V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Reaccredited with 'A++' Grade (4th 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 (TANSCHE) 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.

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

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) and 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)

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

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.

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

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. BIOTECHNOLOGY

To educate rural women students in the field of research and academics with excellent state-of-art Biotechnological skills to serve for the benefit of mankind

Mission of the Department of M.Sc. BIOTECHNOLOGY

1. To impart quality education in Biotechnology to the students with sound disciplinary knowledge
2. To become competent Biotechnologists who will be able to apply the basic principles and techniques of life sciences to solve a wide array of problems to facilitate human welfare in various fields such as health, agriculture and industry with socio-ethical consideration

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. BIOTECHNOLOGY

Programme The Students will be able to

- To acquire knowledge and sound understanding of concepts in various branches of Biotechnology and exhibit their abilities and skills leading to become competent professionals
- To employ their knowledge and technical skills in their profession for problem solving
- To sustain the standards of the profession concerned with ethical consideration

Key Components of Mission Statement	PEO1	PEO2	PEO3
conceptual knowledge	✓	✓	✓
Problem solving	✓	✓	✓
socio-ethical consideration	✓	✓	✓

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 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, synthesize the findings and provide valid conclusion by critical evaluation of theories, policies and practices for the betterment of society. **(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)**

Programme specific outcomes

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.Biotechnology Programme, the students will be able to

PO 1: *Disciplinary Knowledge*

PSO 1.a : Demonstrate and apply their knowledge of cell biology, biochemistry, microbiology and molecular biology to solve the problems related to the field of biotechnology.

PSO 1.b : Understand the principles and handling of various instruments used in Biochemistry, Microbiology and molecular biology laboratory and to equip the practical skills in various areas of Biotechnology 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 : Explain various concepts and processes of Biological sciences both in verbal and written form and illustrate the techniques related to Biotechnology in an effective manner

PO3: *Scientific Reasoning and Problem Solving*

PSO 3.a: apply their acquired theoretical knowledge and analytical and problem solving skills skills to identify and solve problems in day today life.

PSO 3.b: Employ interdisciplinary knowledge to provide better solutions and new ideas in various branches of Biotechnology in a sustainable manner

PO 4: Critical Thinking and Analytical Reasoning

PSO 4: critically think and apply the concepts in life sciences in identifying the problems which can be addressed only through Biotechnology

PSO 4b: Analyse the organization of plant, animal and microbes from cellular level upto genome level and their inter relationship to exploit them for various research and development activities in the field of Agriculture, health and environment.

PO 5: Research Related Skills

PSO 5: develop research related solutions to combat the challenges such as pandemic, famine and environmental deterioration arising globally in day today life with scientific temperament and acquired skills

PO 6: Digital Literacy, Self - Directed and Lifelong Learning

PSO 6 : utilize the ICT tools for their research process in analysing the data quickly and accurately in various fields of Biotechnology

PO 7: Co-operation/Team Work and Multicultural Competence

PSO 7: Work effectively as a member with cooperation in an institution, industry or society through the acquired skills from paper presentation, Industrial visit and Internship programme.

PO 8: Moral and Ethical Awareness

PSO 8 : Understand the IPR, ethics in life science and adapting ecofriendly techniques for sustainable development to meet the global standards and to follow moral values in both professional and personal life

