



## V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)

An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai

Reaccredited with 'A++' Grade (4<sup>th</sup> Cycle) by NAAC

**VIRUDHUNAGAR**

**Quality Education with Wisdom and Values**

### OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS (with effect from Academic Year 2024 - 2025)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes (Aided), 15 UG Programmes (SF), 15 PG Programmes and 6 Ph.D. Programmes. The curricula for all these Programmes, except Ph.D. Programmes, have been framed as per the guidelines given by the and University Grants Commission (UGC) & Tamil Nadu State Council for Higher Education (TANSICHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

The Departments of Commerce, English, History, Mathematics, Biochemistry and Tamil upgraded as Research Centres offer Ph.D. Programmes as per the norms and regulations of Madurai Kamaraj University, Madurai and do not come under the purview of CBCS.

#### A. CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed Courses. The CBCS is followed as per the guidelines formulated by the UGC. The performance of students is evaluated based on the uniform grading system. Computation of the Cumulative Grade Point Average (CGPA) is made to ensure uniformity in evaluation system.

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List of Programmes in which CBCS/Elective Course System is implemented

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#### UG PROGRAMMES

Arts & Humanities	:	History (E.M. & T.M.), English, Tamil
Physical & Life Sciences	:	Mathematics, Zoology, Chemistry, Physics, Biochemistry, Home Science - Nutrition and Dietetics, Costume Design and Fashion, Microbiology, Biotechnology, Computer Science, Information Technology, Data Science, Computer Applications and Computer Applications - Graphic Design
Commerce & Management	:	Commerce, Commerce (Computer Applications), Commerce (Professional Accounting), Business Administration

**PG PROGRAMMES**

- Arts & Humanities : History, English, Tamil
- Physical & Life Sciences : Mathematics, Physics, Chemistry, Zoology, Biochemistry, Home Science - Nutrition and Dietetics, Biotechnology, Computer Science, Computer Science (Data Science) Computer Applications (MCA) \*
- Commerce & Management : Commerce, Business Administration (MBA) \*
- \* AICTE approved Programmes

**OUTLINE OF CHOICE BASED CREDIT SYSTEM- PG**

1. Core Courses
2. Elective Courses
  - Discipline Specific Elective Courses (DSEC)
  - Generic Elective Courses
  - Non-Major Elective Course (NMEC)
3. Skill Enhancement Courses
4. Self Study Course (Online)
5. Extension Activity
6. Extra Credit Courses (Optional)

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**List of Non Major Elective Courses (NME)**  
**(2024-2025 onwards)**

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**PG PROGRAMMES**

Name of the Course	Course Code	Department
Introduction to Epigraphy	24PHIN21	History
Functional English	24PENN21	English
தமிழ் இலக்கிய வரலாறு	24PTAN21	Tamil
Taxation Concepts and Assessment	24PCON21	Commerce
Entrepreneurship Development	24PBAN21	Business Administration
Mathematics for Life Sciences	24PMTN21	Mathematics
Solid Waste Management	24PPHN21	Physics
Chemistry in Everyday Life	24PCHN21	Chemistry
Food Preservation	24PHSN21	Home Science - Nutrition and Dietetics
Nutritional Biochemistry	24PBCN21	Biochemistry
Tissue engineering	24PBON21	Biotechnology
Web Programming	24PCSN21	Computer Science
Fundamentals of Web Design	24PCAN21	Computer Applications

## **B.OUTCOME BASED EDUCATION (OBE) FRAMEWORK**

The core philosophy of Outcome Based Education rests in employing a student - centric learning approach to measure the performance of students based on a set of pre-determined outcomes. The significant advantage of OBE is that it enables a revamp of the curriculum based on the learning outcomes, upgrade of academic resources, quality enhancement in research and integration of technology in the teaching-learning process. It also helps in bringing clarity among students as to what is expected of them after completion of the Programme in general and the Course in particular. The OBE directs the teachers to channelise their teaching methodologies and evaluation strategies to attain the Programme Educational Objectives (PEOs) and fulfill the Vision and Mission of the Institution.

### **Vision of the Institution**

The founding vision of the Institution is to impart Quality Education to the rural womenfolk and to empower them with knowledge and leadership quality.

### **Mission of the Institution**

The mission of the Institution is to impart liberal education committed to quality and excellence. Its quest is to mould learners into globally competent individuals instilling in them life-oriented skills, personal integrity, leadership qualities and service mindedness.

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### **B.1 Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes**

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It is imperative for the Institution to set the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs), consistent with its Vision and Mission statements. The PEOs and the POs should be driven by the Mission of the Institution and should provide distinctive paths to achieve the stated goals. The PEOs for each Programme have to fulfill the Vision and Mission of the Department offering the Programme.

### **Vision of the Department of M.Sc. BIOCHEMISTRY**

To empower our students with scientific knowledge and skills and to mold them with pioneering spirit, forward thinking, leadership and collaborative approach.

**Mission of the Department of M.Sc. BIOCHEMISTRY**

- To handle scientific and research faculty of students through deep learning of Biochemistry for employability in research, academia and pharmaceutical fields,
- To advance traditional boundaries, to motivate for research and entrepreneurship
- Committed to improving the scientific world today.

**B.1.1 Programme Educational Objectives (PEOs)**

PEOs are broad statements that describe the career and professional achievements that the Programme is preparing the graduates to achieve within the first few years after graduation. PEOs are framed for each Programme and should be consistent with the Mission of the Institution.

**Programme Educational Objectives (PEOs) of M.Sc. BIOCHEMISTRY Programme****The Students will be able to**

- provide in-depth knowledge in the core areas of life sciences for industries, clinical, research , pharmaceutical labs, and academia.
- instill the ability of entrepreneurship in research and diagnostics
- equip skillful attitude promoting lifelong learning to meet the ever evolving professional demands by developing ethical , interpersonal and team skills

Key Components of Mission Statement	PEO1	PEO2	PEO3
Employability in research, academia and pharmaceutical fields	✓	✓	✓
Motivation for research and entrepreneurship	✓	✓	✓
Committed to improving the scientific world today	✓	✓	✓

**B.1.2 Programme Outcomes (POs)**

POs shall be based on Graduate Attributes (GAs) of the Programme. The GAs are the attributes expected of a graduate from a Programme in terms of knowledge, skills, attitude and values. The Graduate Attributes include Disciplinary Knowledge,

Communication Skills, Critical Thinking, Problem Solving, Analytical Reasoning, Research Related Skills, Co-operation/Team Work, Scientific Reasoning, Reflective Thinking, Information/Digital Literacy, Multicultural Competence, Moral and Ethical Awareness/Reasoning, Leadership Qualities and Lifelong Learning.

**On successful completion of the Programme, the students will be able to**

- 1 apply their in-depth domain knowledge and practical skills in interdisciplinary fields for research-based endeavours, employment and entrepreneurship development. (*Disciplinary Knowledge*)

- 2 communicate proficiently and confidently with the ability to present complex ideas both in spoken and written forms in a concise manner to assorted groups. (*Communication Skills*)
- 3 identify, formulate and solve problems in a consistent and systematic way with updated skills using modern tools and techniques. (*Scientific Reasoning and Problem Solving*)
- 4 analyze the data, synthesis the findings and provide valid conclusion by critical evaluation of theories, policies and practices for the fulfillment of the local, national, regional and global developmental needs. (*Critical Thinking and Analytical Reasoning*)
- 5 explore and evaluate globally competent research methodologies to apply appropriately in interdisciplinary research; Develop and sustain the research capabilities to meet the emerging needs for the welfare of the society. (*Research Related Skills*)
- 6 use ICT to mould themselves for lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning*)
- 7 self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence*)
- 8 uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness*)

### **B.1.3 Programme Specific Outcomes (PSOs)**

Based on the Programme Outcomes, Programme Specific Outcomes are framed for each PG Programme. Programme Specific Outcomes denote what the students would be able to do at the time of graduation. They are Programme-specific and it is mandatory that each PO should be mapped to the respective PSO.

**On Successful completion of M.Sc.Biochemistry Programme, the students will be able to**

#### **PO 1: Disciplinary Knowledge**

**PSO 1.a:** Apply the knowledge of theoretical and experimental approaches of Biochemistry in research oriented Endeavour to unravel problems in health care with a scientific basis of life process and will have an ability to provide solution to new problems.

**PSO 1.b:** Recognize the importance of bioethics, entrepreneurship and career oriented skills, thus providing a strong foundation for both academic / industrial placements across the country and globe as well as setting up entrepreneurial ventures.

**PO2:** *Communication Skills*

**PSO 2:** Communicate the knowledge of Biochemistry to address environmental, intellectual, societal and ethical issues through case studies .

**PO3:** *Scientific Reasoning and Problem Solving*

**PSO 3.a:** Enrich their analytical and problem solving skills regarding biochemical principles of life processes and technologies for combating human diseases.

**PSO 3.b:** build up the capacity of decision making with regard to scientific progress, personal development and career choice.

**PO4:** *Critical thinking and Analytical Reasoning*

**PSO 4:** Apply the knowledge of experimental approaches on designing experiments, analysis, interpretation of data and synthesis of information to provide valid conclusions for life situations and entrepreneurial situations.

**PO5:** *Research Related Skills*

**PSO 5:** An ability to properly understand the technical aspects with research aptitude of existing technologies that help in addressing the biological and medical challenges faced by human kind by adhering the code of conduct of Biochemistry

**PO6:** *Digital Literacy, Self - directed and Lifelong learning*

**PSO 6:** Analyze and interpret the data using state-of-the-art techniques with ICT and modern tools in planning and executing projects in Biochemistry for health care area, research area and entrepreneurial area.

**PO7:** *Cooperation/Team Work and Multicultural Competence*

**PSO 7:** Develop leadership qualities, team spirit and good interpersonal skills to work effectively in diverse fields like agriculture, health care, research and entrepreneurial fields individually or as a team.

**PO8:** *Moral and Ethical awareness*

**PSO 8:** Follow the global standards of codes of conduct in Life science community and practice the imbibed moral values in their profession to maintain sustainable environment and society.

