical                      S-Seminar</b> |                                |                       |                      |

Part A component and Part B (i) will be taken into account for CGPA calculation for the postgraduate programme and the other components of Part B and Part C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the PG degree.

**NON MAJOR ELECTIVE (NME) OFFERED BY THE DEPARTMENT**

| <b>Semester</b> | <b>Part</b> | <b>Course</b> | <b>Course Code</b> | <b>Title of the Paper</b>            |
|-----------------|-------------|---------------|--------------------|--------------------------------------|
| I               | Part B (ii) | NME-I         | P25NMEBC11         | Biochemistry of Life Style Disorders |
| II              |             | NME-II        | P25NMEBC22         | Diagnostic Biochemistry              |

## **SEMESTER III**



**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: III-CC-V: Cellular Metabolism**

**Ins. Hrs./Week:6**

**Course Credit:5**

**Course Code: P25BC307**

**UNIT- I: Carbohydrate Metabolism**

**(18 Hours)**

Glycolysis-aerobic and anaerobic, inhibitors and regulation. Feeder pathway-entry of hexoses into glycolysis, Galactosemia, fructosuria, Pyruvate dehydrogenase complex-mechanism and regulation. Glyoxalate cycle and its regulation. Gluconeogenesis-source, key enzymes, reaction sequence and its regulation. Blood glucose homeostasis and the role of hormones. The citric acid cycle-pathway, energetic and regulation. Pentose phosphate pathway-significance and its regulation. Metabolism of glycogen and its regulation. Biosynthesis of N-linked and O-linked glycoproteins and mucopolysaccharides-chondroitin sulphate.

**UNIT- II: Lipid Metabolism**

**(19 Hours)**

Oxidation of fatty acids-oxidation of saturated and unsaturated fatty acids ( $\alpha$ ,  $\beta$  &  $\omega$  oxidation). Oxidation of fatty acids with odd and even numbered carbon atoms. Regulation of  $\beta$  oxidation. Ketogenesis and its regulation. Biosynthesis of fatty acid-saturated and unsaturated, chain elongation, regulation. Biosynthesis of prostaglandins, thromboxanes and leukotrienes and hydroxyl eicosanoic acids. Biosynthesis and degradation of triacylglycerol, phosphoglycerolipids-lecithin, cephalin, plasmalogens and phosphatidyl inositol, Sphingolipid-sphingomyelin, cerebroside, sulfatides and gangliosides. Cholesterol-biosynthesis and its regulation. Lipoprotein metabolism-chylomicrons, VLDL, HDL and LDL.

**UNIT- III: Nucleic acid Metabolism**

**(18 Hours)**

Metabolism of nucleotides-*De novo* synthesis and salvage pathways of purine and pyrimidine nucleotides. Regulation and inhibitors of nucleotide biosynthesis. Role of ribonucleotide reductase and its regulation. Degradation of purine and pyrimidine nucleotides.

**UNIT- IV: Amino acids Metabolism**

**(19 Hours)**

Biosynthesis of non-essential amino acids-Role and biological significance of glutamate dehydrogenase, glutamine and asparagine synthetase, lysine, proline and phenylalanine hydroxylase. Inter conversion of amino acids-proline to glutamate, methionine to cysteine, serine to glycine. Biosynthesis of spermine and spermidine. Degradation of amino acids-glucogenic and ketogenic amino acids. Formation of acetate from leucine and aromatic amino acid, pyruvate from cysteine, threonine and hydroxy proline,  $\alpha$ -keto glutarate from histidine

and proline, succinate from methionine, threonine, valine and isoleucine, Oxaloacetate from aspartate, glycine and serine. Transamination, and deamination. The urea cycle and its regulation.

#### **UNIT- V: Metabolic Disorders**

**(16 Hours)**

Biosynthesis and degradation of heme. Jaundice-classification, pathology and Differential diagnosis Oxidation and reduction of inorganic sulphur compounds by microbes and plants. Sulpho transferases and their biological role-rhodanases, sulphatases, 3-mercapto pyruvate sulphur transferases. Mucopolysaccharidoses - Hunter syndrome, Sanfilippo syndrome and Maroteaux-Lamy syndrome. Oxidation of cysteine to sulphate and inter conversion of sulphur compounds.

**Total Lecture Hours-90**

#### **COURSE OUTCOME**

The students are able to

1. Discuss the pathways, regulation and physiological significance of carbohydrate metabolism.
2. Gain knowledge pathways, regulation, and biological significance of lipid metabolism, including lipoprotein metabolism.
3. Describe with biosynthesis, degradation, regulation, and metabolic significance of purine and pyrimidine nucleotides including de novo and salvage pathways.
4. Explain the biosynthesis, inter conversion, degradation and nitrogen metabolism of amino acids.
5. Correlate the disturbance of metabolic reactions to clinical manifestations with reference to heme and sulphur metabolism.

#### **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. (2021). *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](https://www.researchgate.net/publication/334458898_Urea_Cycle)
7. [https://www.researchgate.net/publication/51233381\\_Heme\\_biosynthesis\\_and\\_its\\_regulation\\_Towards\\_understanding\\_and\\_improvement\\_of\\_heme\\_biosynthesis\\_in\\_filamentous\\_fungi](https://www.researchgate.net/publication/51233381_Heme_biosynthesis_and_its_regulation_Towards_understanding_and_improvement_of_heme_biosynthesis_in_filamentous_fungi)

## 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     |

S-Strong (3)

M-Medium (2)

L-Low (1)

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE**  
**(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: III-CC-VI: Clinical Biochemistry**

**Ins. Hrs./Week:6**

**Course Credit: 5**

**Course Code: P25BC308**

**UNIT- I: Biochemical Investigation and Disorders of blood (18 Hours)**

Biochemical investigations in diagnosis, prognosis, monitoring, screening: Specimen collection-blood, (primary/secondary specimen), urine and CSF. Preservation of biological specimens -blood, urine, CSF and amniotic fluid. Biological reference ranges.

Disorders of blood cells: Hemolytic, iron deficiency and aplastic anemia and diagnosis, sickle cell anemia, thalassemia, HbA1c variants. Porphyrias, Thrombocytopenia, causes of leucopenia, leukemia and leucocytosis. Disorders of blood clotting mechanism-Von willebrand's disease, Hemophilia A, B and C, diagnostic test for clotting disorders, D-dimer and its clinical significance.

**UNIT- II: Diabetes mellitus: pathology and complications (18 Hours)**

Acute changes; Chronic complications: Diabetic nephropathy, neuropathy, retinopathy and Diabetic foot ulcers, Random/Fasting/PP glucose testing, Impaired glucose tolerance (IGT), Impaired fasting glucose (IFT), Diagnosis by GTT, Pre-diabetes, Gestational DM, Glycosylated Haemoglobin (HbA1c); Glycated albumin, Hypoglycaemia and critical alert value for glucose. Markers of complications of Diabetes Mellitus: Metabolic syndrome, Lipid profile and lipoproteinemia, Atherosclerosis, Microalbuminuria, eGFR. Point of care testing for glucose (Glucometer) and continuous glucose monitoring (CGM): principle and its use. Major groups of anti-diabetic drugs. Diet and life style modifications.

**UNIT- III: Diagnostic Enzymology and Pre and Post-Natal testing (19 Hours)**

Diagnostic Enzymology: Clinically important enzymes and Isoenzyme as diagnostic markers: Clinical significance of AST, ALT, ALP, ACP, CK,  $\gamma$ -GT, amylase, pseudocholinesterase and their pattern in Myocardial infarction; Liver disease, Bone disease, Muscle disease, Cancer (tumor markers), GI tract pancreatitis; Enzymes as therapeutic agents.

Pre and post-natal testing: Amniocentesis, prenatal detection of inborn errors of metabolism in developing fetus- Autosomal recessive mode of inheritance-cystic fibrosis, X linked recessive inheritance-Duchenne muscular dystrophy. New born screening (NBS) for in born errors of metabolism, Tandem mass spectrometry application in NBS.

**UNIT- IV: Liver and Renal function tests (18 Hours)**

Liver function test panel, Fatty liver. Plasma protein changes in liver diseases. Hepatitis A, B and C. Cirrhosis and fibrosis. Portal hypertension and hepatic coma. Acute phase proteins - CRP, Haptoglobins,  $\alpha$ -fetoprotein, ferritin and transferrin and their clinical significance,

Interpreting serum protein electrophoresis. Inflammatory markers (cytokines such as TNF-  $\alpha$ , IL6 and others).

Renal function tests-tests for glomerular and tubular function-Acute and chronic renal failure-Glomerulonephritis, Nephrotic syndrome, Uraemia, Urinary calculi, Nephrocalcinosis and Nephrolithiasis-causes, pathology and symptoms. Chronic kidney disease. Dialysis-Hemodialysis and Peritoneal dialysis.

#### **UNIT - V: Electrolyte and Hormonal disorders (17 Hours)**

Electrolyte disorder and Clinical significance: Calcium: hypercalcemia and hypocalcemia; Calcium homeostasis in Blood; Phosphate: hyperphosphatemia and hypophosphatemia; Potassium: hyperkalemia and hypokalemia, Sodium: hyponatremia and hypernatremia; Chloride: hyperchloremia and hypochloremia.

Hormonal disorders and diagnostics: T3, T4 and TSH in the diagnosis of thyroid disorders; Diagnostic methods for disorders associated with adrenal, pituitary and sex hormones - Addison's disease, Cushing's syndrome, pituitary tumour, Hypopituitarism and Hypogonadism.

**Total Lecture Hours -90**

#### **COURSE OUTCOME**

The students are able to

1. Explain the principles of biochemical investigations, specimen collection, and the diagnosis of blood and clotting disorders.
2. Describe the pathology, diagnosis, complications, and management of diabetes mellitus and associated metabolic disorders.
3. Interpret the diagnostic significance of enzymes and explain the applications of pre- and post-natal testing in detecting inherited metabolic disorders.
4. Perform and interpret liver and renal function tests and correlate biochemical findings with hepatic and renal disorders.
5. Discuss the biochemical basis, diagnosis, and clinical significance of electrolyte and hormonal disorders.