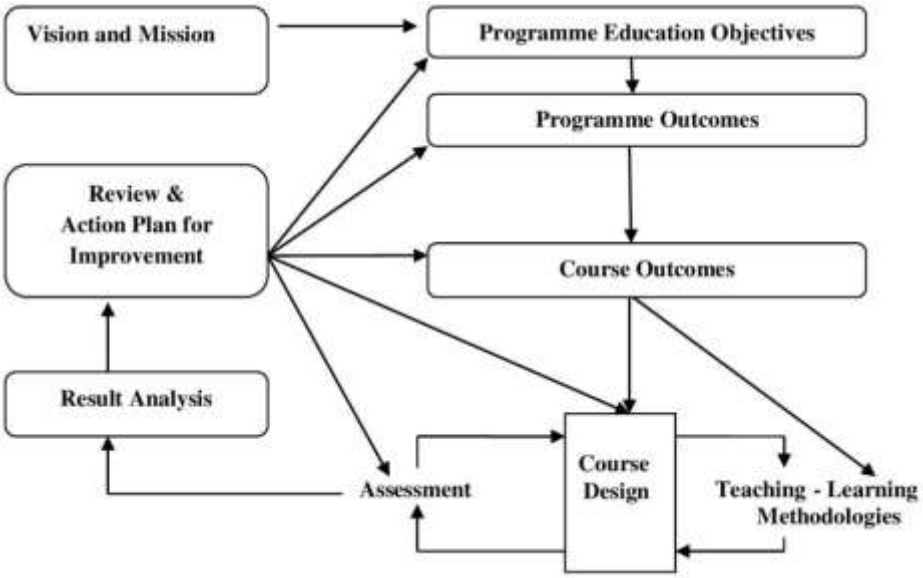
PO-PEO Mapping Matrix

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	✓	✓	-

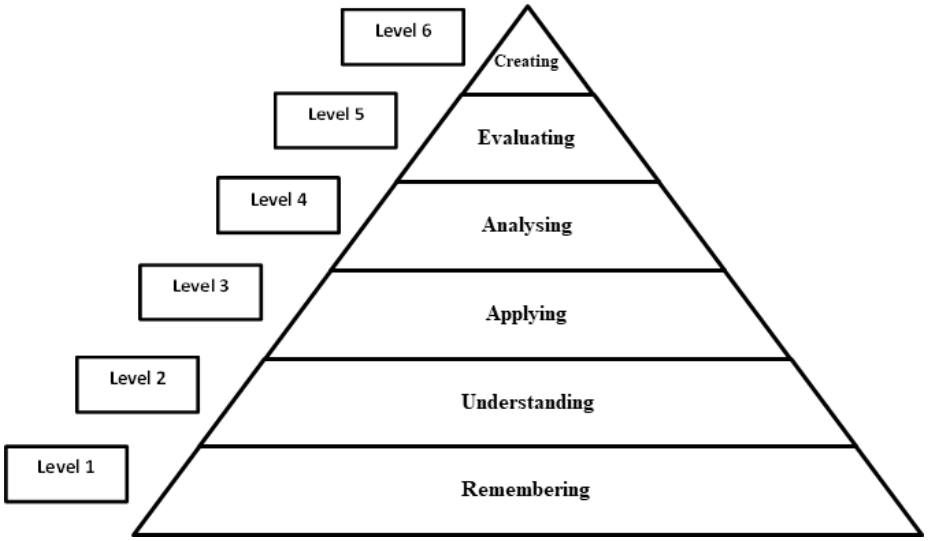
B.1.4 Course Outcomes (COs)

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

ELIGIBILITY FOR ADMISSION

The candidate should have passed in B.Sc. Biotechnology. Biochemistry, Zoology, Botany, Microbiology, (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.2.1Core 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
Total	**:**	**25**

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
Practical Test	:	30
Record Performance	:	10
Total	**:**	**40**

Practical Test - Average of the two Practical Tests 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
					Total	**45***

*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
Total	**:**	**75**

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
					Total	**60**

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
Total	:	**100**

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 Marks

B. 2.3 SKILL ENHANCEMENT COURSES
INTERNAL ASSESSMENT
Distribution of Marks

Theory

Mode of Evaluation		Marks
Periodic Test	:	20
Assignment	:	5
Total	:	**25**

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
Practical Test	:	30
Record Performance	:	10
Total	:	**40**

Practical Test - Average of the two Practical Tests 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
					Total	**30***

*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
Total	:	**75**

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
					Total	**50**

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
Total	**:**	**25**

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
		Total				**45***

*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
Total	:	**75**

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
					Total	**60**

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
Total	**:**	**100**

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
Total	**:**	**25***

*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
Total	**:**	**100**

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
				Total	**75**

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.

B.3ASSESSMENT MANAGEMENT PLAN

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 ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PO Attainment

Graduation Batch	Overall PO Attainment (in percentage)	Whether Expected Level ofPO 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
Total Attainment	**100**

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

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

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

Expected Level of Attainment for each of the Programme Educational Objectives

POs	Level of Attainment
Attainment Value ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ 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 PROGRMME 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. Biotechnology Programme

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
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An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Reaccredited with 'A++' Grade (4th Cycle) by NAAC
VIRUDHUNAGAR
Quality Education with Wisdom and Values

MASTER OF BIOTECHNOLOGY (7024)

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)
Total	**30 (20)**	**30 (22)**	**30 (27)**	**30 (22)**	**120 (91)**
Extra Credit Course(Optional) - Offered by the Department	-	-	0(2)	-	0(2)
Extra Credit Course(Optional) - MOOC	-	-	-	-	Limited to a maximum of 15 credits

MASTER OF BIOTECHNOLOGY

Programme Code - 7024

PROGRAMME CONTENT

M.Sc. Biotechnology -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	Biochemistry	24PBOC11	6	5	3	25	75	100
2	Core Course -2	Molecular Genetics	24PBOC12	6	5	3	25	75	100
3.	Core Course - 3 Practical -1	Biochemistry, Molecular Genetics, and Molecular Cell Biology Practical	24PBOC11P	6	4	6	40	60	100
4.	Elective Course – 1 (DSEC)	Bioinstrumentation	24PBOE11	6	3	3	25	75	100
5.	Elective Course – 2 (Generic)	Molecular Cell Biology	24PBOE12	6	3	3	25	75	100
Total				**30**	**20**				**500**

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	Plant and Animal Biotechnology	24PBOC21	6	5	3	25	75	100
2	Core Course -5	Genetic Engineering	24PBOC22	6	5	3	25	75	100
3	Core Course -6 Practical -2	Microbiology, Plant and Animal Biotechnology & Genetic Engineering Practical	24PBOC21P	6	4	6	40	60	100
4.	Elective Course – 3 (DSEC)	Environmental Biotechnology	24PBOE21	4	3	3	25	75	100
3.	Elective Course-4 (Generic)	Microbiology	24PBOE22	4	3	3	25	75	100
6	Elective Course-5 (NME)	Tissue engineering	24PBON21	4	2	3	25	75	100
Total				**30**	**22**				**600**