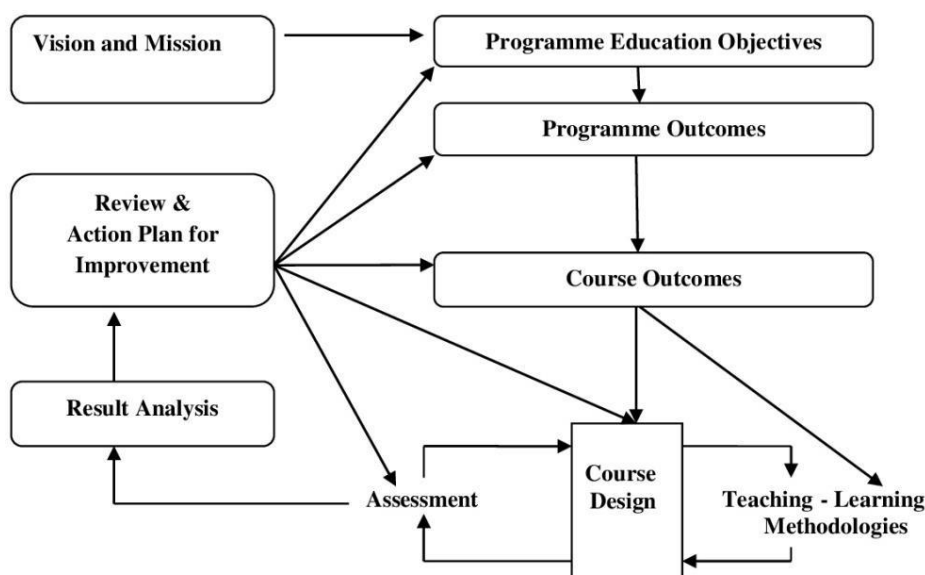
### PO-PEO Mapping Matrix

Attainment of PEOs can be measured by a PO-PEO matrix. PEOs should evolve through constant feedback from alumnae, students, industry, management, *etc.* It is mandatory that each PEO should be mapped to at least one of the Pos.

PEOs POs/PSOs	PEO1	PEO2	PEO3
PO1/PSO1	✓	✓	✓
PO2/PSO2	✓	✓	✓
PO3/PSO3	✓	✓	✓
PO4/PSO4	✓	✓	-
PO5/PSO5	-	✓	✓
PO6/PSO6	✓	✓	✓
PO7/PSO7	✓	✓	✓
PO8/PSO8	✓	✓	-

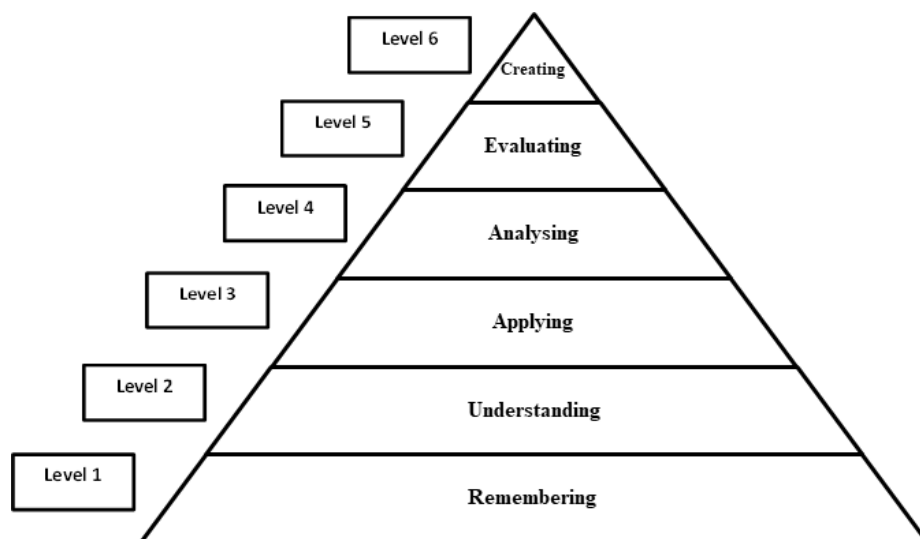
#### B.1.4 Course Outcomes (COs)

Course Outcomes are narrow statements restricted to the course contents given in five units. Course Outcomes describe what students would be capable of, after learning the contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after learning of Course contents. COs are measurable, attainable and manageable in number. COs contribute to attain POs in such a way that each CO addresses at least one of the POs and also each PO is reasonably addressed by adequate number of COs.



It is important to determine the methods of assessment. A comprehensive assessment strategy may be outlined using the revised Bloom's Taxonomy levels.

### BLOOM'S TAXONOMY



### CO - PO Mapping of Courses

After framing the CO statements, the COs framed for each course is mapped with POs based on the relationship that exists between them. The COs which are not related to any of the POs is indicated with (-), signifying Nil. Measurement Mapping is based on Four Points Scale [High (H), Medium (M), Low (L) and Nil (-)]. For calculating weighted percentage of contribution of each Course in the attainment of the respective POs, the weights assigned for H, M and L are 3, 2 and 1 respectively.

### CO-PO/PSO Mapping Table (Course Articulation Matrix)

PO/PSOs	PO1/ PSO1	PO2/ PSO2	PO3/ PSO3	PO4/ PSO4	PO5/ PSO5	PO6/ PSO6	PO7/ PSO7	PO8/ PSO8
COs								
CO1								
CO2								
CO3								
CO4								
CO5								

### ELIGIBILITY FOR ADMISSION

The candidate should have passed in B.Sc. Biochemistry, Zoology, Botany, Microbiology, Biotechnology (General or any Specialization) Degree from any recognized University.



**DURATION OF THE PROGRAMME**

The candidates shall undergo the prescribed Programme of study for a period of two academic years (four semesters).

**MEDIUM OF INSTRUCTION**

English

**B.2 EVALUATION SCHEME**

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory/Project	25	75	100

**B.2.1 Core Courses, Elective Courses (Discipline Specific Elective Courses, Generic Elective Courses & Non Major Elective Courses)****INTERNAL ASSESSMENT****Distribution of Marks****Theory**

Mode of Evaluation	Marks
Periodic Test	: 20
Assignment	: 5
<b>Total</b>	<b>: 25</b>

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

**Practical**

Mode of Evaluation	Marks
Periodic Test	: 30
Record Performance	: 10
<b>Total</b>	<b>: 40</b>

Periodic Test - Average of the best two will be considered

Performance - Attendance and Record

**Question Pattern for Periodic Test****Duration: 2 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6-9	Internal Choice – Either... or Type	4	4	5	20
C	10 - 11	Internal Choice – Either.... or Type	2	2	10	20
<b>Total</b>						<b>45*</b>

\*The total marks obtained in the Periodic Test will be calculated for 20 marks

**Summative Examination****External Assessment**

Distribution of Marks

Mode of Evaluation		Marks
Summative Examination	:	60
Seminar Presentation	:	15
<b>Total</b>	:	<b>75</b>

**Summative Examination****Question Pattern****Duration: 3 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6 - 10	Internal Choice -Either ....or Type	5	5	5	25
C	11 - 13	Internal Choice -Either ...or Type	3	3	10	30
					<b>Total</b>	<b>60</b>

**B.2.2 Project**

Individual Project is compulsory for II PG Students in IV Semester.

**Distribution of Marks**

Mode of Evaluation		Marks
Internal Assessment	:	40
External Examination	:	60
<b>Total</b>	:	<b>100</b>

Internal Assessment: Pre-submission Presentation - 10 Marks

Review Report - 20 Marks

One Open Online Course related to the Project - 10 Marks

External Examination: Project Report - 40 Marks

Viva Voce - 20 Mark

**B. 2.3 SKILL ENHANCEMENT COURSES****INTERNAL ASSESSMENT****Distribution of Marks****Theory**

Mode of Evaluation		Marks
Periodic Test	:	20
Assignment	:	5
<b>Total</b>	:	<b>25</b>

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

**Practical**

Mode of Evaluation		Marks
Periodic Test	:	30
Record Performance	:	10
<b>Total</b>		<b>40</b>

Periodic Test - Average of the best two will be considered

Performance - Attendance and Record

**Question Pattern for Periodic Test****Duration: 2 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 4	Internal Choice – Either... or Type	4	4	5	20
B	5	Internal Choice – Either... or Type	1	1	10	10
<b>Total</b>						<b>30*</b>

\*The total marks obtained in the Periodic Test will be calculated for 20 marks

**Summative Examination****External Assessment**

Distribution of Marks

Mode of Evaluation		Marks
Seminar Paper		10
Seminar Presentation	:	15
Summative Examination	:	50
<b>Total</b>		<b>75</b>

**Summative Examination****Question Pattern****Duration: 3 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6 - 10	Internal Choice - Either ...or Type	5	5	5	25
C	11 - 12	Internal Choice - Either ...or Type	2	2	10	20
<b>Total</b>						<b>50</b>

**B. 2.3.1 Skill Enhancement Course - Professional Competency Skill**

Types of Question – Multiple Choice Questions Only

**INTERNAL ASSESSMENT****Distribution of Marks****Theory**

Mode of Evaluation	Marks
Periodic Test	: 20
Assignment	: 5
<b>Total</b>	<b>: 25</b>

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

**Question Pattern for Periodic Test****Duration: 2 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6-9	Internal Choice – Either... or Type	4	4	5	20
C	10 - 11	Internal Choice – Either.... or Type	2	2	10	20
<b>Total</b>						<b>45*</b>

\*The total marks obtained in the Periodic Test will be calculated for 20 marks

**Summative Examination****External Assessment**

Distribution of Marks

Mode of Evaluation	Marks
Summative Examination	: 60
Seminar Presentation	: 15
<b>Total</b>	<b>: 75</b>

**Summative Examination****Question Pattern****Duration: 3 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6 - 10	Internal Choice - Either ....or Type	5	5	5	25
C	11 - 13	Internal Choice - Either ...or Type	3	3	10	30
<b>Total</b>						<b>60</b>

**B.2.4. Self Study - Online Course**

Practice for CSIR NET-General Paper –Online  
Internal Examination only

- Two Periodic Tests (Online) with Multiple Choice Questions will be conducted in III Semester.
- Model Examination will be conducted after two periodic tests.