#### **TEXT BOOK(S)**

1. Agrawal, Poonam. (2021) *Clinical Case Discussion in Biochemistry: A Book on Early Clinical Exposure (ECE)*. CBS Publishers & Distributors.
2. Basten, Graham (2011) *Introduction to Clinical Biochemistry: Interpreting Blood Results*. 2nd ed., Ventus Publishers, 2011.
3. Chatterjee, M. N., and Rana Shinde (2012) *Textbook of Medical Biochemistry*. 8th ed., Jaypee Brothers Medical Publishers.
4. Devlin, Thomas M. (2014) *Textbook of Biochemistry with Clinical Correlations*. 7th ed., John Wiley & Sons.
5. Montgomery, Robert, Thomas W. Conway, and Allan A. (1996) Spector. *Biochemistry: A Case-Oriented Approach*. 6th ed., Mosby Publishers.
6. Puri, Dinesh (2020) *Textbook of Biochemistry: A Clinically Oriented Approach*. 4th ed., Elsevier,

## REFERENCE BOOK(S)

1. Bishop, Michael. (2018) *Clinical Chemistry: Principles, Techniques, Correlations with Access*. 8th ed., Lippincott Williams & Wilkins.
2. Devi, Rooma, Aman Chauhan, Simmi Kharb, and Chandra Shekhar Pundir (2023) *Clinical Biochemistry: A Laboratory Guide*. 1st ed., Jenny Stanford Publishers,.
3. Devlin, Thomas M. (2006) *Textbook of Biochemistry with Clinical Correlations*. 2nd ed., Wiley and Sons,.
4. Kasper, Dennis, and Braunwald Eugene. (2005) *Harrison's Principles of Internal Medicine*. Vols. 1–2, 16th ed., McGraw-Hill, 5.
5. Scriver, Charles R., et al. (2001) *The Metabolic and Molecular Basis of Inherited Diseases*. 8th ed., McGraw-Hill.
6. Tietz.N.W. (2018) *Fundamentals of Clinical Chemistry and Molecular Diagnostics*. 8th ed., Saunders,.
7. Varley, Harold. (2006). *Practical Clinical Biochemistry*. 6th ed., CBS Publishers,

## E RESOURCES

1. <https://diabetesjournals.org/clinical/article/40/1/10/139035/Standards-of-Medical-Care-in-Diabetes-2022>
2. <https://doi.org/10.2337/diaspect.16.1.32>
3. [https://www.researchgate.net/publication/335830829\\_Quality\\_Control\\_in\\_a\\_Clinical\\_Laboratory](https://www.researchgate.net/publication/335830829_Quality_Control_in_a_Clinical_Laboratory)
4. <https://labpedia.net/quality-control-of-the-clinical-laboratory/>
5. <https://journals.sagepub.com/doi/full/10.1016/j.jala.2008.12.001>
6. <https://doi.org/10.1016/B978-0-12-407821-5.00004-8>
7. <https://www.westgard.com/clia.html>
8. <https://www.labroots.com/webinar/bio-rad-unity-solution-molecular-quality-control-data-management>

## 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     | 3     |
| CO 2 |      |      |      | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 2     |
| CO 3 |      |      |      | 3    | 2    | 3    | 1    | 3    | 1    | 2     | 2     | 3     | 1     |       | 3     |
| CO 4 | 2    | 2    | 2    | 3    | 2    | 2    | 2    | 3    |      |       |       | 1     | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    |      |       |       | 3     | 3     |       | 3     |

S-Strong (3)

M-Medium (2)

L-Low (1)

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE**  
**(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: III-CP-III: Clinical Biochemistry (P)**

**Ins. Hrs./Week: 6**

**Course Credit: 3**

**Course Code: P25BC309P**

**I. Haematology**

RBC count, WBC count – total and differential count, ESR, PCV, MCV. Bleeding Time, Clotting Time and Estimation of hemoglobin. Determination of Electrolytes: Sodium, Potassium and Calcium.

**II. Liver function test**

Estimation of bilirubin – direct and indirect. Estimation of plasma protein, A/G ratio, Prothrombin Time (PT), Assay of serum glutamate oxaloacetate transaminase, alkaline phosphatase, Gamma-glutamyltransferase (GGT), isoenzyme separation of LDH by electrophoresis.

**III. Renal function test**

Collection and Preservation of Urine sample.

Qualitative tests for normal and pathological components of urine.

BUN: Estimation of blood Urea, creatinine, and uric acid. Urea clearance test.

**IV.** Estimation of blood glucose by orthotoluidine and glucose oxidase method. Determination of glycosylated Hb. Glucose tolerance test- Kit method.

Lipid profile: Estimation of cholesterol by Zak's method, lipoprotein profile, estimation of ketone bodies, estimation of triglycerides, free fatty acids and phospholipids.

**V. Group Experiments**

- Antigen – Antibody Reaction - HCG kit method, RA kit method
- Phlebotomy –Venipuncture, Different techniques of venipuncture
- Collection of blood, serum or plasma separation and storage
- Automation in Clinical Biochemistry - Autoanalyser, Semi autoanalyser

**Total Hours- 90**

**COURSE OUTCOME**

The students are able to

- Acquire knowledge and skill in hematology techniques and get knowledge to interpret the electrolyte concentration in serum.
- Assess the Liver Function and interpret the biochemical investigation in a given clinical situation.
- Perform the Renal function test to assess the function of Kidney and report the abnormal parameters with reference range will be achieved by the student.
- Estimate the blood glucose content and lipid profile, to evaluate the alterations and record the observation in accordance to reference range.

5. Acquire practical skills to work in health care sector and assist them to understand the automation process in clinical labs.

### TEXT BOOK(S)

1. Gowenlock, Alan H. (1988). *Varley's Practical Clinical Biochemistry*. 6th ed., CBS Publishers and Distributors,
2. *Manipal Manual of Clinical Biochemistry (For Medical Laboratory and M.Sc. Students)*. (4th ed). (2013). Manipal University.
3. Jambhulkar, Rajesh Kawaduji, and Ninghot, Abhijit D. (2019) *Case Oriented Approach in Biochemistry*. 1st ed.
4. Mukerjee, Kanai L. (1996) *Medical Lab Technology*. (Vols. 1 & 2). Tata McGraw-Hill Publishing Company,
5. Plummer, D.T.(2000). *Practical Biochemistry*. Tata McGraw-Hill Publishing Company, 2000.
6. Sawhney, S. K., and Randhir Singh. (2005) *Introductory Practical Biochemistry*. (2nd ed).

### REFERENCE BOOK(S)

1. Gowenlock, Alan H. (1998) *Varley's Practical Clinical Biochemistry*. (6th ed). CBS Publishers.
2. Godkar, B(2020). *Textbook of Medical Laboratory Technology*. (Vols. 1 & 2, 3rd ed.) Bhalani Publisher.
3. Mukerjee, Kanai L. (1996) *Medical Lab Technology*. (Vols. 1 & 2, 1st ed.). Tata McGraw-Hill Publishers.
4. Chawla, Ranjna. (2014). *Practical Clinical Biochemistry: Methods and Interpretations*. (4th ed)., Jaypee Brothers Medical Publishers,
5. Devi, Rooma, Aman Chauhan, Simmi Kharb, and Chandra Shekhar Pundir. (2023) *Clinical Biochemistry: A Laboratory Guide*. (1st ed.). Jenny Stanford Publishers.

### E RESOURCES

1. [https://www.researchgate.net/publication/260182512\\_Practical\\_Manual\\_in\\_Biochemistry\\_and\\_Clinical\\_Biochemistry](https://www.researchgate.net/publication/260182512_Practical_Manual_in_Biochemistry_and_Clinical_Biochemistry)
2. [https://main.icmr.nic.in/sites/default/files/upload\\_documents/GCLP\\_Guidelines\\_2020\\_Final.pdf](https://main.icmr.nic.in/sites/default/files/upload_documents/GCLP_Guidelines_2020_Final.pdf)<https://www.westgard.com/clia.html>
3. [https://www.researchgate.net/publication/263929434\\_Biochemistry](https://www.researchgate.net/publication/263929434_Biochemistry)
4. <https://ucms.ac.in/Lectures-C-2020/Renal%20function%20Tests%20-%20PPT.pdf>
5. <https://youtu.be/i2PfjEks4GQ>
6. [https://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0005/268790/WHO-guidelines-on-drawing-blood-best-practices-in-phlebotomy-Eng.pdf](https://www.euro.who.int/__data/assets/pdf_file/0005/268790/WHO-guidelines-on-drawing-blood-best-practices-in-phlebotomy-Eng.pdf)

## 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     | 3     |
| CO 2 | 3    | 2    | 1    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 2     |
| CO 3 | 3    | 1    | 2    |      |      |      |      |      | 1    | 2     |       |       | 1     |       | 3     |
| CO 4 | 2    | 2    | 2    |      |      |      |      |      | 2    | 2     | 2     | 1     | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 3     |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

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# SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE



## (AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI – 614 016

(For the Candidates admitted in the academic year 2025–2026)

DEPARTMENT OF BIOCHEMISTRY

M.Sc., BIOCHEMISTRY

Semester: III- CIM: Pharmaceutical Biochemistry

Ins. Hrs./Week: 5

Course Credit: 3

Course Code: P25BCI31

### UNIT- I: General concept of Drug (14 Hours)

Drug discovery and development, drug target identification and validation, Hit identification, General principles of screening, correlations between various animal models and human situations, Correlation between in-vitro and in-vivo screens; Special emphasis on cell-based assay, biochemical assay, radiological binding assay, Pharmacological assay, In vitro, In vivo and Ex-vivo experiments, lead optimization, preclinical studies.

### UNIT- II: Drug metabolism and interactions (17 Hours)

Drug-receptor interactions, receptor theories and drug action, Xenobiotics, xenobiotics phases (Phase-I, Phase-II and Phase-III), role of cytochrome P450 oxidases and glutathione S-transferases in drug metabolism, factors affecting drug metabolism, Enzymes as a drug target, Kinase inhibitors, ATPase inhibitors, drug protein interaction, Drug DNA interaction. Basic ligand concepts-agonist, antagonist, partial agonist, inverse agonist, efficiency and potency. Forces involved in drug-receptor complexes. Receptor classification – the four super families. Receptor binding assays- measurement of  $K_d$ ,  $B_{max}$  and  $IC_{50}$ .