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	Bioinformatics	24PBOC31	6	5	3	25	75	100
2	Core Course -8	Immunology	24PBOC32	6	5	3	25	75	100
3	Core Course -9	Bioprocess Technology	24PBOC33	6	5	3	25	75	100
4	Core Course -10 Practical -3	Bioinformatics, Immunology, Bioprocess Technology Practical	24PBOC31P	6	4	6	40	60	100
5	Elective Course -6 (DSEC)	NanoBiotechnology/ Bioethics, Human Rights and Social Issues/	24PBOE31 24PBOE32 24PBOE33	3	3	3	25	75	100
6	Elective Course -7 (NME)	Gene manipulation Technology	24PBON31	3	2	2	25	75	100
7	Self Study Course	Practice for CSIR NET- General Paper	24PGOL32	-	1	2	100	-	100
8	Internship/ Industrial Activity		24PBOI31	-	2	-	100	-	100
			Total	**30**	**27**				**800**
9	Extra Credit Course	Cryobiology	24PBOO31	-	2	3	100	-	100

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	Research Methodology	24PBOC41	6	5	3	25	75	100
2	Core Course -12	Biostatistics	24PBOC42	6	5	3	25	75	100
3.	Core course-13	Project	24PBOC41PR	6	5	-	40	60	100
4.	Elective Course- 8 (Industry / Entrepreneurship)	Bio entrepreneurship	24PBOE41	6	3	3	25	75	100
5.	Skill Enhancement Course/ Professional Competency Skill	Preparation for Life Science Competitive Examination	24PBOS41	6	3	3	25	75	100
6.	Extension Activity			-	1	-	100	-	100
Total				**30**	**22**				**600**

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M.Sc. BIOTECHNOLOGY

(for those who join in 2024 -2025)

Semester I	**BIOCHEMISTRY**	**Hours/Week: 6**	
Core Course-1		**Credits: 5**	
24PBOC11		Internal 25	External 75

COURSES OUTCOMES

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

CO1 **:** illustrate the basics of pH, chemical structure , properties and metabolism of biomolecules. [K2]

CO2 **:** apply the basic knowledge of buffer systems and metabolism of biomolecules. [K3]

CO3 **:** describe the concepts of Bio-energetics , Biological oxidation pathways, chemical structure and metabolism of biomolecules. [K3]

CO4 **:** analyse the role of biomolecules in metabolic pathways in the biological system. [K4]

CO5 **:** correlate the structure and functions of biomolecules with metabolism and thermodynamic principle. [K4]

UNIT I

Concept of acids and bases: Water: its unique properties, biological buffer system – Diversity of biomolecules, Biomolecules- Carbohydrates- Classification, structure, function and properties of monosaccharides, Disaccharides and polysaccharides with suitable examples .ionization of water, Metabolism: glycogenesis, glycogenolysis, gluconeogenesis, pentose phosphate pathway. **(18 hours)**

UNIT II

Lipids: Nomenclature, classification, structure, chemical and physical properties of fatty acids. Metabolisms: biosynthesis of fatty acids, triglycerols, phospholipids, glycolipids. Cholesterol biosynthesis, bile acids and salt formation. Eicosanoids, sphingolipids and steroid hormones. Oxidation of fatty acids- mitochondrial and peroxisomal ß-oxidation, alpha and beta oxidation, oxidation of unsaturated and odd chain fatty acids, ketone bodies.

(18 hours)

UNIT III

Bioenergetics – Concept of energy, Principle of thermodynamics, Relationship between standard free energy and Equilibrium constant, ATP as universal unit of free energy in Biological systems. Biological oxidation: Electron transport chain, oxidative phosphorylation, glycolysis, citric acid cycle, Cori's cycle, glyoxalate pathway. Photosynthesis, urea cycle, hormonal regulation of fatty acids and carbohydrates metabolism, Mineral metabolism.

(18 hours)

UNIT IV

Amino acids and Protein: Nomenclature, classification, structure, chemical and physical properties of amino acids and proteins. Metabolism: Biosynthesis of amino acids. Degradation of proteins, nitrogen metabolism and carbon skeleton of amino acids. In-born errors of protein metabolism. **(18 hours)**

UNIT V

Nucleic acids: Nomenclature, Classification, structure, chemical and physical properties of purine and pyrimidines. *De novo* and salvage synthesis of purines, pyrimidine bases, nucleosides and nucleotides. Catabolism of purine and pyrimidine bases. Synthetic analogues of nitrogenous bases . **(18 hours)**

TEXT BOOKS

1. Sathyanarayana.U and U.Chakrapani (2023). Biochemistry, 4th Edition, Books and Allied private limited, Kolkata.
2. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer (2023). Biochemistry,10th Edition, W. H. Freeman.
3.Devlin,M.T,(2010).Textbook of Biochemistry with Clinical Correlations, New York:Wiley–Liss
4.Voet, D. and Voet,J.G,(2011) Biochemistry, Asia: International student version, John Wiley and sons

REFERENCE BOOKS

1. Michael M. Cox (2021) Lehninger Principles of Biochemistry, 8thEdition, W. H. Freeman publishers.
2. Philip Kuchel, Simon Easterbrook-Smith, Vanessa Gysbers, Jacqui M. Matthews (2011). Schaum.s Outline of Biochemistry, 3rd Edition (Schaum.s Outline Series), McGraw-Hill.
3. Singh , Goyal (2020).Lippincott's illustrated reviews: Biochemistry, Wolters Kluwer (India) Pvt. Ltd.