**Distribution of Marks**

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
<b>Total</b>	<b>:</b>	<b>100</b>

Two Periodic Tests - Better of the two will be considered

**B.2.5. Extension Activities**

Assessment by Internal Examiner only

**Distribution of Marks**

Mode of Evaluation		Marks
Attendance	:	5
Performance	:	10
Report	:	10
<b>Total</b>	<b>:</b>	<b>25*</b>

\*The marks obtained will be calculated for 100 marks

**B.2.6. EXTRA CREDIT COURSES (OPTIONAL)****2.6.1 Extra Credit Course offered by the Department.**

Assessment by Internal Examiner Only (To be conducted along with the III Periodic Test)

**Distribution of Marks**

Mode of Evaluation		Marks
Quiz (Multiple Choice Questions)	:	25
Model Examination	:	75
<b>Total</b>	<b>:</b>	<b>100</b>

**Question Pattern for Model Examination**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q.No.(1-5)	Internal Choice- Either or Type	5	5	7	35
B Q.No.(6-9)	Internal Choice- Either or Type	4	4	10	40
				<b>Total</b>	<b>75</b>

### 2.6.2 Extra credit Course offered by MOOC (Massive Open Online Course)

- The Courses shall be completed within the first III Semesters of the Programme.
- The allotment of credits is as follows (**Maximum of 15 credits**)

4weeks Course	- 1 credit
8 weeks Course	- 2 credits
12 weeks Course	- 3 credits

### ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study and a minimum of 50% Pass marks in all the Courses.
  - No Pass minimum for Internal Assessment for other Courses.
  - Pass minimum for External Examination is 27 marks out of 60 marks for Core Courses, Discipline Specific Elective Courses and Non-Major Elective Course.
  - Pass minimum for Practice for SET/NET - General Paper is 50 Marks.
- Attendance
  - The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.
  - The students who have only 60-75days (66% -84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amount and fulfilling other conditions according to the respective cases.
  - The students who have attended the classes for 59 days and less – upto 45 days (50% - 65%) can appear for the Summative Examinations only after getting special permission from the Principal.
  - The students who have attended the classes for 44 days or less (<50%) cannot appear for the Summative Examinations and have to repeat the whole semester.
  - These rules are applicable to UG, PG and M.Phil. Programmes and come into effect from 2020-2021 onwards.
  - For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

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### B.3 ASSESSMENT MANAGEMENT PLAN

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An Assessment Management Plan that details the assessment strategy both at the Programme and the Course levels is prepared. The continuous assessment is implemented using an assessment rubric to interpret and grade students.

### B.3.1 Assessment Process for CO Attainment

Assessment is one or more processes carried out by the institution that identify, collect and prepare data to evaluate the achievement of Course Outcomes and Programme Outcomes. Course Outcome is evaluated based on the performance of students in the Continuous Internal Assessments and in End Semester Examination of a course. Target levels of attainment shall be fixed by the Course teacher and Heads of the respective departments.

**Direct Assessment (Rubric based)** - Conventional assessment tools such as Term Test, Assignment, Quiz and End Semester Summative Examination are used.

**Indirect Assessment** - Done through Course Exit Survey.

#### CO Assessment Rubrics

For the evaluation and assessment of COs and POs, rubrics are used. Internal assessment contributes 40% and End Semester assessment contributes 60% to the total attainment of a CO for the theory courses. For the practical courses, internal assessment contributes 50% and Semester assessment contributes 50% to the total attainment of a CO. Once the Course Outcome is measured, the PO can be measured using a CO-PO matrix.

#### CO Attainment

##### Direct CO Attainment

Course Outcomes of all courses are assessed and the CO - wise marks obtained by all the students are recorded for all the assessment tools. The respective CO attainment level is evaluated based on set attainment rubrics.

##### Target Setting for Assessment Method

For setting up the target of internal assessment tools, 55% of the maximum mark is fixed as target. For setting up the target of End Semester Examination, the average mark of the class shall be set as target.

#### Formula for Attainment for each CO

Attainment = Percentage of students who have scored more than the target marks

$$\text{Percentage of Attainment} = \frac{\text{Number of Students who Scored more than the Target}}{\text{Total Number of Students}} \times 100$$

## Attainment Levels of COs

Assessment Methods	Attainment Levels	
Internal Assessment	Level 1	50% of students scoring more than set target marks in Internal Assessment tools
	Level 2	55% of students scoring more than set target marks in Internal Assessment tools
	Level 3	60% of students scoring more than set target marks in internal Assessment tools
End Semester Summative Examination	Level 1	50% of students scoring more than average marks in End Semester Summative Examination
	Level 2	55% of students scoring more than average marks in End Semester Summative Examination
	Level 3	60% of students scoring more than average marks in End Semester Summative Examination

### Indirect CO Attainment

At the end of each Course, an exit survey is conducted to collect the opinion of the students on attainment of Course Outcomes. A questionnaire is designed to reflect the views of the students about the Course Outcomes.

#### Overall CO Attainment=75% of Direct CO Attainment + 25 % of Indirect CO Attainment

In each Course, the level of attainment of each CO is compared with the predefined targets. If the target is not reached, the Course teacher takes necessary steps for the improvement to reach the target.

For continuous improvement, if the target is reached, the Course teacher can set the target as a value greater than the CO attainment of the previous year.

### B.3.2 Assessment Process for Overall PO Attainment

With the help of CO - PO mapping, the PO attainment is calculated. PO assessment is done by giving 75% weightage to direct assessment and 25% weightage to indirect assessment. Direct assessment is based on CO attainment, where 75% weightage is given to attainment through End Semester Examination and 25 % weightage is given to attainment through Internal assessments. Indirect assessment is done through Graduate Exit Survey and participation of students in Co-curricular/Extra-curricular activities.



**PO Assessment Tools**

Mode of Assessment	Assessment Tool	Description
Direct Attainment (Weightage -75%)	CO Assessment	This is computed from the calculated CO Attainment value for each Course.
Indirect Attainment (Weightage - 25%)	Graduate Exit Survey 10%	At the end of the Programme, Graduate Exit Survey is collected from the graduates and it gives the opinion of the graduates on attainment of Programme Outcomes.
	Co-curricular / Extra-curricular activities 15%	For participation in Co-curricular/Extra-curricular activities during the period of their study.

**Programme Articulation Matrix (PAM)**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Average Direct PO Attainment									
Direct PO Attainment in percentage									

**Indirect Attainment of POs for all Courses**

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Graduate Exit Survey								
Indirect PO Attainment								

**Attainments of POs for all Courses**

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Direct Attainment(Weightage - 75%)								
Indirect Attainment(Weightage - 25%)								
Overall PO Attainment								

**Overall PO Attainment= 75% of Direct PO Attainment +  
25% of Indirect PO Attainment (Graduate Exit Survey  
& Participation in Co- curricular and  
Extra-curricular Activities)**

**Expected Level of Attainment for each of the Programme Outcomes**

POs	Level of Attainment
Attainment Value $\geq 70\%$	Excellent
$60\% \leq$ Attainment Value $< 70\%$	Very Good
$50\% \leq$ Attainment Value $< 60\%$	Good
$40\% \leq$ Attainment Value $< 50\%$	Satisfactory
Attainment Value $< 40\%$	Not Satisfactory

**Level of PO Attainment**

Graduation Batch	Overall PO Attainment (in percentage)	Whether Expected Level of PO is Achieved? (Yes/No)

**B.3.3 Assessment Process for PEOs**

The curriculum is designed so that all the courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 3 years of completion of the Programme only through Indirect methods.

**Target for PEO Attainment**

Assessment Criteria	Target (UG)	Target (PG)
Record of Employment	15% of the class strength	30 % of the class strength
Progression to Higher Education	50% of the class strength	5 % of the class strength
Record of Entrepreneurship	2 % of the class strength	5 % of the class strength

**Attainment of PEOs**

Assessment Criteria & Tool	Weightage
Record of Employment	10
Progression to Higher Education	20
Record of Entrepreneurship	10
Feedback from Alumnae	30
Feedback from Parents	10
Feedback from Employers	20
<b>Total Attainment</b>	<b>100</b>

$$\text{Percentage of PEO Attainment from Employment} = \frac{\text{Number of Students who have got Employment}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Higher Education} = \frac{\text{Number of Students who pursue Higher Education}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Entrepreneurship} = \frac{\text{Number of Students who have become Entrepreneurs}}{\text{Target}} \times 100$$

### Expected Level of Attainment for each of the Programme Educational Objectives

POs	Level of Attainment
Attainment Value $\geq 70\%$	Excellent
$60\% \leq \text{Attainment Value} < 70\%$	Very Good
$50\% \leq \text{Attainment Value} < 60\%$	Good
$40\% \leq \text{Attainment Value} < 50\%$	Satisfactory
Attainment Value $< 40\%$	Not Satisfactory

### Level of PEO Attainment

Graduation Batch	Overall PEO Attainment (in percentage)	Whether Expected Level of PEO is Achieved? (Yes/No)

### C. PROCESS OF REDEFINING THE PROGRAMME EDUCATIONAL OBJECTIVES

The college has always been involving the key stakeholders in collecting information and suggestions with regard to curriculum development and curriculum revision. Based on the information collected, the objectives of the Programme are defined, refined and are inscribed in the form of PEOs. The level of attainment of PEOs defined earlier will be analysed and will identify the need for redefining PEOs. Based on identified changes in terms of curriculum, regulations and PEOs, the administrative system like Board of Studies, Academic Council and Governing Body may recommend appropriate actions. As per the Outcome Based Education Framework implemented from the Academic Year 2020 - 2021, the following are the Programme Structure, the Programme Contents and the Course Contents of M.Sc. Biochemistry Programme



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### MASTER OF BIOCHEMISTRY (7015)