### UNIT III: Antimicrobial Agents (15 Hours)

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

### UNIT IV: Clinical Trials (13 Hours)

Clinical trials (Phase-I, Phase-II, Phase-III and Phase-IV clinical trial). Main features of clinical trials, including methodological and organizational considerations and the principles of trial conduct and reporting. Key designs surrounding design, sample size, delivery and assessment of clinical trials.

### UNIT –V: Bioinformatics approaches for drug development (16 Hours)

Identification of potential molecules, chemical compound library preparation, Identification of target in pathogen, Ligand and protein preparation, Molecular docking, Binding free energy estimation, High throughput virtual screening, Docking protocol validation and enrichment analysis, Single point energy calculation, Pharmacokinetics and Pharmacodynamics, ADME and toxicity prediction, Molecular dynamic simulation, Rule of three and five, Lipinsky rule, Pharmacophore development, Quantitative structure activity relationship, 3D-QSAR, Techniques of developing a pharmacophore map covering both ligand based and receptor based approaches.

**Total Lecture Hours-75**

## COURSE OUTCOME

The students are able to

1. Understand and explain the basic concepts of drug discovery and drug development process.
2. Review the different software and computational tools which aid in the design of drugs and its rationalization.
3. Learn about the chemical pathways of biotransformation of drugs.
4. Acquire knowledge on mode of actions of antimicrobials.
5. Analyze the different stages of the drug discovery process with the target & hit identification, assays for drug screening and preclinical studies.

## TEXT BOOK(S)

1. Ghosh, Jayashree.(2010) *A Textbook of Pharmaceutical Chemistry*. (3rd ed.). S. Chand & Company.
2. Gibson, Gordon, and Paul Skett.(1999) *Introduction to Drug Metabolism*. (3rd ed.) Nelson Thornes.
3. Gad, S. C., (editor) (2005). *Drug Discovery Handbook*. Wiley-Interscience.
4. Haque, S. S., and S. S. Randhawa.(2017) *Pharmaceutical Biochemistry*. (2nd ed.). S. Vikas and Company.
5. Kadam, S. S., and R. Mahadik. (1998) *Textbook of Medicinal Chemistry*. (Vol. 1, 5th ed).Nirali Prakashan,.

## REFERENCE BOOK(S)

1. Abdul Wahab, & Khan, S. U. (2015). Handbook of pharmaceutical biochemistry for health professionals. LAP LAMBERT Academic Publishing.
2. Ashton, M., et al. (2024). An integrated guide to human drug metabolism: From basic chemical transformations to drug-drug interactions (1st ed.).
3. Borchardt, R. T., et al. (2004). Pharmaceutical profiling in drug discovery for lead selection. AAPS Press.
4. Cairns, D. (2012). Essentials of pharmaceutical chemistry (4th ed.). Pharmaceutical Press.
5. Charifson, P. R. (Ed.). (2002). Practical application of computer-aided drug design. Marcel Dekker.

## E- RESOURCES

1. <https://guides.lib.uiowa.edu/c.php?g=132196&p=863259>
2. <https://libguides.library.usyd.edu.au/c.php?g=508174&p=3476667>
3. <https://guides.library.usciences.edu/ChemistryBioChemPharmaceuticalChem>
4. <https://epgp.inflibnet.ac.in/>
5. <https://guides.Indlibrary.org/pharmacy/pharm-books>

## 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     | 3     |
| CO 2 |      |      |      | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 2     |
| CO 3 |      |      |      | 3    | 2    | 3    | 1    | 3    |      |       |       | 3     | 1     |       | 3     |
| CO 4 | 2    | 2    | 2    | 3    | 2    | 2    | 2    | 3    |      |       |       | 1     | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 3     |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: III-EC V: Research Methodology**

**Ins. Hrs. / Week: 5**

**Course Credit: 3**

**Course Code: P25BCE35A**

**UNIT- I: Research Ethics**

**(18 Hours)**

Philosophy- definition, nature, scope and concept. Ethics- definition, moral philosophy, nature of moral judgments and reactions. Ethics with respect to science and research - Scientific misconducts- falsification, fabrication, and plagiarism- Use of plagiarism software- Turnitin, Urkund and other open source software tools. Redundant publications- duplicate and overlapping publications. Publication ethics- definition and importance. Publication misconduct- definition, concept, problems that lead to unethical behavior, types, violation of publication ethics, authorship and contributor ship. Software tool to identify predatory publications developed by SPPU. Subject specific ethical issues- authorship, Conflicts of interest.

**UNIT-II: Scientific Writing**

**(16 Hours)**

Research- Definition, importance and characteristics. Research problems- Definition, selection and sources of research problems. References in research – Books, Journals and Internet Sites. Scientific Writing- Definition and kinds of scientific documents – research paper, review paper, book reviews, thesis, conference and project reports. Components of a research paper. Preparation and submission of research project proposals to funding agencies. Selection of journals for publication- Impact factor– Citation index and H index, Thesis writing- Components.

**UNIT-III: Data Presentation**

**(12 Hours)**

Data- Definition, source, types and collection, Primary and secondary data. Classification- chronological, alphabetical, geographical, qualitative and quantitative classification. Frequency distribution. Tabulation of data-components, rules and classifications. Diagrammatic presentation of data- Simple Bar, Multiple Bar, Component Bar, Percentage Bar, Pie chart, Pictogram, Cartograms. Graphical presentation of data-rules and classification.

**UNIT-IV: Data Processing**

**(15 Hours)**

Measures of central tendency- Definition, arithmetic mean—Direct and shortcut method; median-individual data, discrete series, continuous series; mode-grouping table and analyzing table method. Measures of Dispersion - quartile deviation, mean deviation, standard deviation, Coefficient of variation. Correlation-types, Karl Pearson coefficient of correlation and Regression—Rank correlation coefficient. Regression analysis.

**UNIT-V: Data Analysis**

**(14 Hours)**

Sampling distribution and test of significance- Populations and samples, Hypothesis and its testing, characteristics of hypothesis, Null hypothesis- Type I & II errors and alternative hypothesis, Confidential level, Test of significance- Parametric test - Student 't' test. Analysis of variance— 'F' test. Chi square test and goodness of fit. Introduction to

Copyediting, Objectives of copy editing (correctness, consistency, coherence and clarity), editing your own paper (fixing grammar and usage errors, basic punctuation, consistent style and clear sentences), creating and using a style sheet for effective copyediting, tools available (MS Editor, Grammarly, Quillbot).

**Total Lecture Hours-75**

### **COURSE OUTCOME**

The students are able to

1. Acquire awareness of ethical aspects on research and development including plagiarism issues and equal opportunities/equal treatment
2. Develop skills in identification of research problem.
3. Apply the methods while working on a research project work and appreciate the technique of result analysis, interpretation and writing the report
4. Discuss the methods of processing of data in research studies, classify and explain the various methods of central tendency and dispersion, determine the measures of asymmetry in research
5. Explain the basic concepts in testing of hypothesis, types of errors, steps and limitations of hypothesis testing

### **TEXT BOOK(S)**

1. Banerjee, B. (2018). Methods in biostatistics for medical students and research workers (9th ed.). Jaypee Brothers Medical Publishers.
2. Premkumar, A., Prasanna, S., & Christopher, S. (2017). Principles and practice of biostatistics (1st ed.). Elsevier.
3. Rastogi, V. B. (2015). Biostatistics (3rd ed.). Medtech Publishers.
4. Shah, I., & Boddy, P. (2020). Essentials of biostatistics and research methodology (3rd ed.). Academic Publishers.
5. Prasanth, K. (2017). Guide to research methodology and biostatistics (1st ed.). CBS Publishers.

### **REFERENCE BOOK(S)**

1. Daniel, W. W. (2012). *Biostatistics: A foundation for analysis in the health sciences* (10th ed.). Wiley.
2. Daniel, W. W., & Cross, C. L. (2014). *Biostatistics: Basic concepts and methodology for the health sciences* (10th ed.). Wiley.
3. Dubey, D., & Srivastava, U. (2019). *Biostatistics and research methodology* (1st ed.). Vikas Publishing House.
4. Gupta, S. P. (2017). *Statistical methods* (43rd ed.). Sultan Chand & Sons.
5. Kothari, C. R. (2023). *Research methodology: Methods and techniques*. New Age International.
6. Sharma, S. (2016). *Research methodology and biostatistics: A comprehensive guide for health care professionals* (1st ed.). Elsevier.
7. Kumar, V. (2023). *Discover the editor in you: Copyediting as a career*. New Delhi.

### **E-RESOURCES**

1. <https://digitalguardian.com/blog/what-data-classification-data-classification-definition>
2. <https://www.formpl.us/blog/research-report>
3. <https://www.mooc-list.com/tags/biostatistics>

4. <https://www.mooc-list.com/tags/researchmethodology>
5. [https://www.westga.edu/academics/research/vrc/assets/docs/tests of significance notes.pdf](https://www.westga.edu/academics/research/vrc/assets/docs/tests%20of%20significance%20notes.pdf)

#### **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 |
|-------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| <b>CO 1</b> | 3    | 1    | 2    |      | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     | 3     | 3     |
| <b>CO 2</b> | 3    | 2    | 1    | 3    | 2    |      |      |      |      | 2     | 2     | 3     | 3     |       | 2     |
| <b>CO 3</b> | 3    |      |      | 3    | 2    |      |      |      |      | 2     | 2     | 3     | 1     |       | 3     |
| <b>CO 4</b> | 2    |      |      |      | 2    |      |      |      |      | 2     | 2     | 1     | 3     |       | 3     |
| <b>CO 5</b> | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 3     |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

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# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE



## (AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI – 614 016

*(For the Candidates admitted in the academic year 2025–2026)*

### DEPARTMENT OF BIOCHEMISTRY

#### M.Sc., BIOCHEMISTRY

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#### Semester: III- EC-V: Biostatistics and Data Sciences

Ins. Hrs./Week: 5

Course Credit: 3

Course Code: P25BCE35B

#### UNIT- I: Data Presentation

(15 Hours)

Nature of biological and clinical experiments – Collection of data in experiment- Primary and secondary data. Methods of data collection. Classification and tabulation. Different forms of diagrams and graphs related to biological studies. Measures of Averages- Mean, Median, and mode. Use of these measures in biological studies.