Web resources:

1. mcdb-webarchive.mcdb.ucsb.edu/.../biochemistry/.../website-tourf.htm
2. www.biochemweb.org/
3. http://golgi.harvard.edu/biopages.html
4. webarchive.mcdb.ucsb.edu/sears/biochemistry/info/website-

Course code 24PBOC11	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	2	2	3	3	3	2	3	3	2
CO 2	2	2	2	2	2	3	2	3	2	2
CO 3	2	2	1	2	2	3	2	3	1	1
CO 4	3	2	2	3	3	2	3	3	2	2
CO 5	3	3	2	3	1	3	3	3	2	2

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

Dr.V.Jeyasimga
Course Designer

Dr.V.Jeyasimga
Head of the Department

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M.Sc. BIOTECHNOLOGY

(for those who join in 2024 -2025)

Semester I	**MOLECULAR GENETICS**	**Hours/Week: 6**	
Core Course-2		**Credits: 5**	
24PBOC12		**Internal 25**	**External 75**

Course outcomes:

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

CO1 **:** understand the molecular mechanisms of gene expression and the organization and functions of genetic material in the living world. [K2]

CO2 **:** illustrate the genetic regulatory mechanisms at different levels and explain the processes behind mutations and other genetic changes and study various chromosomal abnormalities. [K3]

CO3 **:** apply the knowledge of gene expression and DNA damage on genetic diseases and their diagnosis. [K3]

CO4 **:** analyse the complexity of genome, gene expression, chromosomal abnormalities, mutation and karyotyping. [K4]

CO5 **:** correlate the basics of gene expression, Allele frequencies and genotype frequencies in populations and describe the concepts behind the theory of evolution. [K4]

UNIT I

Mendelian law of inheritance and Principles .Genes and chromosomes, Colinearity of Genes and Proteins, Genetic code, Identification of DNA as the genetic material. The complexity of the eukaryotic genome (introns, exons, repetitive DNA sequence, gene duplication and pseudogenes). DNA markers -VNTR, STR, microsatellite, SNP and their detection techniques.

(18 hours)

UNIT II

Replication of DNA, Gene expression and regulation in prokaryotes and eukaryotes. Mutation: Spontaneous and virus induced mutation, Radiation induced mutation. Ionizing radiation, UV radiation. Chromosomal Abnormalities and associated genetic diseases, Techniques in the study of chromosomes and their applications, Recombination – models.

(18 hours)

UNIT III

Allele frequencies and genotype frequencies, Random mating population, Hardy-Weinberg principle, complications of dominance, special cases of random mating – multiple alleles, different frequencies between sexes (autosomal and X-linked) inbreeding, genetics and evolution, random genetic drift, Karyotyping and usefulness of chromosomes in understanding Genetic variation, Genetics of eukaryotes gene linkage and chromosome mapping. **(18 hours)**

UNIT IV

DNA Damage and Repair-Internal and external agents causing DNA damages DNA damages (Oxidative damages, Depurinations, Depyrimidinations, O6-methylguanine, Cytosine deamination, single and double strand breaks). Mechanisms of DNA damage (transition, transversion, frameshift, nonsense mutations). Repair mechanisms (Photo reactivation, excision repair, mismatch repair, post replication repair, SOS repair) Discovery: Early experiments of McClintock in maize. Insertion sequences in prokaryotes. Complex transposons (ex. Tn3, Tn5, Tn9 and Tn10). Mechanisms, control consequences and application of transposition by simple and complex elements. **(18 hours)**

UNIT V

Extrachromosomal heredity: Biology of Plasmids, their discovery, types and structure of F.RTH. *col* factors and Ti – Replication and partitioning, Incompatibility and copy number control-natural and artificial plasmid transfer and their applications- Human Genome Project, Genomics and Modern methodologies in understanding genome. **(18 hours)**

TEXT BOOKS

1. Gardner, Simmons and Snustad (2023).Principles of Genetics, Students edition,Visionias publishers
2. Geoffrey M. Cooper, Robert E. Hausman(2018). The Cell- A Molecular Approach, 7th Edition, Sinauer Associates, Inc.
3. Kavitha B. Ahluwalia (2010). Genetics, New Age International Pvt Ltd and Publishers, New Delhi.

REFERENCE BOOKS

1. J.J. Pasternak (2005). An Introduction to Human Molecular Genetics, 2nd Edition,Wiley Less
2. Robert Brooker (2024). Genetics- Analysis and Principles. 8th edition. McGraw Hill.
3. Leland Hartwell,Leroy Hood, Michael Goldberg, Ann Reynolds, Lee Silver (2021).Genetics: From Genes to Genomes, 7th Edition, McGraw Hill.
4. Rastogi Smita and Neelam Pathak (2010). Genetic Engineering, Oxford University Press, New Delhi.
5. Watson, Hopkins, Roberts, Steitz, Weiner (2013). Molecular Biology of Genes, 7th Edition,Pearson

Course Code 24PBOC12	**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.V.Jeyasimga

Head of the Department

Dr.R.Gloria Jemmi Christobel
Course Designer

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M.Sc. BIOTECHNOLOGY

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Semester I	**Biochemistry, Molecular Genetics & Molecular Cell biology Practical**	**Hours/Week: 6**	
Core Course - 3 practical 1		**Credits: 4**	
24PBOC11P		**Internal 40**	**External 60**

Course outcomes:

On successful completion of the course the students will be able to

CO 1 : Illustrate basic biochemistry and molecular biology procedures (K2)

CO 2 : explain the principle and method of estimating the biomolecules [K2]