*Outcome Based Education with Choice Base Credit System*

Programme Structure - Allotment of Hours and Credits

For those who join in the Academic Year 2024-2025

Components	Semester				Total Number of Hours (Credits)
	I	II	III	IV	
Core Course	6 (5)	6 (5)	6 (5)	6 (5)	24 (20)
Core Course	6 (5)	6 (5)	6 (5)	6 (5)	24 (20)
Core Course	-	-	6 (5)	-	6 (5)
Core Course Practical	6 (4)	6 (4)	6 (4)	-	18 (12)
Project	-	-	-	6 (5)	6(5)
Elective Course (DSEC)	6 (3)	4 (3)	3 (3)	-	13 (9)
Elective Course (Generic)	6 (3)	4 (3)	-	-	10 (6)
Elective Course(NME)	-	4 (2)	3 (2)	-	7 (4)
Elective Course- (Industry / Entrepreneurship) 20% Theory 80 % Practical	-	-		6 (3)	6 (3)
Skill Enhancement Course/ Professional Competency Skill	-	-	-	6 (3)	6 (3)
Self Study Course	-	-	0 (1)	-	0 (1)
Internship/Industrial Activity	-	-	0 (2)	-	0 (2)
Extension Activity	-	-	-	0 (1)	0 (1)
<b>Total</b>	<b>30 (20)</b>	<b>30 (22)</b>	<b>30 (27)</b>	<b>30 (22)</b>	<b>120 (91)</b>
Extra Credit Course(Optional) - Offered by the Department	-	-	0(2)	-	0(2)
Extra Credit Course(Optional) - MOOC	-	-	-	-	Limited to a maximum of 15 credits



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### MASTER OF BIOCHEMISTRY

Programme Code - 7015

### PROGRAMME CONTENT

#### M.Sc. Biochemistry -SEMESTER I

S.No.	Components	Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1.	Core Course -1	Basics of Biochemistry	24PBCC11	6	5	3	25	75	100
2	Core Course -2	Biochemical and Molecular Biology Techniques	24PBCC12	6	5	3	25	75	100
3.	Core Course- 3 Practical -1	Laboratory Course On Biomolecules And Biochemical Techniques Practical	24PBCC11P	6	4	6	40	60	100
4.	Elective Course -1 (DSEC)	Physiology and Cell Biology	24PBCE11	6	3	3	25	75	100
5.	Elective Course - 2 (Generic)	Microbiology and Immunology	24PBCE12	6	3	3	25	75	100
<b>Total</b>				<b>30</b>	<b>20</b>				<b>500</b>



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### M.Sc. Biochemistry -SEMESTER II

S. No.	Components	Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1.	Core Course -4	Cellular Metabolism	24PBCC21	6	5	3	25	75	100
2	Core Course -5	Clinical Biochemistry	24PBCC22	6	5	3	25	75	100
3	Core Course-6 Practical -2	Laboratory Course on Clinical Biochemistry	24PBCC21P	6	4	6	40	60	100
4	Elective Course-3 (DSEC)	Energy and Drug Metabolism	24PBCE21	4	3	3	25	75	100
5	Elective Course - 4 (Generic)	Developmental Biology	24PBCE22	4	3	3	25	75	100
6	Elective Course - 5 (NME)	Nutritional Biochemistry	24PBCN21	4	2	3	25	75	100
<b>Total</b>				<b>30</b>	<b>22</b>		<b>600</b>		

**M.Sc. Biochemistry -SEMESTER III**

S.No.	Components	Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course -7	Industrial Microbiology	24PBCC31	6	5	3	25	75	100
2	Core Course -8	Molecular Biology	24PBCC32	6	5	3	25	75	100
3	Core Course -9	Enzymology	24PBCC33	6	5	3	25	75	100
4	Core Course-10 Practical -3	Laboratory course on Enzymology, Microbiology and Cell Biology	24PBCC31P	6	4	6	40	60	100
5	Elective Course -6 (DSEC)	Biostatistics and Data Science	24PBCE31	3	3	3	25	75	100
6	Elective Course -7 (NME)	Molecular Basis of Diseases And Therapeutic Strategies	24PBCN31	3	2	3	25	75	100
7	Self Study Course	Practice for CSIR NET-General Paper	24PGOL32	-	1	2	100	-	100
8	Intership/Industrial Activity		24PBCI31	-	2	-	100	-	100
Total				30	27				800
9	Extra Credit Course	Gene Editing, Cell and Gene therapy	24PBCO31	-	2	3	100		100

**M.Sc. Biochemistry -SEMESTER IV**

S. No.	Components	Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1.	Core Course -11	Pharmaceutical Biochemistry	24PBCC41	6	5	3	25	75	100
2	Core Course -12	Biosafety, Lab Safety And IPR	24PBCC42	6	5	3	25	75	100
3.	Core Course -13	Project	24PBCC41PR	6	5	-	40	60	100
4.	Elective Course- 8 (Industry / Entrepreneurship)	Bioinformatics Practical	24PBCE41P	6	3	3	40	60	100
5.	Skill Enhancement Course/ Professional Competency Skill	Preparation for Competitive Examination - Life Sciences	24PBCS41	6	3	3	25	75	100
6.	Extension Activity			-	1	-	100	-	100
<b>Total</b>				<b>30</b>	<b>22</b>				<b>600</b>





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### M.Sc. BIOCHEMISTRY

(for those who join in 2024 -2025)

Semester I	<b>BASICS OF BIOCHEMISTRY</b>	Hours/Week: 6	
Core Course-1		Credits: 5	
<b>24PBCC11</b>		Internal 25	External 75

#### COURSES OUTCOMES

On successful completion of the course, the students should be able to:

**CO1:** Illustrate the chemical structure and explain the properties of biomolecules.

[K2]

**CO2:** classification and general functions of biomolecules [K3]

**CO3:** Describe the biological role of biomolecules in biological system (K3)

**CO4:** Analyze the various levels of structural organization of proteins and nucleic acids .(K4)

**CO5.** Applying the knowledge of biomolecules in research and diagnosis (K4)

#### UNIT I

Carbohydrates- Classification, structure (configurations and conformations, anomeric forms), function and properties of monosaccharides, mutarotation, Disaccharides and oligosaccharides with suitable examples . Polysaccharides - Homopolysaccharides (starch, glycogen, cellulose, inulin, dextrin, agar, pectin, dextran). Heteropolysaccharides - Glycosaminoglycans– source, structure, functions of hyaluronic acid, chondroitin sulphates, heparin, keratan sulphate,. Glycoproteins - proteoglycans. O- Linked and N-linked glycoproteins..

**(18 hours)**

## UNIT II

Lipids – Classification of lipids, structure, properties and functions of fatty acids, triacylglycerols, phospholipids, glycolipids, sphingolipids and steroids – Biological importance. Eicosanoids- classification, structure and functions of prostaglandins, thromboxanes, leukotrienes. Lipoproteins – Classification, structure, transport (endogenous and exogenous Pathway ) and their biological significance. **(18 hours)**

## UNIT III

Overview of Amino acids - classification, structure and properties of amino acids, Biological role. Non- Protein amino acids and their biological significance .Proteins – classification based on structure and functions. Primary, secondary, super secondary (motifs) (Helix-turn –helix, helix-loop-helix, Beta-alpha-beta motif, Rosemann Rossmann fold, Greek key ),tertiary and quaternary structure of proteins. Determination of amino acid sequence. Chemical synthesis of a peptide, Forces involved in stabilization of protein structure, Ramachandran plot. Folding of proteins- Molecular chaperons – Hsp 70 and Hsp 90 - biological role.

**(18 hours)**

## UNIT IV

Membrane Proteins - Types and their significance. Cytoskeleton proteins - actin , tubulin , intermediate filaments . Biological role of cytoskeletal proteins. Membrane structure-fluid mosaic model. **(18 hours)**

## UNIT V

Nucleic acids – types and forms (A, B, C and Z) of DNA. Watson-Crick model-Primary, secondary and tertiary structures of DNA. Triple helix and quadruplex DNA. Mitochondrial and chloroplast DNA. Determination of nucleic acid sequences by Maxam Gilbert and Sanger's methods. Forces stabilizing nucleic acid structure. Properties of DNA and RNA.

Structure and role of nucleotides in cellular communications. Major and minor classes of RNA, their structure and biological functions . (18 hours)

### TEXT BOOKS

1. Satyanarayan,U (2014) Biochemistry (4th ed), ArunabhaSen Books & Allied (P) Ltd, Kolkata.
2. Voet.D & Voet. J.G (2010) Biochemistry , (4th ed), JohnWiley & Sons, Inc.

### REFERENCE BOOKS

1. David L.Nelson and Michael M.Cox (2012) LehningerPrinciples of Biochemistry (6th ed) W.H. Freeman.
2. Metzler D.E (2003). The chemical reactions of livingcells (2nd ed), Academic Press.
3. Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill.
4. Lubert Stryer (2010) Biochemistry,(7th ed), W.H.Freeman

Course Code 24PBCC11	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO3 3.a	PSO3 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
<b>CO 1</b>	2	2	2	2	1	2	3	2	2	1
<b>CO 2</b>	2	2	2	3	2	3	2	3	2	1
<b>CO 3</b>	3	3	2	3	2	3	2	3	2	2
<b>CO 4</b>	2	2	2	3	1	2	2	2	1	1
<b>CO 5</b>	2	3	3	3	2	3	3	3	2	1

**Strong (3)      Medium (2)      Low (1)**

Dr.P.Annapoorani  
Head of the Department

Dr.R.Renuka  
Course Designer



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### M.Sc. BIOCHEMISTRY

(for those who join in 2024-2025)

Semester: I	<b>BIOCHEMICAL AND MOLECULAR BIOLOGY TECHNIQUES</b>	Hours/Week: 6	
Core Course-2		Credits: 5	
Course Code		Internal	External
<b>24PBCC12</b>		25	75

#### COURSES OUTCOMES

After completion of the course, the students should be able to:

CO1: Understand the Biophysical, Biochemical and Molecular Biological techniques. [K2]

CO2: Apply the knowledge on different types of Identification and separation techniques in biological investigations. [K3]

CO3: Determine the Biochemical and Biophysical characterization of macromolecules and their complexes for structural biology experiments. [K3]

CO4 : Analyze the practical and data handling skills required to undertake the Bio Technical research. [K4]

CO5: Examine the principles and techniques of Biochemistry that motivates the students for higher education and acquiring skills in separation techniques to identify different biomolecules in scientific research. [K4]

#### UNIT I

General approaches to biochemical investigation, cell culture techniques and microscopic techniques. Organ and tissue slice technique, cell distribution and homogenization techniques, cell sorting, and cell counting, tissue Culture techniques. Cryopreservation, Biosensors- principle and applications. Principle, working and applications of light microscope, dark field, phase contrast and fluorescent microscope. Electron microscope- Principle, instrumentation of TEM and SEM, Specimen preparation and applications-shadow casting, negative staining and freeze fracturing.