#### UNIT- II: Data Processing

(15 Hours)

Measures of Dispersion for biological characters – Quartile deviation, Mean deviation, Standard deviation and coefficient of variation. Measures of skewness and kurtosis. Correlation and regression – Rank correlation – Regression equation. Simple problems based on biochemical data.

#### UNIT- III: Data Analysis I

(15 Hours)

Basic concepts of sampling- Simple random sample, stratified sample and systemic sampling. Sampling distribution and standard error. Test of significance based on large samples. Test for mean, difference of means, proportions and equality of proportions.

#### UNIT –IV: Data Analysis II

(15 Hours)

Small sample tests-Students't' test for mean, difference of two way means, tests for correlation and regression coefficients. Chi-square test for goodness of a non-independence of attributes. F test for equality of variances. ANOVA- one way and two way. Basic concept related to biological studies.

#### UNIT –V: Data Science

(15 Hours)

Introduction to Data Science, Definition of data science, importance, and basic applications, Machine Learning Algorithms, Deep Learning, Artificial Neural Networks and their Application, Reinforcement Learning, Natural Language Processing Artificial Intelligence (AI), Data Visualization, Data Analysis, Optimization Techniques, Big Data, Predictive Analysis. Application of AI in medical, health and pharma industries.

**Total Lecture Hours-75**

## **COURSE OUTCOME**

The students are able to

1. Understand the concepts of statistical population and sample, variables and attributes. Tabular and graphical representation of data based on variables.
2. Acquire knowledge on the criteria for the independence of data based on attributes. Measures of central tendency, Dispersion, Skewness and Kurtosis.
3. Learn the different sampling methods and analysing statistical significance.
4. Understand the student's t test, ANOVA, Chi square test to analyse the significance of various research.
5. Learn on data science, algorithm for machine learning, artificial intelligence and big data, their applications in clinical and pharma domain .

## **TEXT BOOK(S)**

1. MacFarland, T. W. (2024). Introduction to data science in biostatistics using R, the tidyverse ecosystem, and APIs.
2. Milton, J. S. (1992). Statistical methods in the biological and health sciences (2nd ed.). McGraw-Hill.
3. Rosner, B. (2005). Fundamentals of biostatistics. Duxbury Press.
4. Sundar Rao, P. S. S., Jesudian, G., & Richard, J. (1987). An introduction to biostatistics (2nd ed.). Prestographik.
5. Warren, J., Gregory, E., & Grant, R. (2004). Statistical methods in bioinformatics (1st ed.). Springer.
6. Zar, J. H. (1984). Biostatistical methods. Prentice Hall International.

## **REFERENCE BOOK(S)**

1. Daniel, W. W. (2012). Biostatistics: A foundation for analysis in the health sciences (10th ed.). Wiley.
2. Daniel, W. W., & Cross, C. L. (2014). Biostatistics: Basic concepts and methodology for the health sciences (10th ed.). Wiley.
3. Dubey, D., & Srivastava, U. (2019). Biostatistics and research methodology (1st ed.). Vikas & Co.
4. Gupta, S. P. (2017). Statistical methods (43rd ed.). Sultan Chand & Sons.
5. Sharma, S. (2016). Research methodology and biostatistics: A comprehensive guide for health care professionals (1st ed.). Elsevier

## **E RESOURCES**

1. [https://www.ibm.com/docs/en/SSLVMB\\_28.0.0/pdf/Accessibility.pdf](https://www.ibm.com/docs/en/SSLVMB_28.0.0/pdf/Accessibility.pdf)
2. [https://pure.tue.nl/ws/portalfiles/portal/19478370/20160419\\_CO\\_Mzolo.pdf](https://pure.tue.nl/ws/portalfiles/portal/19478370/20160419_CO_Mzolo.pdf)
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5453888/>
4. <https://home.ubalt.edu/ntsbarsh/excel/excel.html>
5. [https://students.shu.ac.uk/lits/it/documents/pdf/analysing\\_data\\_using\\_spss.pdf](https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf)
6. <https://www.ibm.com/support/pages/ibm-spss-statistics-28-documentation>

## 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     | 3     |
| CO 2 | 3    | 2    | 1    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 2     |
| CO 3 |      |      |      |      | 2    | 3    | 1    | 3    | 1    | 2     |       |       | 1     |       | 3     |
| CO 4 |      |      |      |      | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 3     |

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

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

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**Semester: III- EC-V: Gene Editing, Cell and Gene therapy**

**Ins. Hrs./Week: 5**

**Course Credit: 3**

**Course Code: P25BCE35C**

**UNIT- I: Gene Editing**

**(15 Hours)**

Basis of gene editing, DNA Damage-Definition and its types, DNA repair mechanisms, Double strand DNA breaks, Nonhomologous End-Joining (NHEJ), Homology directed repair, Programmable nucleases for gene editing, Meganucleases, Zinc-Finger nucleases, Transcription Activator-Like Effector Nucleases (TALEN), CRISPR-Cas systems, gene editing using CRISPR-Cas, drawbacks and major challenges to present gene editing techniques, gene editing for human disease therapy.

**UNIT- II: Gene and cell therapy**

**(15 Hours)**

Basics of Gene and cell therapy, types of gene therapy, gene therapy strategies, therapeutic targets for gene therapy, choice of the therapeutic target, administration routes, delivery systems, expression of transgene, persistence of the gene therapy, cell targeting, immunological response to the therapy, ethical and legal issues, concerns about gene and cell therapy.

**UNIT- III: Vectors for Gene therapy**

**(15 Hours)**

Non-viral and viral vectors for gene therapy, Physical methods of gene delivery, Polymer, Lipid and inorganic material based chemical systems for gene delivery, Viral vectors, Lentiviral, Adenoviral, Adeno-associated virus, Herpes Simplex virus, vaccinia, baculoviral vectors for gene delivery, choice of viral vector and oncolytic virus. Gene therapy applications, Gene therapy for cancer, suicide and oncolytic gene therapy.

**UNIT- IV: Stem cells and tissue regeneration**

**(15 Hours)**

Adult and fetal stem cells, embryonic stem cells, cell reprogramming, induced pluripotent stem cells (iPSC), Chemically induced pluripotent stem cells (CiPSC), reprogramming factors, iPSC derived progenitors 'cells, Organoids, three dimensional (3D) bioprinting.

**UNIT- V: Regulation of Gene Therapy**

**(15 Hours)**

Regulatory and Ethical Considerations of stem cell and Gene Therapy, pluripotent stem cell-based cell replacement therapies. Assessing Human Stem Cell Safety, Use of Genetically Modified Stem Cells in Experimental Gene Therapies. Technological challenges towards development of pluripotent stem cell-based cell replacement therapies.

**Total Lecture Hours-75**

## **COURSE OUTCOME**

The students are able to

1. Read, and evaluate scientific articles within the subjects of immune therapy, gene therapy and cell therapy.
2. Clone gene of their interest for several downstream purposes with a robust comprehension about wide variety of applicable gene delivery vectors.
3. Provide examples of diseases that can be treated with immune therapy, gene therapy and cell therapy.
4. Identify knowledge gaps and need for further research within their chosen topic of immune therapy, gene therapy or cell therapy.
5. Critically discuss and reflect on ethical and social aspects of using immune, gene or cell therapy and the student will be persuaded to contemplate on upcoming technologies for futuristic benefits.

## **TEXT BOOK(S)**

1. Crueger, Wulf. *Biotechnology: A Textbook of Industrial Microbiology*. 2nd ed., CBS Publishers, 2016.
2. Dubey, R. C. *Book on Biotechnology*. 5th ed., S. Chand and Company, 2014.
3. Glick, R., and J. J. Pasternak. *Molecular Biotechnology*. 3rd ed., ASM Press, 2002.
4. Johnand, S. N. *Gene Biotechnology*. 2nd ed., Himalaya Publishing House, 2006.
5. Kresina, Thomas F., and S. K. Upadhyay. *An Introduction to Molecular Medicine and Gene Therapy*. 1st ed., 2021.
6. Pasternak, J. J. *An Introduction to Human Molecular Genetics*. 2nd ed., 2005.
7. Primrose, R. W., and S. B. Old. *Principles of Gene Manipulation*. 4th ed., Blackwell Scientific Publications, 1989.
8. Singh, B. D. *Biotechnology*. 3rd ed., Kalyani Publishers, 2007.
9. Strachan, Tom, and Andrew Read. *Human Molecular Genetics*. 4th ed., 2010.
10. Tyagi, I. D. *Biotechnology and Genetic Engineering*. 1st ed., Jain Brothers Publishers, 2005.
11. Verma, P. S., and V. K. Agarwal. *Genetic Engineering*. 1st ed., S. Chand Publishers, 2009.

## **REFERENCE BOOK(S)**

1. Brown, T. A. (2006). *Gene cloning and DNA analysis: An introduction* (5th ed.). Wiley-Blackwell.
2. Glove, D. M. (1984). *Gene cloning: The mechanisms of DNA manipulations*. Chapman and Hall.
3. Gardner, A. G., & Simmons, M. J. (2006). *Principles of genetics* (8th ed.). John Wiley & Sons.
4. Griffiths, A. J. F., Wessler, S. R., Doebley, J., & Carroll, S. B. (2010). *Introduction to genetic analysis* (10th ed.). W. H. Freeman.
5. Levine, H. (2006). *Genetic engineering: A reference handbook*. ABC-CLIO.
6. Primrose, S. M., & Twyman, R. M. (2006). *Principles of gene manipulation and genomics* (7th ed.). Blackwell Publishers.
7. Winnacker, E. L. (2002). *From genes to clones: Introduction to gene technology*. VCH Publishers.
8. Watson, J. D., Gilman, M., Witkowski, J., & Zoller, M. (1992). *Recombinant DNA*. W. H. Freeman.

9. Scherman, Daniel, (editor) (2019). *Advanced Textbook on Gene Transfer, Gene Therapy, and Genetic Pharmacology: Principles, Delivery, and Pharmacological and Biomedical Applications of Nucleotide-Based Therapies*. (2nd ed.). National Scientific Research Center (CNRS).