CO 3 : Sketch the working procedures for DNA, RNA & protein estimations [K3]

CO 4 : Infer the results and complete the record [K4]

CO 5 : analyze the outcomes of the sample analysis using biochemical techniques [K4]

1. Basic calculations in Biochemistry - Normality, Molarity, Molality percent solutions (v/v, w/v),Calibration of pH meter,Preparation of biological buffer - phosphate buffer.
2. Estimation of Carbohydrate by DNS method
3. Extraction of Proteins from biological materials
4. Estimation of Proteins by Lowry's method
5. Ammonium sulphate Precipitation of proteins,Membrane Dialysis
6. SDS PAGE
7. Western blotting
8. Isolation of DNA from plants/animal tissue
9. Estimation of DNA by diphenylamine method

10. Purity check of DNA & RNA by UV Spectrophotometry - A260/280
11. Agarose gel electrophoresis of DNA
12. Demonstration of PCR
13. Isolation and Estimation of RNA by orcinol method
14. Separation of sugars by Paper Chromatography
15. Separation of amino acids by Thin layer chromatography
16. Gel permeation chromatography,
17. Restriction digestion of DNA
18. Giant chromosome studies in Chironomus larvae
19. Meiotic study in flower bud
20. Cell counting and cell viability
21. Introduction to Microtome and types
22. Microtomy-Fixation of tissue
23. Microtomy -Embedding
24. Microtomy-Sectioning of tissue
25. H&E Staining of tissues

TEXT BOOKS

1. David Plummer (2017) An Introduction to Practical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd
2. Jayaraman, J (2015),laboratory Manual in Biochemistry, New age publishers
3. Varley H (2006) Practical Clinical Biochemistry (6th ed) , CBS Publishers
4. Prof. Sarin A. Chavhan, Prof. Sushilkumar A. Shinde (2019) A Guide to Chromatography Techniques , 1st Edition, Notion Press Media Pvt Ltd ,Chennai
5. Sadasivam .S,(2022). Biochemical Methods.4th edition,New Delhi: New Age International.Print

Course Code 24PBOC11P	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.V.Jeyasimga **Dr.D.Karthiyaini**

Head of the Department **Course Designer**

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

Semester I	**Bioinstrumentation**	**Hours/Week: 6**	
Elective Course – 1 (DSEC)		**Credits: 3**	
24PBOE11		**Internal 25**	**External 75**

Course outcomes:

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

CO1: understand the biophysical, biochemical and molecular biology techniques. [K2]
CO2: apply the knowledge on different types of identification and separation techniques in biological investigations. [K3]
CO3: illustrate 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 biotechnical research. [K4]
CO5: examine the application of biochemical techniques in scientific research. [K4]

UNIT I

Microscopic Techniques: Principles and Applications: Compound, Light, Stereo, Phase Contrast, Fluorescent Microscopy, Scanning and Transmission Electron Microscopy,Scanning and tunneling microscopy, Atomic Force Microscopy, Confocal Microscopy, FRET and Flow Cytometry. **(18 hours)**

UNIT II

Centrifugation – Principles - RCF, Sedimentation concept - - Different types of centrifuge – Types of rotors – Centrifugation types: Differential and Density gradient

centrifugation – Ultra Centrifuge. Preparative centrifugation, analytical centrifugation. isopycnic centrifugation and applications.Chromatography Techniques: Principle and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GC & HPLC. **(18 hours)**

UNIT III

Electrophoretic Techniques: Principle and Application of Agarose Gel Electrophoresis, 2D-gel Electrophoresis, PAGE- NATIVE & SDS PAGE, Iso-electric Focusing, High resolution Electrophoresis, Immuno Electrophoresis (Immunofixation EP,), ELISA, RIA, Southern, Northern and Western Blotting. Electro blotting, PCR and RT-PCR, Microarray (DNA, Proteins). **(18 hours)**

UNIT IV

Spectroscopic Techniques: Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, Mass Spectroscopy, IR Spectroscopy NMR, ESR, Atomic Absorption Spectroscopy, X- ray Spectroscopy, Laser Spectroscopy and Raman Spectroscopy.

(18 hours)

UNIT V

Radio-isotopic Techniques: Introduction to Radioisotopes, Uses and their Biological Applications, Radioactive Decay – Types and Measurement , Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography, RIA, Radiation Dosimetry, Health effects of Radiations. Good laboratory practices, personal protection equipments. Care and maintenance of laboratory equipments, Laboratory safety symbols, Potential hazards of laboratory techniques. **(18 hours)**

TEXT BOOKS

1. Keith Wilson, John Walker (2018) Principles and Techniques of Biochemistry and Molecular Biology,8th Edition, Cambridge University Press.
2. David M. Freifelder (2018) Physical Biochemistry: Applications to Biochemistry and Molecular Biology, 8th Edition,W.H.Freeman & Co..

REFERENCE BOOKS

1. David Sheehan (2016), Physical Biochemistry: Principles and Applications, 2nd Edition , Wiley-Blackwell.
2. Rodney F.Boyer (2012), Biochemistry Laboratory: Modern Theory and Techniques,2nd Edition,Prentice Hall.
3. Kaloch Rajan (2011), Analytical techniques in Biochemistry and Molecular Biology, eBook,Springer.
4. Segel I.H (2010) Biochemical Calculations ,2nd Edition,,John Wiley and Sons.
5. Robyt JF (2015) Biochemical techniques: Theory and Practice, 1st Edition, CBS Publishers& Distributors.
6. L.Veerakumari (2015) Bioinstrumentation Kindle edition, MJP Publisher
7. Douglas A. Skoog, F. James Holler, and Stanley R. Crouch (2016) ,Principles of Instrumental Analysis , 7th Edition,Cengage Learning.