**(18 hours)**

## **UNIT II**

Basic principles of centrifugation, Preparative ultracentrifugation, Differential centrifugation, Density gradient centrifugation, Analytical ultra centrifugation.

Chromatographic techniques-Basic principles, Types-Adsorption( Hydroxy apatite & Hydrophobic interaction chromatography) and Partition chromatography. Chiral and counter current chromatography. Principle, Instrumentation and Applications of paper, Thin layer, GLC, HPLC-(Low and High pressure), Affinity, Ion exchange, Gel permeation chromatography techniques. **(18 hours)**

## **UNIT III**

Electrophoretic Techniques: General principles of electrophoresis, supporting medium, factors affecting electrophoresis, Isoelectric focusing-principle, ampholyte, development of pH gradient and application. PAGE-gel casting-horizontal, vertical, slab gels, sample application, detection-staining using CBB, silver, fluorescent stains. SDS PAGE-principle and application in molecular weight determination principle of disc gel electrophoresis ,2D PAGE. Electrophoresis of nucleic acids-agarose gel electrophoresis of DNA, pulsed field gel electrophoresis- principle, apparatus, application. Electrophoresis of RNA, curve. Microchip electrophoresis and 2D electrophoresis, Capillary electrophoresis. **(18 hours)**

## **UNIT IV**

Spectroscopic techniques: Basic laws of light absorption- principle, instrumentation and applications of UV-Visible, IR, ESR, NMR, Mass spectroscopy, Turbidimetry and Nephelometry. Luminometry (Luciferase system, chemiluminescence). X - ray diffraction. Atomic absorption spectroscopy - principle and applications - Determination of trace elements. **(18 hours)**

## **UNIT V**

Radiolabeling Techniques and Centrifugation: Nature of radioactivity-detection and measurement of radioactivity, methods based upon ionisation (GM counter) and excitation (scintillation

counter), autoradiography and applications of radioactive isotopes, Biological hazards of radiation and safety measures in handling radioactive isotopes . (18 hours)

### TEXT BOOKS

1. Keith Wilson, John Walker (2010) Principles and Techniques of Biochemistry and Molecular Biology (7th ed) Cambridge University Press.

### REFERENCE BOOKS

1. David Sheehan (2009), Physical Biochemistry: Principles and Applications (2nd ed), Wiley-Blackwell
2. David M. Freifelder (1982) Physical Biochemistry: Applications to Biochemistry and Molecular Biology, W.H. Freeman
3. Rodney F. Boyer (2012), Biochemistry Laboratory: Modern Theory and techniques, (2nd ed), Prentice Hall
4. Kaloch Rajan (2011), Analytical techniques in Biochemistry and Molecular Biology, Springer
5. Segel I.H (1976) Biochemical Calculations (2nd ed), John Wiley and Sons
6. Robyt JF (2015) Biochemical techniques: Theory and Practice (1st ed), CBS Publishers & Distributors.

Course Code 24PBCC12	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3	2	2	3	3	3	2	3	3	2
CO2	2	2	2	2	2	3	2	3	2	2
CO3	2	2	1	2	2	3	2	3	1	1
CO4	3	2	2	3	3	2	3	3	2	2
CO5	3	3	2	3	1	3	3	3	2	2

**Strong (3)      Medium (2)      Low (1)**

Dr.P.Annapoorani  
Head of the Department

Mrs.M.Rajakumari  
Course Designer



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**M.Sc Biochemistry**

**(for those who join in 2024-2025)**

Semester I	<b>LABORATORY COURSE ON BIOMOLECULES AND BIOCHEMICAL TECHNIQUES</b>	Hours/Week: 6	
Core Course -3 Practical- 1		Credits: 4	
Course Code <b>24PBCC11P</b>		Internal 40	External 60

### COURSES OUTCOMES

On successful completion of this course, students should be able to:

CO1: understand the techniques used in the isolation, purification and estimation of different biomolecules that are widely employed in research (K2)

CO2: explain the Principle, Instrumentation and method of estimating the biomolecules and chromatographic techniques (K2).

CO3: sketch the flowchart for the estimation of various biomolecules (K3)

CO4. observe and calculate the results for the estimation and chromatographic separation of various macro and biomolecules and complete the record work. (K3)

CO5. analyze the outcomes of the sample analysis using biochemical techniques (K4)

### UNIT I

#### Biochemical studies and estimation of macromolecules

1. Isolation and estimation of glycogen from liver.
2. Purification of Polysaccharides –Starch and assessment of its purity ( 18 hours)

### UNIT II

#### UV absorption

1. Isolation and estimation of RNA.
2. Isolation and estimation of DNA from animal tissue.
3. Denaturation of Protein and absorption studies. ( 18 Hours)

### UNIT III

#### Colorimetric estimations

1. Estimation of Pyruvate
2. Estimation of tryptophan. (10 Hours)

### UNIT IV

#### Estimation of minerals

1. Estimation of calcium
2. Estimation of iron (18 Hours)

### UNIT V

#### Plant Biochemistry

1. Qualitative analysis Phytochemical screening
2. Estimation of Flavonoids -Quantitative analysis ( 10 Hours)

#### Group Experiments – (Any Four)

1. Fractionation of sub-cellular organelles by differential centrifugation-Mitochondria and nucleus
2. Identification of the separated sub-cellular fractions using marker enzymes (any one)
3. Separation of identification of lipids by thin layer chromatography.
4. Separation of plant pigments from leaves by column chromatography
5. Identification of Sugars by Paper Chromatography
6. Identification of Amino acids by Paper Chromatography ( 16 Hours)

#### TEXT BOOKS

1. David Plummer (2001) An Introduction to Practical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd
2. Jayaraman, J (2011),laboratory Manual in Biochemistry, New age publishers
3. Varley H (2006) Practical Clinical Biochemistry (6th ed) , CBS Publishers
4. O. Debiyi and F. A. Sofowora, (1978 )“Phytochemical screening of medical plants,” Iloyidia, vol. 3, pp. 234–246,
5. Prof. Sarin A. Chavhan, Prof. Sushilkumar A. Shinde (2019) A Guide to Chromatography Techniques Edition:1
6. Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011)



Course Code 24PBCC11P	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO 1	3	3	2	3	3	3	2	1	2	2
CO 2	3	3	2	2	2	3	2	1	2	2
CO 3	3	3	2	3	3	3	2	1	2	2
CO 4	3	3	2	3	3	3	2	1	2	2
CO 5	3	3	2	3	3	3	2	1	2	2

**Strong (3)    Medium (2)    Low (1)**

Dr.P.Annapoorani  
**Head of the Department**

Dr.R.Salini  
**Course Designer**



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**M.Sc Biochemistry**

**(for those who join in 2024-2025)**

Semester I	<b>PHYSIOLOGY AND CELL BIOLOGY</b>	Hours/Week: 6	
Elective Course -1 (DSEC)		Credits: 3	
Course Code <b>24PBCE11</b>		Internal 25	External 75

### COURSE OUTCOMES

On completion of the course the students will be able to

CO1. comprehend the biological and chemical processes within a human cell [K2]

CO2. identify and prevent diseases and examining the problems from a different perspective. [K3]

CO3. identify general characteristics in individuals with imbalances of acid- base, fluid and electrolytes. [ K3 ]

CO4. Analyse the defects in digestion, nutritional deficiencies and intolerances, and gastrointestinal pathologies [K4]

CO5. interpret the mechanism: the transmission of biochemical information between cell membrane and nucleus. [K4]

### UNIT I

**Major classes of cell junctions-** anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs)- cadherins, integrins. Types of tissues. Epithelium- organisation and types. The basement membrane. Cell cycle- mitosis and meiosis, Cell cycle-phases and regulation. Cell death mechanisms- an overview-apoptosis, necrosis. **(18 Hours)**

## UNIT II

**Digestive system-** structure and functions of different components of digestive system, digestion and absorption of carbohydrates, lipids and proteins, role of bile salts in digestion and absorption, mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive system. Composition of blood, lymph and CSF. Blood cells - WBC, RBC and energy metabolism of RBC, Blood clotting mechanism and blood groups- ABO and Rhesus system. **(18 hours)**

## UNIT III

**Respiratory system-**Gaseous transport and acid-base homeostasis. Mechanism of the movement of O<sub>2</sub> and CO<sub>2</sub> through lungs, arterial and venous circulation. Bohr effect, oxygen and carbon dioxide binding haemoglobin. pH maintenance by cellular and intracellular proteins. Phosphate and bicarbonate buffers, Metabolic acidosis and alkalosis. Respiratory acidosis and alkalosis. Regulation of fluid and electrolyte balance. **(18 hours)**

## UNIT IV

**Sensory transduction, Nerve impulse transmission-** nerve cells, synapses, reflex arc structure, resting membrane potential, Nernst equation, action potential, voltage gated ion-channels, impulse transmission, neurotransmission, neurotransmitter receptors, synaptosomes, synaptotagmin, rod and cone cells in the retina, changes in the visual cycle, photochemical reaction and regulation of rhodopsin, odour receptors, learning and memory. Chemistry of muscle contraction – actin and myosin filaments, theories involved in musclecontraction, mechanism of muscle contraction, energy sources for muscle contraction. **(18 hours)**

## UNIT V

**Hormones & Reproductive system** - Hormones – Classification, Biosynthesis, circulation in blood, modification and degradation. Mechanism of hormone action, Target cell concept. Hormones of Hypothalamus, pituitary, Pancreatic, thyroid & parathyroid, adrenal and gonadal hormones. Synthesis, secretion, physiological actions and feedback regulation of synthesis. Sexual differentiation and development; sperm transport, sperm capacitation,

semen analyses and Acrosome reaction. Clinical relevance of female reproductive physiology- menstrual cycle, pregnancy and menopause. Fertilisation and infertility issues.