## E-RESOURCES

1. <https://drive.google.com/file/d/1tghNWPyuqPiqK1Rl11ZzUrFwcoMiuoMa/view?usp=sharing>
2. [https://drive.google.com/file/d/17\\_C3p\\_9TND52KR5TqUelyNZQ6qQ5wS6/view?usp=sharing](https://drive.google.com/file/d/17_C3p_9TND52KR5TqUelyNZQ6qQ5wS6/view?usp=sharing)
3. <https://www.mooc-list.com/tags/genetics>
4. <https://www.mooc-list.com/tags/genetically-modified-organisms>
5. <https://ncert.nic.in/ncerts/l/lebo105.pdf>
6. <https://www.pdfdrive.com/an-introduction-to-genetic-engineering-e40034206.html>
7. <https://www.pdfdrive.com/genetic-engineering-e33644320.html>

## 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     | 3     |
| CO 2 | 3    | 2    | 1    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 2     |
| CO 3 | 3    | 1    | 2    |      |      |      |      |      | 1    | 2     | 2     | 3     | 1     |       | 3     |
| CO 4 | 2    | 2    | 2    |      |      |      |      |      | 2    | 2     | 2     | 1     | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 3     |

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

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: III- SEC: Clinical Lab Technology**

**Ins. Hrs./Week:2**

**Course Credit:2**

**Course Code: P25SEBC31**

**UNIT-I: Collection, Specimen Handling (06 Hours)**

Blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste-Non infectious waste, biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines.

**UNIT-II: Blood Grouping, Rh Typing, and Blood Banking Procedures (06Hours)**

Determination of Blood group and Rh factor, Basic blood banking procedures- cross matching, screening test. Blood transfusion and hazards.

**UNIT-III: Biochemical Estimation in Blood and Urine (06 Hours)**

Estimation of blood sugar by Enzymatic method, HbA1C, Qualitative and quantitative analysis of urine sample- NPN-urea, uric acid, creatinine. Mineral, vitamin and CSF analysis.

**UNIT-IV: Immunodiagnostics Techniques (06 Hours)**

Widal test, VDRL test, ASO, RA, CRP and Complement fixation Test. RIA, ELISA, Skin test – Montaux and Lepramin test.

**UNIT-V: Enzymes and Hormones Assay in Clinical Diagnosis (06 Hours)**

Assay of clinically important enzymes- LDH, creatine kinase, transaminases, phosphatases - Estimation of clinically important hormones – Insulin, Thyroid and Reproductive hormones and its clinical significance.

**Total Lecture Hours: 30**

**COURSE OUTCOME**

The students are able to

1. Acquire knowledge about Collection and preservation of biological samples.
2. Estimate the various constituents in biological sample.
3. Perform the routine procedures adopted in blood bank.
4. Analyze and interpret the values for both normal and disease conditions.
5. Assay the enzymes and hormones &interpret clinical implications.

**TEXT BOOK(S)**

1. Gowenlock, A. H. (1988). Varley's practical clinical biochemistry (6th ed.). CBS Publishers and Distributors.
2. Mukherjee, K. L., & Chakravarthy, A. (2022). Medical laboratory technology (4th ed., Vol. 1).
3. Sood, R. (2006). Textbook of medical laboratory technology. Jaypee Publishers.
4. Tietz, N. W. (2018). Fundamentals of clinical chemistry and molecular diagnostics (8th ed.). W.B. Saunders.

## REFERENCE BOOK(S)

1. Chawla, R. (2014). Practical clinical biochemistry: Methods and interpretations (4th ed.). Jaypee Brothers Medical Publishers.
2. Jacobs, D. S. (2004). Laboratory test handbook: Concise, with disease index. Lexi-Comp.
3. Mukerjee, K. L. (1996). Medical laboratory technology (Vols. 1–2, 1st ed.). Tata McGraw-Hill.
4. Mukerjee, K. L. (1996). Medical laboratory technology (Vols. 1–2, 3rd ed.). Tata McGraw-Hill.
5. Holt, J. G. (Ed.). (1994). Bergey's manual of determinative bacteriology. Williams & Wilkins.

## E-RESOURCES:

1. <https://www.youtube.com/watch?v=QNYIX5Ne9IQ>
2. <https://www.slideshare.net/doctorrao/agglutination-tests-and-immunoassays>
3. <https://microbenotes.com/introduction-to-precipitation-reaction/>
4. <https://www.researchgate.net/publication/260182512> Practical Manual in Biochemistry and Clinical Biochemistry
5. [https://www.euro.who.int/\\_data/assets/pdf\\_file/0005/268790/WHO-guidelines-on-drawing-blood-best-practices-in-phlebotomy-Eng.pdf](https://www.euro.who.int/_data/assets/pdf_file/0005/268790/WHO-guidelines-on-drawing-blood-best-practices-in-phlebotomy-Eng.pdf)

## 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    | 2    | 3    | 2    | 2     | 2     | 3     | 3     | 3     | 3     |
| CO 2 | 3    |      |      |      | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 2     |
| CO 3 | 3    | 1    | 2    | 3    | 2    |      |      |      |      | 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     |

S-Strong (3)

M-Medium (2)

L-Low (1)

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## **SEMESTER IV**



**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

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**Semester: IV- CC-VII: Molecular Biology**

**Ins. Hrs./Week: 5**

**Course Credit: 5**

**Course Code: P25BC410**

**UNIT- I: Mendel's laws of inheritance**

**(15 Hours)**

Dominance-complete, incomplete and co- dominance, multiple alleles-gene mapping in haploids and diploids, recombination mapping- restriction mapping- modes of gene information transfer in bacterial- conjugation, transformation and transduction. The bacterial chromosome, the eukaryotic genome- chromosome structure – Histones, Nucleosome, chromatin- heterochromatin, euchromatin, chromatin remodeling, DNAase hypersensitive sites, genome organization – the C-value paradox, reassociation kinetics, repetitive sequences, gene amplification, telomeres, pseudogenes, split genes, organelle genomes – mitochondrial and chloroplast genome.

**UNIT- II: DNA replication and repair**

**(15 Hours)**

Enzymes of replication, prokaryotic replication mechanisms, primosome and replisomes, eukaryotic DNA replication, the role of topoisomerases and telomerase, regulation of replication, difference between prokaryotic and eukaryotic replication. Mutations -Types of mutations, mechanisms of mutations, mutagenic agents. DNA repair mechanisms – Direct repair, excision repair, mismatch repair, recombination repair, SOS response, eukaryotic repair systems. Recombination and mobile genetic elements- the Holliday model, the general recombination in *E.coli*, site specific recombination, transposons and retrotransposons.

**UNIT III: Transcription**

**(15 Hours)**

Transcription – Prokaryotic transcription-subunits of RNA polymerase, *E. coli* promoters, sigma factor and promoter recognition, alternative sigma factors, initiation, elongation, Rho-dependent and independent termination of transcription. Eukaryotic transcription- Initiation, promoter elements, RNA polymerases, transcription factors, regulatory sequences in eukaryotic protein – coding genes, CpG islands, enhancers. Post transcriptional modifications in eukaryotes- RNA processing- mRNA 5' capping and 3' poly-adenylation, introns and exons, RNA splicing- spliceosome assembly, alternative splicing, processing of tRNA and rRNA, self-splicing, ribozymes, RNA editing- substitution and insertion/deletion editing, Genome editing-CRISPR- Cas technology.

**UNIT IV: Translation**

**(15 Hours)**

Translation – organization of the ribosome, the genetic code, evidence for a triplet code, deciphering the genetic code, wobble hypothesis, deviation in the genetic code, unusual codons. Activation, initiation, elongation and termination of translation in *E. coli*. The role of tRNA and rRNA, suppressor tRNAs and inhibitors of protein synthesis. Comparison of prokaryotic translation with eukaryotic translation. Post translational modification of

proteins- Proteolytic cleavage, covalent modifications, glycosylation of proteins, disulfide bond formation, Protein sorting – signal peptides, transport of secretory proteins, Golgi and post-golgi sorting, coated vesicles, targeting of mitochondrial, lysosomal and nuclear proteins, Protein degradation-Ubiquitination of proteins, Protein folding-chaperones

### **UNIT V: Gene Expression**

**(15 Hours)**

Regulation of gene expression in prokaryotes—Positive and negative control, the lac operon, identification of operator and regulator sequences by mutations, induction and repression, Foot-printing and gel-shift assays for identification of protein-DNA interactions. Catabolite repression. *Trp* operon – Attenuation, alternative secondary structures of *trp* mRNA.

Regulation of gene expression in eukaryotes- Response elements, DNA-binding motifs, steroid receptors, association of methylation and histone acetylation with gene expression.

**Total Lecture Hours-75**

### **COURSE OUTCOME**

The students are able to

1. Explain genome organization, DNA replication, recombination, transposition, DNA damage, mutation, and repair mechanisms.
2. Describe transcription, translation, genetic code, and gene regulation in prokaryotes and eukaryotes.
3. Explain RNA processing, RNA splicing, and their roles in human diseases.
4. Describe the principles and applications of gene silencing techniques.
5. Apply molecular biology concepts to analyze biological problems and develop research-oriented skills.

### **TEXT BOOK(S)**

1. Ajay Paul. (2007). Textbook of cell and molecular biology. Books and Allied.
2. Cram. (2015). Textbook of principles of molecular biology.
3. Freifelder, D. (2008). Molecular biology (2nd ed.). Narosa Publications.
4. Cooper, G. M., & Hausman, R. E. (2004). The cell: A molecular approach (3rd ed.). ASM Press.
5. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D., & Darnell, J. (2010). Molecular cell biology (5th ed.).
6. Karp, G. (2013). Cell and molecular biology: Concepts and experiments (8th ed.). Wiley India.
7. Griffiths, A. J. F., Wessler, S. R., Lewontin, R. C., Carroll, S. B., & Doebley, J. (2004). An introduction to genetic analysis (12th ed.). W.H. Freeman.