Course Code 24PBOE11	**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.V.Jeyasimga
Head of the Department

Dr.R.Gloria Jemmi Christobel
Course Designer

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(for those who join in 2024 -2025)

Semester I	**MOLECULAR CELL BIOLOGY**	**Hours/Week: 6**	
Elective Course -2 (Generic)		**Credits: 3**	
24PBOE12		**Internal 25**	**External 75**

Course outcomes:

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

CO1 : understand the molecular machinery of living cells and the principles that govern the structures of macromolecules and their participation in molecular recognition.[K2]

CO2 : illustrate the structures and purposes of basic components in prokaryotic and eukaryotic cells and their molecular mechanism. [K3]

CO3 : Apply the knowledge and understanding of the principles and basic mechanisms of cell and its components on signalling and apoptosis. [K3]

CO4 : Analyse the cell organelles and their functions [K4]

CO5 : Categorize the cellular functions through various microscopes and relate them with the normal and abnormal cell signaling events. [K4]

UNIT I

Introduction to cell Biology- Basic properties of cells-Cellular dimension-Size of cells and their composition-Cell origin and Evolution (Endosymbiotic theory).Organelles of the eukaryotic cell and its functions; Plasma membrane - structural organization, transport across membrane (Passive, Active and Bulk transport); Cell-Cell adhesion- Cell junctions (Tight junctions, gap junctions, desmosomes, adherens); Extra cellular matrix (ECM)- components and role of ECM in growth. Cytoskeleton- Microfilaments and Microtubules. (18 hours)

UNIT II

Structure of Nucleic acids, Genome organization in Eukaryotes, DNA Replication, Transcription, Translation and post translational Modification. Synthesis, sorting and trafficking of proteins: site of synthesis of organelle and membrane proteins – transport of secretory and membrane proteins across ER – transport to mitochondria, nucleus, chloroplast and peroxisome - protein glycosylation – mechanism and regulation of vesicular transport – golgi and post-golgi sorting and processing – receptor mediated endocytosis; Synthesis of membrane lipids. (18 hours)

UNIT III

Nucleus: Nuclear envelope – Nuclear pore complexes-nuclear matrix – organization of chromatin – supercoiling, linking number, twist - nucleosome and high order of folding and organization of chromosome (Solenoid and Zigzag model)-Global structure of chromosome – (Lamp brush and polytene chromosomes). (18 hours)

UNIT IV

Molecular basis of eukaryotic cell cycle, Regulation and cell cycle check points; Programmed cell death (Apoptosis); Cell-Cell signaling-signaling molecules, types of signaling, signal transduction pathways (GPCR-cAMP, IP3 , RTK, MAP Kinase, JAK-STAT, Wnt Pathway). (18 hours)

UNIT V

Cancer Biology: Multistage cancer development Mitogens, carcinogens, oncogenes and proto-oncogenes, tumor suppressor genes- Rb, p53. Apoptosis and significance of apoptosis. (18 hours)

TEXT BOOKS

1. Karp G (2018), Cell and Molecular Biology, 8th edition, John Wiley & Sons, New York.
2. Lodish,H., Berk, A., Zipursky, S.L., Matsudaira, P., Kaiser, A., Krieger, Scott and Darnell, J (2016) Molecular Cell Biology. Media Connected, 6th edition. W.H.Freeman and Company.

3. Geoffrey.M.Cooper, Robert.E.Hausman (2013)The Cell-A Molecular Approach, 6th edition. Sinauer Associates.

REFERENCE BOOKS

1. David E.Sadva (2009) Cell biology organelles structure and function, CBS publishers and distributors, New Delhi.
2. Prakash S. Lohar (2009) Cell and Molecular Biology, 1 st Edition,MJP Publishers
3. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff(2014) Molecular Biology of the Cell, Fifth edition. Garland Science.
4. Luiz Carlos Uchoa, Janqueira, Jose, Carneiro (2005). Basic Histology Text and Atlas, 11th edition, McGraw-Hill Professional.
5. Paul A (2001), Text Book Of Cell And Molecular Biology, 2nd Edition, Niyogi Books
6. T.Fleming (2002), Cell interactions: A practical approach,2nd edition,Oxford University Press.
7. Gardner (2017) , Cell Biology and Histology, 8th Edition,Lippincott Williams & Wilkins.

Course Code 24PBOE12	**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	1	1	2	3	2	2	2
CO 2	2	1	3	2	2	2	2	2	2	2
CO 3	3	1	3	2	2	2	2	2	2	2
CO 4	3	1	3	3	3	2	2	2	1	1
CO 5	1	3	1	1	1	2	2	2	2	1

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

Dr. V. Jeyasimga
Head of the Department

Dr. S. Jeyaruby
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
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VIRUDHUNAGAR
Quality Education with Wisdom and Values

M.Sc. BIOTECHNOLOGY

(for those who join in 2024 -2025)

Semester II	**PLANT AND ANIMAL BIOTECHNOLOGY**	Hours/Week: 6	
Core Course-4		Credits: 5	
Course Code **24PBOC21**		Internal **25**	External **75**

COURSE OUTCOMES:

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

CO1: summarise the molecular mechanisms underlying gene expression, regulation, and manipulation in plants and animals. [K2]

CO2.: describe the plant and animal tissue culture methods used in biotechnological research. [K3].