(18 hours)

### TEXT BOOKS

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6th ed). John Wiley & Sons. Inc.
2. Bruce Alberts and Dennis Bray (2013), Essential Cell Biology, (4th ed), Garland Science.
3. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. (5th ed). Sunderland, Mass. Sinauer Associates, Inc.
4. Wayne M. Baker (2008) the World of the Cell. (7th ed). Pearson Benjamin Cummings Publishing, San Francisco. Cell Biology
5. John E. Hall (2010). Guyton and Hall Textbook of Medical Physiology (12th ed), Saunders
6. Harrison's Endocrinology by J. Larry Jameson Series: Harrison's Specialty, 19th Edition Publisher: McGraw-Hill, Year: 2016.

### REFERENCE BOOKS

1. Ronald Voet & Judith G. Voet (2006), *Biochemistry*, 2<sup>nd</sup> Edition, John Wiley & Sons, U.S.A.
2. Benjamin Lewin (2004), *Genes VIII*, Oxford University Press, New York.
3. S.C. Rastogi (1986), *Cell and Molecular biology*, 3<sup>rd</sup> edition, New Age International Pvt Ltd, New Delhi.
4. Becker, Kleinsmith, Hardin (2002). *The world of the cell*, 4th Edition, Benjamin Cummings.

Course Code 24PBCE11	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
<b>CO 1</b>	2	2	2	1	1	2	3	2	2	2
<b>CO 2</b>	2	1	3	2	2	2	2	2	2	2
<b>CO 3</b>	3	1	3	2	2	2	2	2	2	2
<b>CO 4</b>	3	1	3	3	3	2	2	2	1	1
<b>CO 5</b>	1	3	1	1	1	2	2	2	2	1

**Strong (3)    Medium (2)    Low (1)**

Dr.P.Annapoorani  
**Head of the Department**

Mrs.P.Ramalakshmi  
**Course Designer**



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### M.Sc BIOCHEMISTRY

( for those who join in 2024-2025)

Semester: I	<b>MICROBIOLOGY &amp; IMMUNOLOGY</b>	Hours/Week: 6	
Elective Course -2 (Generic)		Credits: 3	
Course Code <b>24PBCE12</b>		Internal 25	External 75

### COURSE OUTCOMES

After completion of the course, the students should be able to:

- CO1:** Illustrate the different types of microorganisms and explain their life cycle along with beneficial, harmful and immunological effects in humans (K2)
- CO2:** Apply the microbial classification system to identify the microorganisms involved in food microbiology, antibiotic resistance and illness of living beings. (K3)
- CO3:** Select the types of culture media, food preservation approaches, microbial screening methods, immune cells and immunological reactions, mode of action of antimicrobials in various fields of microbiology. (K3)
- CO4:** analyze the variety of antimicrobial agents along with their mode of action, classification of microbes, food spoilage, immune system and organs of the immune system . (K4)
- CO5:** Infer the life cycle of microbes, culture media, methods of food preservation and antigen antibody interaction. (K4)

### UNIT I

Taxonomical classification - bacteria, viruses (DNA, RNA), algae, fungi and protozoa. Distribution and role of microorganisms in soil, water and air. Charaka's classification of microbes, lytic cycle and lysogeny. Types of culture media, isolation of pure culture, growth curve and the measurement of microbial growth. **(18 hours)**

## UNIT II

Food Preservation and fermentation – cereals, cereal products, fruits, vegetables, meat, fish, poultry, eggs, milk and milk products. General principles of traditional and modern methods of food preservation - Removal or inactivation of microorganisms, boiling, steaming, curing, pasteurization, cold processing, freeze drying, irradiation, vacuum packing, control of oxygen and enzymes. Microbes involved in preparation of fermented foods - curd -cheese, yoghurt, kefir, pickles, rice pan cake, appam, ragi porridge (கேழ்வரகு கூழ் ) and bread (18 hours)

## UNIT III

Contamination and spoilage of foods - bacterial food poisoning, *Salmonella*, *Clostridium botulinum* (botulism), *Staphylococcus aureus*, fungal food poisoning – aflatoxin, food infection – *Clostridium*, *Staphylococcus* and *Salmonella*. Pathogenic microorganisms, *E. coli*, *Pseudomonas*, *Klebsilla*, *Streptococcus*, *Haemophilus*, & *Mycobacterium*, causes, control, prevention, cure and safety. Food microbiological screening- Real time PCR, ELISA, Aerobic and anaerobic Plate Count, dye reduction method, anaerobic lactic acid bacteria, anaerobic sporeformers, Hazard analysis critical control point (HACCP) (18 hours)

## UNIT IV

Antimicrobial chemotherapy, General characteristics of antimicrobial agents. Mechanism of action – sulfonamides, sulphones and PAS. Penicillin, streptomycin- spectra of activity, mode of administration, mode of action, adverse effects and sensitivity test., Antiviral and antiretroviral agents, Antiviral RNA interference, natural intervention (Natural immunomodulators routinely used in Indian medical philosophy). (18 hours)

## UNIT V

Immune system- definition and properties. Cells of the immune system – neutrophils, eosinophils, basophils, mast cells, monocytes, macrophages, dendritic cells, natural killer cells, and lymphocytes (B cells and T cells). Lymphoid organs- Primary and Secondary; structure and functions. Antigens and Complement System: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Antigen - antibody interactions - molecular mechanism of binding. Affinity, avidity, valency, cross reactivity and multivalent binding. Immunoglobulins & Immune Response: Structure, classes and distribution of antibodies.

Antibody diversity. Immune system in health & disease, Transplantation immunology- graft rejection and HLA antigens. Immunological techniques, Flow cytometry and its application

**(18 hours)**

### TEXT BOOKS

1. Michael J. Pelczar Jr. (2001) Microbiology (5th ed), McGraw Hill Education (India) Private Limited
2. Frazier WC, Westhoff DC, Vanitha NM (2010) Food Microbiology (5th ed), McGraw Hill Education (India) Private Limited
3. Willey J and Sherwood L (2011) Prescott's Microbiology (8th ed) McGraw Hill Education (India)

### REFERENCE BOOKS

1. Ananthanarayanan, Paniker and Arti Kapil (2013) Textbook of Microbiology (9th ed) Orient BlackSwan
2. Judy Owen, Jenni Punt Kuby (2013) Immunology (Kindt, Kuby Immunology) (7th ed) W. H. Freeman & Co
3. Brooks GF and Carroll KC (2013) Jawetz Melnick & Adelbergs Medical Microbiology, (26th ed) McGraw Hill Education
4. Greenwood D (2012), Medical Microbiology, Elsevier Health

Course Code 24PBCE12	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3	2	3	3	3	2	3	1	1	2
CO2	3	2	3	2	2	3	3	2	1	2
CO3	3	2	3	2	2	3	3	1	1	2
CO4	3	2	3	3	3	2	3	2	1	2
CO5	3	2	3	3	3	2	3	2	1	2

**Strong (3)      Medium (2)      Low (1)**

Dr.P.Annapoorani  
Head of the Department

Dr.R.Salini  
Course Designer





## V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)

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Reaccredited with 'A++' Grade (4<sup>th</sup> Cycle) by NAAC

**VIRUDHUNAGAR**

**Quality Education with Wisdom and Values**

### M.Sc. Biochemistry

(for those who join in 2024-2025)

Semester II	<b>CELLULAR METABOLISM</b>	Hours/Week: 6	
Core Course - 4		Credits: 5	
Course Code <b>24PBCC21</b>		Internal 25	External 75

### COURSES OUTCOMES

**On successful completion of this course, students should be able to:**

After completion of the course, the students should be able to:

CO1. Appreciate the modes of synthesis and degradation of glucose , lipids, proteins , nucleic acids and will be able to justify the pros and cons of maintaining their normal levels

[K2]

CO2. find the integrated approach of anabolic and catabolic pathways of various biomolecules

[K3]

CO3. apply the crucial role of enzymes with regard to the integration of metabolic Pathways.

[K3]

CO4. analyze the role of key enzymes that regulate various metabolicPathways. [K4]

CO5. Correlate the disturbance of metabolic reactions to clinical manifestations [K4]

### UNIT I

Glycolysis – aerobic and anaerobic, inhibitors, and regulation. Feeder pathway- entry of hexoses into glycolysis, Galactosemia, fructosuria, Pyruvate dehydrogenase complex- mechanism and regulation. Glyoxalate cycle and its regulation. Gluconeogenesis- source, key enzymes, reaction sequence and its regulation. Blood glucose homeostasis and the role of hormones. Pentose phosphate pathway- significance and its regulation. Metabolism of glycogen and its regulation. Biosynthesis of N-linked and O-linked glycoproteins, mucopolysaccharides, Chondroitin sulphate. **(18 Hours)**

## UNIT II

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. **(18 Hours)**

## UNIT III

Metabolism of nucleotides- *De novo* synthesis and salvage pathways of purine and pyrimidine nucleotides. Regulation and inhibitors of nucleotide biosynthesis. Role of ribonucleotide reductase and its regulation. Degradation of purine and pyrimidine nucleotides **(18 Hours)**

## UNIT IV

Biosynthesis of non- essential amino acids.- Role and biological significance of glutamate dehydrogenase, glutamine and asparagine synthetase, lysine, proline and phenylalanine hydroxylase. Interconversion of amino acids - proline to glutamate, methionine to cysteine, serine to glycine. Biosynthesis of spermine and spermidine. Degradation of amino acids – glucogenic and ketogenic amino acids. Formation of acetate from leucine and aromatic amino acid, pyruvate from cysteine, threonine and hydroxy proline,  $\alpha$ -keto glutarate from histidine and proline, succinate from methionine, threonine, valine and isoleucine, Oxaloacetate from aspartate, glycine and serine. **(18 Hours)**