### **REFERENCE BOOK(S)**

1. De Robertis, E. B., & De Robertis, E. M. F. (2001). *Cell and molecular biology* (8th ed.). Wolters Kluwer India Pvt. Ltd.
2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2002). *Molecular biology of the cell* (4th ed.). Garland Science.
3. Karp, G. (2004). *Cell and molecular biology* (4th ed.). John Wiley & Sons.
4. Cox, M. M., & Nelson, D. L. (2008). *Principles of biochemistry* (5th ed.). W.H. Freeman & Company.
5. Dale, J. W., & Schantz, M. (2007). *From genes to genomes*. John Wiley & Sons.

6. Flint, S. J., Enquist, L. W., Racaniello, V. R., & Skalka, A. M. (2000). *Principles of virology*. ASM Press.
7. Kieleczawa, J. (2006). *DNA sequencing II*. Jones and Bartlett Publishers.
8. Kornberg, A., & Baker, T. A. (2005). *DNA replication* (2nd ed.). University Science Books.
9. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., & Losick, R. (2006). *Molecular biology of the gene* (5th ed.). Pearson Education.

## E-RESOURCES

1. <https://www.pdfdrive.com/biochemistry-books.html>
2. <https://drive.google.com/file/d/1tghNWPYuqPiqK1R111ZzUrFwcoMiuoMa/view?usp=sharing>
3. <https://mooc.es/course/molecular-biology/>
4. [https://onlinecourses.swayam2.ac.in/cec20\\_ma13/preview](https://onlinecourses.swayam2.ac.in/cec20_ma13/preview)
5. <https://learn.genetics.utah.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 |
|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| CO 1 | 3    | 1    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     | 3     | 3     |
| CO 2 | 3    | 2    | 1    | 3    | 2    | 2    | 2    | 3    | 2    |       |       |       | 3     |       | 2     |
| CO 3 | 3    | 1    | 2    | 3    | 2    | 3    | 1    | 3    | 1    |       |       |       | 1     |       | 3     |
| CO 4 | 2    |      |      |      |      |      | 2    | 3    | 2    | 2     | 2     | 1     | 3     |       | 3     |
| CO 5 | 3    |      |      |      |      |      | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 3     |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

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**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

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**Semester: IV- CC-VIII: Developmental Biology**

**Ins. Hrs./Week: 5**

**Course Credit: 5**

**Course Code: P25BC411**

**UNIT- I: Overview of Developmental biology (15 Hours)**

Background of Developmental biology - Principles of developmental biology –Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

**UNIT- II: Model organisms (15 Hours)**

Gametogenesis – production of gametes, Formation of zygote, fertilization and early development: molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination. *Drosophila* Developmental biology- Axis formation, Genes & mutation. *C.elegans* – Vulva formation, Axis formation.

**UNIT- III: Regeneration Developmental Biology (15 Hours)**

Stem cells – Definition, Classification, Embryonic and adult stem cells, properties, identification, Culture of stem cells, Differentiation and dedifferentiation, Stem cell markers, techniques and their applications in modern clinical sciences. Three- dimensional culture and transplantation of engineered cells. Tissue engineering - skin, bone and neuronal tissues.

**UNIT- IV: Morphogenesis & Organogenesis (15 Hours)**

Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans*, eye lens formation, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

**UNIT- V: Cellular senescence and Cell fate decision (16 Hours)**

Cellular senescence – concepts & Frizzled receptor in Development and disease. Diabetes and developmental biology, Cell death pathways in developments. Markers of important diseases.

**Total Lecture Hours-75**

**COURSE OUTCOME**

The students are able to

1. Grasp knowledge about the background of developmental biology.
2. Gain abundant knowledge about model organism and gametogenesis.
3. Acquire knowledge about stem cells and their applications in regenerative therapy.

4. Understand about morphogenesis and organogenesis.
5. Learn the basics of cell death mechanisms and cell fate decision.

### TEXT BOOK(S)

1. Browder, L. W., Erickson, C. A., & Jeffery, W. R. (1991). *Developmental biology* (3rd ed.). Saunders College Publishing.
2. Gilbert, S. F. (2010). *Developmental biology* (9th ed.). Sinauer Associates.
3. Sarin, C. (1990). *Genetics*. Tata McGraw-Hill Publishing Company.
4. Sastry, K. V., & Shukla, V. (2018). *Developmental biology* (2nd ed.). Rastogi Publications.
5. Strickberger, M. W. (2002). *Genetics* (3rd ed.). Prentice Hall of India.

### REFERENCE BOOK(S)

1. Balinsky, B. I. (2012). *An introduction to embryology* (6th ed.). Cengage Learning India.
2. Hall, B. K., & Olson, W. M. (2006). *Keywords and concepts in evolutionary developmental biology* (New ed.). Harvard University Press.
3. Diwan, A. P., & Dhakad, N. K. (1996). *Animal regeneration* (3rd ed.). Anmol Publications.
4. Gilbert, S. F. (2010). *Developmental biology* (9th ed.). Sinauer Associates.
5. Hazarika, G. (2022). *Developmental biology* (2nd ed.). Ashok Book Stall Publications Ltd.

### E-RESOURCES

1. <https://www.freebookcentre.net/Biology/Developmental-Biology-Books.html>
2. <https://lib-ebooks.com/developmental-biology-12th-edition-pdf/>
3. <https://www.worldcat.org/title/developmental-biology/oclc/698642961>
4. <https://sites.google.com/a/indonesia-fb48a.web.app/yjuikuopoiukuy/-pdf-download-developmental-biology-by-scott-f-gilbert>
5. <http://www.freebookcentre.net/Biology/Plant-Biology-Books.html>
6. <http://bgc.org.in/pdf/study-material/developmental-biology-7th-ed-sf-gilbert.pdf>

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| CO 1 | 3    | 1    | 2    | 3    | 2    | 2    |      |      |      | 2     | 2     | 3     | 3     | 3     | 3     |
| CO 2 | 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    |       |       |       |       |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 3     |

S-Strong (3)

M-Medium (2)

L-Low (1)

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**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: IV-CP VI: Molecular Biology Techniques (P)**

**Ins. Hrs./Week: 6**

**Course Credit: 3**

**Course Code: P25BC412P**

**PRACTICALS**

1. Isolation of Plasmid DNA from bacterial culture.
2. Isolation of Genomic DNA.
3. Isolation of chromosomal DNA from animal tissues.
4. Spectrophotometric analysis of purity of isolated DNA
5. Separation of genomic and plasmid DNA fragment by Agarose gel electrophoresis
6. Restriction digestion of DNA
7. Estimation of DNA by Diphenylamine method.
8. Isolation of RNA from animal tissues.
9. Analysis of RNA by formaldehyde – Agarose electrophoresis.
10. Estimation of RNA by Orcinol method
11. Extraction of protein from animal tissue.
12. Separation of proteins by agarose gel electrophoresis
13. Separation of proteins by SDS-PAGE
14. Estimation of protein by Lowry's method and Biuret's method
15. PCR – Demonstration

**Total Hours-90**

**COURSE OUTCOME**

The students are able to

1. Understand how to extract and quantify DNA from samples.
2. Learn about extraction and quantification of RNA from samples.
3. Acquire knowledge about the basics of Molecular techniques.
4. Inculcate in-depth knowledge about electrophoresis techniques.
5. Learn the principle and procedure for PCR and Blotting techniques.

**TEXT BOOK(S)**

1. Chaitanya, K. V. (2013). *Cell & molecular biology: A lab manual*. Practice Hall India Learning Pvt. Ltd.
2. Pawar, H. A. (2018). *A practical book on pharmacognosy and phytochemistry I* (1st ed.). Everest Publishing House.
3. Jayaraman, J. (2000). *Manuals in biochemistry* (3rd ed.). New Age International Publishers.
4. Nigam. (2007). *Lab manual of biochemistry* (1st ed.). Tata McGraw-Hill Education.
5. Plummer, D. T. (2001). *Practical biochemistry* (3rd ed.). McGraw-Hill Publishing Company.

## REFERENCE BOOK(S)

1. Som D. (2018). Practical Manual of Molecular Biology (2nd ed.). Kaav Publications.
2. Gupta MK. (2016). A Practical Manual of Phytochemistry and Pharmacognosy. Notion Press.
3. Masoodi KZ, Lone SM. (2021). Advanced Methods in Molecular Biology and Biotechnology (1st ed.). Academic Press.
4. Bhurat MR. (2019). A Practical Book of Pharmacognosy and Phytochemistry – II (1st ed.). Nirali Prakashan Publishers.
5. Sawhney SK, Singh R. (2005). Introductory Practical Biochemistry (2nd ed.). Alpha Science International Ltd.
6. Sambrook J, Fritsch EF, Maniatis T. Molecular Cloning: A Laboratory Manual.
7. Greene JJ, Rao VB. Recombinant DNA: Principles and Methodologies.
8. Sivaranjani S, et al. (2023). Molecular Biology Practical Handbook. AkiNik Publications.

## E-RESOURCES

1. <https://www.pdfdrive.com/biochemistry-books.html>
2. <https://www.sciencedirect.com/book/9780128244494/advanced-methods-in-molecular-biology-and-biotechnology>
3. <https://www.mdpi.com/1420-3049/23/2/463>
4. [https://www.researchgate.net/publication/224870589\\_Agarose\\_Gel\\_Electrophoresis\\_for\\_the\\_Separation\\_of\\_DNA\\_Fragments](https://www.researchgate.net/publication/224870589_Agarose_Gel_Electrophoresis_for_the_Separation_of_DNA_Fragments)
5. <https://www.kopykitab.com/A-Practical-Book-Of-Pharmacognosy-And-Phytochemistry-II>

## 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     | 3     |
| CO 2 | 3    | 2    | 1    | 3    | 2    | 2    | 2    | 3    | 2    |       |       |       | 3     |       | 2     |
| CO 3 | 3    |      |      |      | 2    | 3    |      | 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     |

S-Strong (3)

M-Medium (2)

L-Low (1)

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**  
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*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: IV-EC VI: Forensic Science**

**Ins. Hrs./Week: 4**

**Course Credit: 3**

**Course Code: P25BCE46A**

**UNIT- I: Forensic Science (12 Hours)**

Forensic Science: Definition, History and Development, Scope and Need, Basic Principles, Branches of Forensic Science, Tools and Techniques of Forensic Science. Forensic Science Laboratories: Organizational setup of CFSL, FSL, GEQD, FPB, NICFS, CDTs, NCRB, NPA. Mobile Forensic Science Laboratory. Education of Forensic Science, Role of Media, Human Right and Criminal Justice System.