CO3: apply the biotechnological principles to solve practical problems in the agriculture and healthcare industry.[K3].

CO4: analyse the effectiveness and safety of genetically modified crops or animals for addressing global challenges such as food security, climate change, and disease control. [K4]

CO5: examine the molecular biology techniques to improve sustainability, productivity and suitability for pharmaceutical and industrial applications [K4].

UNIT I

Introduction of plant tissue culture, composition of media, Micropropagation, organogenesis, somatic embryogenesis, haploid and triploid production, protoplast isolation and fusion, hybrid and cybrid, synthetic seed production. Secondary metabolites in plants -

Phytochemicals- Glycosides and Flavonoids; Anthocyanins and Coumarins - Lignans, Terpenes, Volatile oils and Saponins; Carotenoids and Alkaloids: biogenesis, therapeutic applications.

(18 Hours)

UNIT II

Plant Transformation: Direct transformation by electroporation and particle gun bombardment. *Agrobacterium* mediated gene transfer.Ti plasmid vector. Theory and techniques for the development of new genetic traits, conferring resistance to biotic and abiotic stress. Plant engineering towards the development of enriched food products, plant growth regulators; Molecular Marker aided breeding: RFLP maps, Linkage analysis, RAPD markers, STS Mirco satellite, SCAR, SSCP, QTL, Map based cloning and Molecular marker assisted selection.

(18 Hours)

UNIT III

Cell culture: primary and established culture; organ culture; tissue culture. Disaggregation of tissue and primary culture; cell separation, Slide and coverslip cultures, flask culture, test tube culture techniques, cell synchronization, cryopreservation. Scaling up of animal cell culture, bioreactors in animal cell culture.cell line and cloning micromanipulation and cloning, somatic cell cloning. Karyotyping; measuring parameters for growth, measurement of cell death, apoptosis and its determination, cytotoxicity assays. (18 hours)

UNIT IV

Animal health :disease diagnosis, hybridoma technique, monoclonal antibodies, application of probes for disease, diagnosis of existing and emerging animal diseases. Prophylaxis - Vaccines, Oral vaccines, DNA Vaccines in animal disease. (18 hours)

UNIT V

Application of animal cell culture for in vitro testing of drugs, in production of human and animal viral vaccines and pharmaceutical proteins. Culture Scale up and mass production of biologically important compounds. Harvesting of products, purification and assays. Transgenic animals: Production and application; transgenic animals in livestock improvement, transgenic

animals as model for human diseases; Stem Cells- Properties, Types,Therapy, Prospects and Ethics in stem cell research. (18 hours)

TEXT BOOKS

1. Razdan. M. K., 2011. Plant tissue culture. Oxford and IBH publishing Company Pvt. Ltd, New Delhi.
2. Chawla. H. S., 2020. Introduction to plant biotechnology.3rd edition,Oxford and IBH publishing company pvt. Ltd, New delhi
3. Ian Freshney, Culture of animal cells:A Manual of Basic Technique and Specialized Applications (2021). 8th edition, Wiley-Blackwell publishers.
4. Slater, 2008. Plant Biotechnology: The Genetic manipulation of plants, Second Edition, Oxford University Press, USA

REFERENCE BOOKS

1. W.H.Freeman, K. Dass. 2005, Textbook of Biotechnology, Second Edition, Wiley Dreamtech, India (P) Ltd.
2. H.Kreuzer & A.Massey. 2001. Recombinant DNA and Biotechnology: A guide for teachers Second Edition. ASM press, Washington.
3. M.Sudhir. (2014). Applied Biotechnology & Plant Genetics. Dominant publishers & Distributors.
4. A.Puhler Ed., (1993),Genetic Engineering of Animals VCH Publishers, Weinheim, FRG.
5. John R.W.Masters, (2004),Animal Cell culture Practical approach. Oxford
6. D. Balasubramaniam, Bryce, Dharmalingam, Green (1996) Concepts in Biotechnology Jayaraman Univ. Press.

Course Code 24PBOC21	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	1	1	2	3	2	2	2
CO 2	2	1	3	2	2	2	2	2	2	2
CO 3	3	1	3	2	2	2	2	2	2	2
CO 4	3	1	3	3	3	2	2	2	1	1
CO 5	1	3	1	1	1	2	2	2	2	1

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

Dr.V.Jeyasimga **Dr.S.Gurupavithra**

Head of the Department **Course Designer**

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M.Sc. BIOTECHNOLOGY

(for those who join in 2024 -2025)

Semester II	**GENETIC ENGINEERING**	**Hours/Week: 6**	
Core Course-5		**Credits: 5**	
Course Code		**Internal**	**External**
24PBOC22		**25**	**75**

COURSE OUTCOMES:

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

CO1: understand the basics of gene cloning and the role of enzymes and vectors responsible for gene manipulation. [K2]

CO2: illustrate the gene transfer methods and identify suitable hosts for cloning and construction of vectors. [K3]

CO3: apply the basic techniques used in genetic engineering, such as DNA extraction, gel electrophoresis and PCR . [K3]