## UNIT V

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

Maroteaux-Lamy syndrome. Oxidation of cysteine to sulphate and inter conversion of sulphur compounds. **(18 Hours)**

### BOOKS RECOMMENDED

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman
2. Voet.D and Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.
3. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
4. Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill.
5. Textbook of Biochemistry with Clinical Correlations, 7th Edition, Thomas M. Devlin (Editor), Wiley
6. Human Biochemistry – James M.Orten & Otto.W.Neuhan- 10th edn- The C.V.Mosby Company

Course Code 24PBCC21	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
<b>CO 1</b>	3	3	3	3	2	2	2	2	2	2
<b>CO 2</b>	3	2	3	2	2	2	2	2	2	2
<b>CO 3</b>	3	3	3	3	2	2	2	2	2	2
<b>CO 4</b>	3	2	2	3	2	2	2	1	2	1
<b>CO 5</b>	3	3	3	3	2	2	2	2	2	2

**Strong (3) Medium (2) Low (1)**

**Dr.P.Annapoorani**  
Head of the Department

**Dr. R.Gloria Jemmi Christobel**  
Course Designer



## V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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**VIRUDHUNAGAR**

**Quality Education with Wisdom and Values**

**M.Sc. Biochemistry**

**( for those who join in 2024-2025)**

Semester II	<b>CLINICAL BIOCHEMISTRY</b>	Hours/Week: 6	
Core Course -5		Credits: 5	
Course Code <b>24PBCC22</b>		Internal 25	External 75

### COURSES OUTCOMES

**On successful completion of this course, students should be able to:**

- CO1. explain the biological significance of sample collection and awareness of the diagnostic/screening tests to detect common non- communicable diseases so as to understand role of laboratory investigations for biochemical parameters and understand the disorders associated with blood cells. [K2]
- CO2. describe the etiology of metabolic diseases like diabetes and atherosclerosis and avoid such lifestyle disorders by healthy eating and correlate the symptoms with underlying pathology based on diagnostic and prognostic markers. [K3]
- CO3. identify the diagnostic application of serum/plasma enzymes to correlate their levels with the organ pathologies associated with specific diseases. [K3]
- CO4. analyse the role of pre and post-natal diagnosis leading to healthy progeny. [K4]
- CO5. evaluate the serum hormone levels and clinical symptoms with underlying hormonal disturbances and review the onward transmission of signal by different pathways by comparing and contrasting them and critically evaluate the network between them resulting in the biological outcome. [K4]

### UNIT I

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

Disorders of blood cells: Hemolytic, iron deficiency and 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 **(18 Hours)**

## UNIT II

Diabetes mellitus: pathology and complications: Acute changes; Chronic complications: Diabetic nephropathy, neuropathy, retinopathy and Diabetic foot ulcers, Random/Fasting/PP glucose testing, Impaired glucose tolerance (IGT), Impaired fasting glucose (IFG), Diagnosis by GTT, Pre-diabetes, Gestational DM, Glycosylated Haemoglobin (HbA1c); Glycated albumin, Hypoglycaemia and critical alert value for glucose. Markers of complications of Diabetes mellitus: Metabolic syndrome, Lipid profile & lipoproteinemia, Atherosclerosis, Diabetic nephropathy, Microalbuminuria, eGFR.

Point of care testing for glucose (Glucometers) and continuous glucose monitoring (CGM): principle and its use. Major groups of anti-diabetic drugs. Diet and life style modifications **(18 Hours)**

## UNIT III

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. **(18 Hours)**

#### **UNIT IV**

Liver function tests: 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. **( 18 Hours)**

#### **UNIT V**

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

Electrolyte disorder: calcium: hypercalcemia and hypocalcemia; Calcium homeostasis in Blood; phosphate: hyperphosphatemia or hypophosphatemia; Clinical significance: Potassium: hyperkalemia and hypokalemia, Sodium: hyponatremia and hypernatremia; Chloride: hyperchloremia, 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, Hypogonadism **(18 Hours)**

#### **TEXT BOOKS**

1. Thomas M. Devlin (2014) Textbook of Biochemistry with Clinical Correlations (7th ed). John Wiley & Sons
2. Montgomery R, Conway TW, Spector AA (1996), Biochemistry: A Case-Oriented Approach (6th ed), Mosby Publishers, USA.
3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (2018) (8th ed), Saunders
4. Dinesh Puri, (2020) Text book of Biochemistry: A clinically oriented approach – 4th Edition, Elsevier.
5. M.N. Chatterjee and Rana Shinde (2012). Textbook of Medical Biochemistry (8th ed), Jaypee Brothers Medical Publishers.

6. Clinical Case Discussion In Biochemistry A Book On Early Clinical Exposure (ECE),  
Poonam Agrawal, 2021, CBS Publishers & distributors pvt. Ltd

Course Code 24PBCC22	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO 1	2	2	2	3	1	2	3	2	1	1
CO 2	2	2	1	3	2	2	2	2	1	1
CO 3	3	2	1	3	2	2	2	2	1	1
CO 4	3	3	1	2	3	2	2	1	1	1
CO 5	3	3	3	2	1	2	2	2	1	1

**Strong (3) Medium (2) Low (1)**

Dr.P.Annapoorani  
**Head of the Department**

Mrs.P.Ramalakshmi  
**Course Designer**



## V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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**VIRUDHUNAGAR**

**Quality Education with Wisdom and Values**

### M.Sc. Biochemistry

(for those who join in 2024-2025)

Semester II	<b>LABORATORY COURSE ON CLINICAL BIOCHEMISTRY</b>	Hours/Week: 6	
Core Course -6 Practical -2		Credits: 4	
Course Code <b>24PBCC21P</b>		Internal 40	External 60

### COURSES OUTCOMES

On successful completion of this course, students should be able to

CO1: understand the techniques and principles behind the clinical parameter analysis (K2)

CO2: explain the principle and method of estimating the biomolecules (K2).

CO3: Identify the normal and abnormal parameters of biological samples using colorimetry and other basic biochemical methods (K3)

CO4. observe and calculate the results for the estimation and assays of various macro and biomolecules (K3)

CO5. Infer the normal and abnormal parameters of biological samples analyzed by colorimetry and other basic biochemical methods for enzyme assay, hematology and serology (K4)

### UNIT 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 **(18 Hours)**

### UNIT II

Liver function test: Estimation of bilirubin – direct and indirect. Estimation of plasma protein, A/G ratio, Thymol turbidity test, Prothrombin Time (PT), Assay of serum glutamate oxaloacetate transaminase, alkaline phosphatase, Gamma-glutamyltransferase (GGT), isoenzyme separation of LDH by electrophoresis. **(18 Hours)**



### UNIT 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 (18 Hours)

### UNIT IV

Serology : 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. (18 Hours)

### UNIT V

Group Experiments

- a. Antigen – Antibody Reaction - HCG kit method , RA kit method
- b. Phlebotomy –Venipuncture , Different techniques of venipuncture
- c. Collection of blood ,Serum or Plasma separation and Storage
- d. Automation in Clinical Biochemistry -Autoanalyser ,Semiautoanalyser (18 Hours)

### Reading List (Print and Online)

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/cli.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/i2PjEks4GQ>
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)

### Self-Study

1. Laboratory handling of human biological specimen
2. Automation in Clinical Biochemistry

**RECOMMENDED TEXTS**

- 1 Practical Clinical Biochemistry- Varley's by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition ,1988.
2. Manipal Manual of Clinical Biochemistry (For Med.Lab.And Msc Stud.) 2013 (4 Edition )
3. Case Oriented Approach in Biochemistry-Dr. Rajesh Kawaduji Jambhulkar, Dr. Abhijit D. Ninghot: 2019 First Edition
4. Medical Lab Technology Vol I& II, Kanai L Mukerjee New Delhi: Tata Mcgraw Hill Publishing Company, 1996.
5. Practical Biochemistry – Plummer, New Delhi: Tata Mcgraw Hill Publishing Company, 2000.
6. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd ed, 2005.

Course Code 24PBCC21P	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
	<b>CO1</b>	3	3	2	3	3	3	2	1	2
<b>CO2</b>	3	3	2	2	2	3	2	1	2	2
<b>CO3</b>	3	3	2	3	3	3	2	1	2	2
<b>CO4</b>	3	3	2	3	3	3	2	1	2	2
<b>CO5</b>	3	3	2	3	3	3	2	1	2	2

**Strong (3) Medium (2) Low (1)**

Dr.P.Annapoorani  
**Head of the Department**

Dr. R. Gloria Jemmi Christobel  
Mrs.M.Rajakumari  
**Course Designer**



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**M.Sc. Biochemistry**

**(for those who join in 2024-2025)**

Semester II	<b>ENERGY AND DRUG METABOLISM</b>	Hours/Week: 4	
Elective Course – 3 (DSEC)		Credits: 3	
Course Code <b>24PBCE21</b>		Internal 25	External 75

### COURSES OUTCOMES

**On successful completion of this course, students should be able to:**

- CO1. CO1. explain the thermodynamics concept, redox systems, biological oxidation, Electron transport, oxidative phosphorylation and its inhibitors, light and dark reactions, Interconversion of major foodstuffs, Metabolism of xenobiotics (K2)
- CO2. identify the role of mitochondria in the production of energy currency of the cell, P/O ratio and light and dark reactions, major metabolic pathways and sulfate ion activation (K3)
- CO3. apply the concept of thermodynamics, ATPase, biological oxidation, Xenobiotic reactions, inhibitors and process of photosynthesis for the welfare of humankind (K3)
- CO4. analyze thermodynamics, diverse role of ETC, inhibitors, different pathways, transport and phase reactions of Xenobiotics (K4)
- CO5. infer the role of Redox Potential, oxidative phosphorylation, light and dark reactions, energetics of metabolic pathways and mode of action of Xenobiotics for health care and entrepreneurial area. (K4)

### UNIT I

Thermodynamic- principles in biology- Concept of entropy, enthalpy and free energy change. Redox systems. Redox potential and calculation of free energy. Biological oxidation – Oxidases, dehydrogenases, hydroperoxidases, oxygenases. Energy rich compounds – phosphorylated and non-phosphorylated. High energy linkages **(12 Hours)**