**UNIT-II: Blood Analysis (12 Hours)**

Fresh blood – grouping and typing of fresh blood samples including enzyme types. Analysis of stains of blood and allied body fluids for their groups and enzyme tests. Disputed paternity and maternity problems – DNA extraction and profiling techniques. Wild life forensics – Scope, evidences and identification.

**UNIT-III: Body fluids Analysis (12 Hours)**

Analysis of illicit liquor including methyl and ethyl alcohol and alcohol in body fluids and breathe. Analysis of chemicals in trap cases - Petroleum product, Chemical examination of insecticides, pesticides and psychotropic drugs – Sedatives, stimulants, opiates and drugs of abuse. Detection of poisons from viscera, tissues and body fluids. . Examination and identification of saliva, milk, urine and faecal matter.

**UNIT-V: Biological Evidence and Trace Material Analysis (12 Hours)**

History, classification, search, lifting and examination of fingerprints, development of latent fingerprints by various methods. Identification of hair, determination of species origin, sex, site and individual identification from hair. Medicolegal aspects of wounds, Post-mortem examination and PM changes, asphyxia death, sexual offences, infanticide. Forensic psychiatry and lie detection.

**UNIT - V: Forensic Ethics (12 Hours)**

Introduction, Definition, Scope, Ethics in Forensic Science, Professionalism and ethics: Importance of professional ethics, the importance Of professional ethics to science practitioners, development of code of conduct and code of ethics for Forensic Science; Application of codes and ethics, How ethical requirements impact the daily work of a forensic scientist; Ethical dilemmas and their resolution.

**Total Lecture Hours-60**

**COURSE OUTCOME**

The students are able to,

1. Gain knowledge on basics of forensic science and method for collection and preservation of samples.

2. Assess the paternity, maternity problems and DNA profiling.
3. Identify the presence of alcohol, insecticides and pesticides in body fluids.
4. Detail on the test performed to identify the presence of drugs and poisons in body fluids.
5. Identify species and sex from the available body fluids.

### TEXT BOOK(S)

1. Lee, H. (2001). *Crime scene handbook*. Academic Publication.
2. Lade, S. H. (n.d.). *Forensic biology* (2nd ed.). CRC Press.
3. Gardner, R. M., & Krouskup, D. R. (2021). *Practical crime scene processing and investigation* (3rd ed.). CRC Press.
4. James, S. H. (2007). *Forensic science: An introduction to scientific and investigative techniques* (3rd ed.). CRC Press.
5. Saferstein, R. (2006). *Criminalistics: An introduction to forensic science* (9th ed.). Pearson Education.
6. Turvey, B. E. (2011). *Criminal profiling: An introduction to behavioral evidence analysis* (3rd ed.). Academic Press.
7. Fisher, B. A. J. (2003). *Techniques of crime scene investigation* (7th ed.). CRC Press.

### REFERENCE BOOK(S)

1. Rudin, Norah, and Keith Inman. *An Introduction to Forensic DNA Analysis*. 2nd ed., CRC Press, 2001.
2. Saferstein, Richard E. *Forensic Science Handbook*, vol. 2 & 3, Pearson Publication, 2004.
3. Sharma, B. R. *Forensic Science in Criminal Investigation and Trial*. 4th ed., 2017.
4. Parikh, C. K. *Textbook of Medical Jurisprudence, Forensic Medicine, and Toxicology*. 9th ed., CBS Publishers and Distributors Pvt. Ltd., 2023.
5. Barrard, and Gerald. *The Identification of Firearms and Forensic Ballistics: Special Edition*. Palladium Press, 2002.

### E-RESOURCES

1. [http://www.crcnetbase.com/page/forensic\\_ebooks](http://www.crcnetbase.com/page/forensic_ebooks)
2. <https://www.fbi.gov/file-repository/handbook-of-forensic-services-pdf.pdf/view>
3. <http://www.forensic-science-society.org.uk/>

### 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     | 3     |
| CO 2 | 3    | 2    | 1    |      |      |      | 2    |      |      | 2     | 2     | 3     | 3     |       | 2     |
| CO 3 | 3    | 1    | 2    |      |      |      | 1    | 3    | 1    | 2     | 2     | 3     | 1     |       | 3     |
| CO 4 | 2    | 2    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 3     |

S-Strong (3)

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**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: IV-EC- VI: Drug Design and Development**

**Ins. Hrs. /Week: 4**

**Course Credit: 3**

**Course Code: P25BCE46B**

**UNIT I: Introduction to Drug Discovery and Development (12 Hours)**

Introduction to drugs and pharmaceuticals – History and evolution of drug discovery – Sources of drugs (natural, synthetic, semi-synthetic, biotechnology-derived products) – Drug discovery pipeline – Target identification and validation – Disease mechanisms and therapeutic targets – Role of genomics, proteomics, and metabolomics in drug discovery.

**UNIT II: Lead Identification and Optimization (12 Hours)**

Concept of lead compounds – Methods of lead identification – Natural products as drug leads – High-throughput screening (HTS) – Combinatorial chemistry – Structure-activity relationship (SAR) – Quantitative structure-activity relationship (QSAR) – Lead optimization strategies – Pharmacophore modeling.

**UNIT III: Computer-Aided Drug Design (12 Hours)**

Introduction to computer-aided drug design (CADD) – Molecular docking – Virtual screening – Ligand-based and structure-based drug design – Molecular dynamics simulation – Drug-likeness and Lipinski's Rule of Five – ADME prediction – Bioinformatics tools in drug discovery.

**UNIT IV: Preclinical and Clinical Drug Development (12 Hours)**

Preclinical studies – Toxicological evaluation – Pharmacokinetics and pharmacodynamics – Investigational New Drug (IND) application – Clinical trials: Phase I, II, III, and IV – Good Laboratory Practices (GLP) – Good Clinical Practices (GCP) – Ethical considerations in clinical research.

**UNIT V: Drug Regulations, Patents, and Recent Advances (12 Hours)**

Drug regulatory agencies and approval processes – Role of CDSCO, US FDA, and EMA – Intellectual Property Rights (IPR) and patents in pharmaceuticals – Generic drugs and biosimilars – Personalized medicine – Artificial intelligence in drug discovery – Drug repurposing – Challenges and future perspectives in drug development.

**Total Lecture Hours-60**

**COURSE OUTCOME**

The students are able to,

1. Explain the principles, stages, and challenges involved in drug discovery and development.
2. Analyse methods used for lead identification, optimization, and structure-activity relationship studies in drug design.

3. Apply computational and bioinformatics tools for rational drug design and virtual screening.
4. Evaluate preclinical and clinical development processes, including pharmacokinetic, toxicological, and ethical considerations.
5. Assess regulatory requirements, intellectual property issues, and emerging technologies influencing modern drug development.

#### TEXT BOOK(S)

1. Patrick, G. L. (2023). *An introduction to medicinal chemistry* (8th ed.). Oxford University Press.
2. Silverman, R. B., & Holladay, M. W. (2014). *The organic chemistry of drug design and drug action* (3rd ed.). Academic Press.
3. Krogsgaard-Larsen, P., Liljefors, T., & Madsen, U. (2016). *Textbook of drug design and discovery* (5th ed.). CRC Press.
4. Smith, H. J., & Williams, H. (2006). *Introduction to the principles of drug design and action* (4th ed.). CRC Press.
5. Nogrady, T., & Weaver, D. F. (2005). *Medicinal chemistry: A molecular and biochemical approach* (3rd ed.). Oxford University Press.

#### REFERENCE BOOK(S)

1. Wermuth, C. G. (Ed.). (2015). *The practice of medicinal chemistry* (4th ed.). Academic Press.
2. Abraham, D. J. (Ed.). (2011). *Burger's medicinal chemistry, drug discovery and development* (7th ed.). Wiley.
3. Jorgensen, W. L. (2009). *The many roles of computation in drug discovery*. Science Press.
4. Rang, H. P., Ritter, J. M., Flower, R. J., & Henderson, G. (2023). *Rang & Dale's pharmacology* (10th ed.). Elsevier.
5. Ghosh, A. K., & Brindisi, M. (2020). *Medicinal chemistry and drug discovery*. Elsevier.

#### E-RESOURCES

1. <https://www.drugbank.com>
2. <https://pubchem.ncbi.nlm.nih.gov>
3. <https://www.fda.gov>
4. <https://www.ema.europa.eu>
5. <https://www.rcsb.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    | 1    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     | 3     | 3     |
| CO 2 | 3    | 2    | 1    |      |      |      | 2    |      |      | 2     | 2     | 3     | 3     |       | 2     |
| CO 3 | 3    | 1    | 2    |      |      |      | 1    | 3    | 1    | 2     | 2     | 3     | 1     |       | 3     |
| CO 4 | 2    | 2    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 3     |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

# SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE



## (AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI – 614 016

(For the Candidates admitted in the academic year 2025–2026)

DEPARTMENT OF BIOCHEMISTRY

M.Sc., BIOCHEMISTRY

Semester: IV-EC- VI: Advances in Clinical Research

Ins. Hrs. /Week: 4

Course Credit: 3

Course Code: P25BCE46C

### UNIT- I: Introduction to clinical research

(12 Hours)

Introduction to clinical research, terminologies and definition in clinical research, origin and history of clinical research, difference between clinical research and clinical practice, types of clinical research, phases of clinical research, clinical trials in India - the national perspective, post marketing surveillance, pharmaceutical industry - global and Indian perspective, clinical trial market, career in clinical research.

### UNIT- II: Pharmacology and drug development

(12 Hours)

Introduction to pharmacology, concept of essential drugs, routes of drug administration, introduction to drug discovery and development, hurdles in drug development, sources of drugs, basics of drug, discovery & development, approaches to drug discovery, evolutionary classification of the strategies for drug discovery, emerging technologies in drug discovery, preclinical testing, investigational new drug application, clinical trials, new drug application and approval, pharmacokinetics, pharmacodynamics, recent advances - pharmacogenomics and protein based therapies.