## UNIT II

Electron transport chain-various complexes of ETC, Q-cycle. Inhibitors of ETC. Oxidative phosphorylation-P/O ratio, chemiosmotic theory. Mechanism of ATP synthesis - role of F<sub>0</sub>-F<sub>1</sub> ATPase, ATP-ADP cycle. Inhibitors of oxidative phosphorylation ionophores, protonophores. Regulation of oxidative phosphorylation **(12 Hours)**

## UNIT III

Light reaction-Hills reaction, absorption of light, photochemical event. Photo ETC-cyclic and non-cyclic electron flow. Photophosphorylation-role of CF<sub>0</sub>-CF<sub>1</sub> ATPase. Dark reaction- Calvin cycle, control of C<sub>3</sub> pathway, and Hatch-Slack pathway (C<sub>4</sub> pathway), Photorespiration. Synthesis and degradation of starch **(12 Hours)**

## UNIT IV

Interconversion of major food stuffs. Energy sources of brain, muscle, liver, kidney and adipose tissue. Amphibolic nature of Citric acid cycle. Anaplerotic reaction. Krebs cycle, Inhibitors and regulation of TCA cycle. Transport of extra mitochondrial NADH – Glycerophosphate shuttle, malate aspartate shuttle. Energetics of metabolic pathways – glycolysis, (aerobic and anaerobic), citric acid cycle, beta oxidation **(12 Hours)**

## UNIT V

Activation of sulphate ions – PAPS, APS, SAM and their biological role. Metabolism of xenobiotics – Phase I reactions – hydroxylation, oxidation and reduction. Phase II reactions – glucuronidation, sulphation, glutathione conjugation, acetylation and methylation. Mode of action and factors affecting the activities of xenobiotic enzymes.

**(12 Hours)**

## TEXT BOOKS

1. David L. Nelson and Michael M. Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H. Freeman
2. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012), Harper's Illustrated Biochemistry, (29th ed), McGraw-Hill Medical

**REFERENCE BOOKS**

1. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
2. Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill.
3. Devlin RM (1983) Plant Physiology (4th ed), PWS publishers
4. Taiz L , Zeiger E (2010), Plant Physiology (5th ed), Sinauer Associates, Inc

Course Code 24PBCE21	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
	<b>CO1</b>	3	3	2	3	3	3	3	1	1
<b>CO2</b>	3	3	2	3	3	3	3	1	2	2
<b>CO3</b>	3	2	2	3	3	3	3	1	2	2
<b>CO4</b>	3	3	2	3	3	3	3	2	2	2
<b>CO5</b>	3	3	2	3	3	3	2	2	2	2

**Strong (3) Medium (2) Low (1)**

Dr.P.Annapoorani  
**Head of the Department**

Dr.R.Salini  
**Course Designer**



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### M.Sc. Biochemistry (for those who join in 2024-2025)

Semester II	<b>DEVELOPMENTAL BIOLOGY</b>	Hours/Week: 4	
Elective Course – 4 (Generic)		Credits: 3	
Course Code <b>24PBCE22</b>		Internal 25	External 75

#### COURSES OUTCOMES

**On successful completion of this course, students should be able to:**

**CO1:** Appreciate the principles of developmental biology and new terms involved[K2]

**CO2:** Apply the knowledge to study gametogenesis in model organisms like plants and animals like Drosophila [K3]

**CO3:** Analyze the crucial role of stem cells in regeneration and their application in tissue engineering [K3]

**CO4:** Compare various processes like morphogenesis, organogenesis and metamorphosis[K4]

**CO5:** Analyze the correlation between cell fate and senescence. [K4]

#### UNIT I

Overview of Developmental biology: Background of Developmental biology - Principles of developmental biology –Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development. **(12 Hours)**

## UNIT II

Model organisms: Gametogenesis – production of gametes, Formation of zygote, fertilization and early development: molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination. *Drosophila* Developmental biology- Axis formation, Genes & mutation. *C.elegans* – Vulva formation, Axis formation. **(12 Hours)**

## UNIT III

Regeneration Developmental Biology: Stem cells – Definition, Classification, Embryonic and adult stem cells, properties, identification, Culture of stem cells, Differentiation and dedifferentiation, Stem cell markers, techniques and their applications in modern clinical sciences. Three-dimensional culture and transplantation of engineered cells. Tissue engineering - skin, bone and neuronal tissues. **(12 Hours)**

## UNIT IV

Morphogenesis & Organogenesis: 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. **(12 Hours)**

## UNIT V

Cellular senescence and Cell fate decision : Cellular senescence – concepts & Frizzled receptor in Development and disease. Diabetes and developmental biology, Cell death pathways in developments. Markers of important diseases. **(12 Hours)**

## TEXT BOOKS

1. Arumugam.N. (2003). *A Text Book of Embryology*, Nagercoil, TamilNadu: Saras Publication, 1<sup>st</sup> Edition.
2. Subramanian.M.A. (2012). *Developmental Biology*, Chennai: MJP Publishers, 1<sup>st</sup> Edition.

**REFERENCE BOOKS**

1. Balinsky (1981). *An Introduction to Embryology*, Philadelphia: W.B. Saunders Company, 5<sup>th</sup> Edition.
2. Berill, N.J.(1971). *Developmental Biology*, London: MC Graw Hill, 1<sup>st</sup> Edition.
3. Saunder.J.W. (1982). *Developmental Biology – Pattern and Principles*, Newyork: Macmillan.

Course Code 24PBCE22	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
	CO1	2	1	2	3	1	2	2	1	1
CO2	3	2	3	1	2	3	2	1	2	2
CO3	3	3	3	3	3	3	3	3	3	3
CO4	2	2	2	2	3	3	1	2	1	2
CO5	3	3	3	3	3	3	3	2	2	2

**Strong (3) Medium (2) Low (1)**

Dr.P.Annapoorani  
**Head of the Department**

Dr.Sinthia Ganeshan  
**Course Designer**





## V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)

An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai

Reaccredited with 'A++' Grade (4<sup>th</sup> Cycle) by NAAC

**VIRUDHUNAGAR**

**Quality Education with Wisdom and Values**

### M.Sc. Biochemistry ( for those who join in 2024-2025)

Semester II	<b>NUTRITIONAL BIOCHEMISTRY</b>	Hours/Week: 4	
Elective Course – 5 (NME)		Credits: 2	
Course Code <b>24PBCN21</b>		Internal 25	External 75

#### On successful completion of this course, students should be able to:

CO1: recall the basic concepts of food groups, BMR, SDA and nutrients. [K1]

CO2: describe the biological importance of biomolecules in human nutrition. [K2]

CO3: summarise the nutritional requirements and biochemical change in different physiological states of human. [K2]

CO4: identify the causes and clinical manifestations of different nutrient deficiency diseases. [K3]

CO5: assess the interrelationships between biomolecules within the human body to maintain the sustainable health. [K4]

#### UNIT I

Basic concepts - Nutrition - Food groups and balanced diet. Novel Foods. Calorific value of foods: Direct and indirect calorimetry. Empty calories. Basal metabolic rate: Factors affecting BMR. SDA and physical activity. Calculation of day's energy requirement. Assessment of nutritional status. Lactose intolerance. Nutritional requirement and biochemical changes in different physiological states -infancy, childhood, pregnancy, lactation, and ageing. Sports nutrition.

**(12 Hours)**

#### UNIT II

Elements of nutrition - Plant and animal sources of simple and complex carbohydrates, fats and proteins and their requirement. Biological significance, deficiency and toxicity of macronutrients and micronutrients. Role of dietary fibre. Protein sparing action of carbohydrates and fats.

Essential amino acids. Essential fatty acids. Effects of naturally occurring food toxins, preservatives, additives, alcohol and tobacco on health. **(12 Hours)**

### **UNIT III**

Vitamins and Minerals- Dietary sources, classification, biochemical functions, requirements, absorption, metabolism and excretion. Vitamin B complex as coenzyme. Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper. **(12 Hours)**

### **UNIT IV**

Malnutrition - Diseases arising due to Protein - Calorie Malnutrition and undernutrition (Kwashiorkor and Marasmus), Prevention of malnutrition. Deficiency diseases associated with vitamin B complex, vitamin C and A, D, E & K vitamins - Mineral deficiency diseases - aetiology, sign and symptoms and dietary supplementation. Enrichment and fortification (vitamins and minerals) **(12 Hours)**

### **UNIT V**

Nutrition in diseases - Aetiology, signs and symptoms , treatment and dietary management during fever(Typhoid and Malaria) and infectious diseases(COVID-19), Jaundice, hyper acidity (Ulcer), Atherosclerosis, Hypertension, kidney diseases and diabetes in adults. Starvation and Obesity. Inter-relationship of nutrition, infection, immunity and poverty **(12 Hours)**

### **TEXT BOOKS**

Sri Lakshmi, B. (2018). Nutrition Science, 6 th Edition, New Delhi: New Age International Ltd.

### **REFERENCE BOOKS**

- 1.Chatterjea, M.N. (2012). Textbook of medical biochemistry, 8 th edition, New Delhi: Jaypeebrothers medical publishers.
2. Denise R. Ferrier. (2020). Lippincott illustrated reviews biochemistry, South asian edition, NewDelhi: wolters kluwer India pvt ltd.
3. Nagini, S. (2007). Textbook of biochemistry, 2 nd edition, Chennai: Scitech publications.
4. Sathyanarayana, U. (2020). Biochemistry, 5 th edition, Netherland: Elsvier.

5. Sharma, D.C. (2017). Nutritional biochemistry, New Delhi: CBS publishers and distributors.
6. Singh, S.P. (2006). Principles of biochemistry, New Delhi: CBS publishers.

Course Code 24PBCN21	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
	CO1	2	2	2	2	2	2	2	2	1
CO2	2	2	2	2	2	2	3	2	2	2
CO3	2	2	2	2	2	3	2	2	3	2
CO4	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2

**Strong (3) Medium (2) Low (1)**

Dr.P.Annapoorani  
Head of the Department

Mrs.P.Ramalakshmi  
Course Designer