### UNIT- III: Ethical considerations and guidelines in clinical research

(12 Hours)

Historical guidelines in clinical research, Nuremberg code, declaration of Helsinki, Belmont report, international conference on harmonization (ICH)-brief history of ICH, structure of ICH, ICH harmonization process, guidelines for good clinical practice, glossary, the principles of ICH GCP, institutional review board / independent ethics committee, investigator, sponsor, clinical trial protocol and protocol amendment(s), investigator's brochure, essential documents for the conduct of a clinical trial.

### UNIT- IV: Regulation in clinical research and management

(12 Hours)

Introduction of clinical trial regulation, European Medicine Agency, US FDA, drug and cosmetic act, Schedule Y, ICMR Guideline. Clinical Trial Management project management, protocol in clinical research, informed consent, case report form, investigator's brochure (IB), selection of an investigator and site, clinical trial stakeholders, ethical and regulatory submissions, documentation in clinical trials, pharmacovigilance, training in clinical research, roles and responsibilities of clinical research professionals.

### UNIT- V: Clinical data management

(12 Hours)

Introduction to CDM, CRF Design, clinical data entry, electronic data capture, data validation, discrepancy management, clinical data coding, SAE reconciliation, quality assurance & clinical data management, guideline & regulation in clinical trial data.

**Total Lecture Hours-60**

**COURSE OUTCOME:**

The students are able to

1. Discuss the basic introductory knowledge on the clinical research
2. Compare the protocols related to the clinical trial procedures in India and abroad
3. Apply the GLP in clinical research lab
4. Test the activity of the newly formulated drugs in experimental animals
5. Evaluate the formulations preparation and usage of the newly revealed drug for human consumption and design the protocols for clinical trials

**TEXT BOOK(S):**

1. Friedman, L. M. (2015). *Fundamentals of clinical trials* (5th ed.). Springer.
2. Machin, D., & Day, S. (2004). *Textbook of clinical trials*. John Wiley & Sons.
3. Indian Council of Medical Research. (2000, 2014, 2017). *Ethical guidelines for biomedical research on human subjects*.
4. Brody, T. (2016). *Clinical trials* (2nd ed.). Elsevier.
5. Gallin, J. I. (2002). *Principles and practice of clinical research* (2nd ed.). Elsevier.
6. World Health Organization. (2001). *Health research methodology: A guide for training in research methods* (2nd ed.). WHO.

**REFERENCE BOOK(S)**

1. Craig, C. R., & Stitzel, R. E. (2001). *Modern pharmacology with clinical correlations* (6th ed.). Lippincott Williams & Wilkins.
2. Shargel, L., Wu-Pong, S., & Yu, A. B. C. (2012). *Applied biopharmaceutics and pharmacokinetics* (6th ed.). McGraw-Hill Medical.
3. Lloyd, J., & Raven, A. (Eds.). (1994). *Handbook of clinical research*. Churchill Livingstone.
4. Di Ignazio, G., Di Giovanna, G., & Haynes, B. (2018). *Principles of clinical research*. CRC Press / BSP Books.
5. Rondels, R. K., Varley, S. A., & Webbs, C. F. (Eds.). (2000). *Clinical data management* (2nd ed.). Wiley.
6. Machin, D., Day, S., & Green, S. (2015). *Textbook of clinical trials*. John Wiley & Sons..

**E-RESOURCES**

1. <https://www.amazon.in/Advancements-Clinical-Research-Advances-Experimental-ebook/dp/B01MPY9EON>
2. <https://www.slideshare.net/slideshow/clinical-research-208096411/208096411>
3. <https://www.msmanuals.com/en-in/professional/clinical-pharmacology/concepts-in-pharmacotherapy/drug-development>
4. [https://journals.lww.com/ijaweb/fulltext/2017/61030/regulatory\\_requirements\\_for\\_clinical\\_trials\\_in.2.aspx](https://journals.lww.com/ijaweb/fulltext/2017/61030/regulatory_requirements_for_clinical_trials_in.2.aspx)
5. [https://en.wikipedia.org/wiki/Clinical\\_data\\_management](https://en.wikipedia.org/wiki/Clinical_data_management)

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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| CO 2 | 3    | 2    | 1    | 3    | 2    | 2    | 2    | 3    | 2    |       |       | 3     | 3     |       | 2     |
| CO 3 | 3    | 1    |      |      |      |      | 1    | 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     |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE**  
**(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI – 614 016**

*(For the Candidates admitted in the academic year 2025–2026)*

**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc., BIOCHEMISTRY**

**Semester: IV-PCC: Life Sciences for Competitive Examination**

**Ins. Hrs. /Week: 2**

**Course Credit: 2**

**Course Code: P25PCBC41**

**UNIT- I: Basics of Taxonomy**

**(06 Hours)**

Principles & methods of taxonomy, classical & modern methods of taxonomy of plants, animals and microorganisms. Levels of structural organization: Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems. Herbarium preparation.

**UNIT- II: System of classifications**

**(06 Hours)**

Outline classification of plants, animals & microorganisms, structural details: Important criteria used for classification in each taxon. Classification of plants (Bentham and Hooker), animals (Whitaker's) and microorganisms. Prokaryote and eukaryote cell: structural and function of cell wall, mitochondria, chloroplast, ribosomes, E.R., Golgi complex and nucleus.

**UNIT- III: Plant hormones and Nitrogen metabolism**

**(06 Hours)**

Plant hormones - Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action. Sensory photobiology & Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks. Nitrogen metabolism- Nitrate and ammonium assimilation.

**UNIT- IV: Plant physiology**

**(06 Hours)**

Translocation of water, ions, solutes and macromolecules from soil-xylem and phloem, transpiration, introduction to secondary metabolites. Stress physiology. Response of plants to biotic (pathogens and insects) and abiotic (water, temp and salt) stresses.

**UNIT- V: Environmental hazards and management**

**(06 Hours)**

Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Bioremediation; Phytoremediation; Solid waste management: toxic effects and treatments, methods, technologies for management of hospital waste - incineration, autoclaving, mechanical/chemical, microwave, plasma torch, detoxification, advanced wet oxidation and thermal, dry heat.

**Total Lecture Hours-30**

**COURSE OUTCOME**

The students are able to

1. Acquire knowledge on the basics in classification and naming plants and herbarium preparation
2. Comprehend systematic classification of plants and animals
3. Understand the biosynthesis and biological role of plant hormones and ecosystem

4. Recognize the correlation between photosynthesis, photoperiodism and nitrogen metabolism
5. Exploit the pollutants and various method of bioremediation

### TEXT BOOK(S)

1. Verma, P. S., & Agarwal, V. K. (2003). *Cytology, genetics, evolution and ecology*. S. Chand & Co. Ltd.
2. Verma, S. K. (1999). *Textbook of plant physiology*. S. Chand & Co. Ltd.
3. Srivastava, H. S., & Shankar, N. (2018–2019). *Plant physiology and biochemistry* (1st ed., 7th reprint). Rastogi Publications.
4. Pandey, S. N., & Sinha, B. K. (2008). *Plant physiology* (4th ed.). Vikas Publishing House Pvt. Ltd.
5. Buchanan, B., Gruissem, W., & Jones, R. (2015). *Biochemistry and molecular biology of plants* (2nd ed.). Wiley-Blackwell.
6. Taiz, L., & Zeiger, E. (2012). *Plant physiology* (5th ed.). Amazon Press.
7. Goodwin, T. W., & Mercer, E. I. (1983). *Introduction to plant biochemistry* (2nd ed.). Pergamon Press.
8. Harborne, J. B. (1997). *Plant biochemistry* (5th ed.). Harcourt Asia Pvt. Ltd.; Academic Press.
9. McDash. (1993). *Fundamentals of ecology* (2nd ed.). Tata McGraw-Hill Publishing Company.

### REFERENCE BOOK(S)

1. Plummer, D. T. (1989). *Biochemistry: The chemistry of life* (1st ed.). McGraw-Hill.
2. Taiz, L., & Zeiger, E. (2010). *Plant physiology* (5th ed.). Sinauer Associates.
3. Kumar, A., & Purohit, S. (2003). *Plant physiology: Fundamentals and applications* (2nd ed.). Agrobios Publishers.
4. Hopkins, W. G., & Hüner, N. P. A. (2009). *Introduction to plant physiology* (4th ed.). John Wiley & Sons.
5. Steward, F. C. (1964). *Plants at work: A summary of plant physiology* (22nd ed.). Addison-Wesley.
6. Dey, P. M., & Harborne, J. B. (2000). *Plant biochemistry*. Harcourt Asia / Academic Press.
7. Kumar, H. D. (2008). *Modern concepts of ecology* (8th ed.). Vikas Publishing House.
8. Mukherjee, B. (2008). *Fundamentals of environmental biology*. Silverline Publications.
9. Kumar, P., & Mina, U. (2022). *Life sciences: Fundamentals and practice (Part II)* (6th ed.). Pathfinder Publication.

### E-RESOURCES

1. <http://www.esalq.usp.br/lepse/imgs/conteudo/Plant-Physiology-by-Vince-Ordog.pdf>
2. <https://ncert.nic.in/textbook/pdf/kebo112.pdf>
3. <https://www.ctahr.hawaii.edu/oc/freepubs/pdf/pnm3.pdf>
4. <https://ncert.nic.in/textbook/pdf/kebo113.pdf>
5. <https://byjus.com/biology/plant-growth-regulators/>
6. <https://icar.org.in/files/mAgMicro.pdfv>
7. <https://collegedunia.com/exams/calvin-cycle-c-3-cycle-definition-stages-diagram-roducts-biology-articleid-1723>
8. <https://www.nios.ac.in/media/documents/SrSec314NewE/Lesson-10.pdf>
9. <https://testbook.com/biology/photosynthesis>

10. [https://ec.europa.eu/echo/files/evaluation/watsan2005/annex\\_files/WEDC/es/ES07CD.pdf](https://ec.europa.eu/echo/files/evaluation/watsan2005/annex_files/WEDC/es/ES07CD.pdf)

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| CO 2 | 3    | 2    | 1    |      |      |      | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 2     |
| CO 3 | 3    | 1    | 2    |      |      |      | 1    | 3    | 1    | 2     |       |       | 1     |       | 3     |
| CO 4 | 2    | 2    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     |       |       | 3     |       | 3     |
| CO 5 | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 2    | 2     | 2     | 3     | 3     |       | 3     |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

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