CO4: Analyze the outcomes of genetic engineering. [K4]

CO5: Elucidate different techniques involved in genetic engineering [K4]

UNIT I

Gene cloning. Genetic engineering tools. Nucleic acid manipulating enzymes. Promoters, Selectable markers and reporters used in rDNA technology. Restriction digestion, Ligation, Transformation, Selection of Recombinants. Construction of gene libraries. (18 hours)

UNIT II

E.Coli vectors - pBR322 and its derivatives; Cloning vectors for gram negative bacteria - ColE1, p15A, R1, IncPa, pSC101; Lambda bacteriophage vectors, filamentous phages, Cosmids, Phasmids, Phagemids. Cloning in gram-positive bacteria (*Bacillus subtilis).* (18 hours)

UNIT III

Cloning in yeast Saccharomyces cerevisiae. Types of vectors; Bacterial artificial chromosomes, Yeast Artificial chromosomes. Eukaryotic vectors. SV40 ; Specialized cloning vector for cDNA; Synthesis of specific RNA in vitro; Vectors for cloning promoters and terminators; vectors with adjustable copy number. (18 hours)

UNIT IV

Nucleic acid hybridization techniques; Molecular probes (Types of probes and its construction); probe labeling. Nick translation, End labeling and Random primer labeling. Polymerase chain reaction and its variants; DNA fingerprinting; DNA sequencing first generation sequencing methods (Maxam and Gilbert sequencing, Sangers Dideoxy sequencing, Pyrosequencing, PCR based sequencing and hybridization sequencing).Second generation sequencing methods . (18 hours)

UNIT V

Site directed mutagenesis; DNA microarray; chromosome walking and jumping.Molecular techniques in prenatal diagnosis gene therapy, Transgenic animals (knockout mice) and plants (*Flavr sav*r tomato), Pharmaceutical products (Vaccine, Humulin, etc), Crop improvement- Pesticide resistance, herbicide resistance, transgenic animals and GM foods; Modern Concepts in Genetic Analysis. (18 hours)

TEXT BOOKS

1. Razdan. M. K., (2011). Plant tissue culture. Oxford and IBH publishing Company Pvt. Ltd,
2. T.A. Brown,(2020). Gene cloning and DNA analysis: An introduction, 6th edition, Wiley- Blackwell.
3. Sandy B.Primrose and Richard Twyman, 2006. Principles of Gene Manipulation and genomics, 7th edition, Wiley-Blackwell.
4. Lewin, 2009. Genes X, 10th edition, Jones & Barlett Publishers

REFERENCE BOOKS

1. Raymond Rodriguez and David T.Denhart 2003.Vectors, A survey of molecular cloning vectors and their uses
2. Errst-L. Winnacker 1987.From genes to clones. Introduction to Gene Technology,
3. Ed. David V. Geoddel 2002.Gene Expression technologies. Methods in enzymology (Vol.185)
4. William Wu, Michael J.Welsh, Peter B.Kaufrmar, Helen H.Zhang 2001. Methods in Gene Biotechnology

Course Code 24PBOC22	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	1	1	2	3	2	2	2
CO 2	2	1	3	2	2	2	2	2	2	2
CO 3	3	1	3	2	2	2	2	2	2	2
CO 4	3	1	3	3	3	2	2	2	1	1
CO 5	1	3	1	1	1	2	2	2	2	1

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

Dr. V. Jeyasimga — **Head of the Department**

Dr. D. Karthiyaini — **Course Designer**

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M.Sc. BIOTECHNOLOGY

(for those who join in 2024 -2025)

Semester II	**MICROBIOLOGY, PLANT AND ANIMAL BIOTECHNOLOGY & GENETIC ENGINEERING PRACTICAL**	Hours/Week: 6	
Core Course -6 Practical -2		Credits: 5	
Course Code- **24PBOC21P**		Internal 40	External 60

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: recall the procedures in Microbiology, Plant and Animal tissue culture. [K2]

CO2: isolate, identify and characterize microbes from different sources.[K2]

CO3: Examine Plant and Animal cell culture methods[K3]

CO4: illustrate the techniques of pure culture of microbes and protoplast isolation[K3]

CO5: analyse the problems and situations in the given subject area[K4]

1. Sterilization Techniques: Dry heat, Moist heat and Filter sterilization
2. Media preparation : Liquid and Solid Media
3. Plating Techniques : Streak plate method, Pour plate method, Spread plate method
4. Isolation of microbes from soil, water and air
5. Enumeration of total count of the bacteria
6. Staining Techniques : Gram staining , Negative staining of bacteria
7. IMViC test of enteric bacteria
8. Determination of growth curve of bacteria – E.coli
9. Plant tissue culture media preparation and Sterilization
10. Generation of Callus from leaf
11. Cell suspension culture
12. Isolation of plant protoplast

13. Protoplast viability test.
14. Demonstration of Animal Cell culture: Procedure for handling cells and medium.
15. Cell counting and viability
16. Restriction enzyme digestion.
17. Ligation.
18. Competent cell preparation
19. Transformation and selection of recombinants.
20. Cloning of fragments in PBR322
21. Insertional inactivation/Blue white screening

REFERENCE BOOKS

1. Smith, R. H. (2006). Plant tissue culture -Techniques and Experiments. 2nd edition USA : Elsevier Science and Technology Books.
2. Razdan,M K (2019), Introduction To Plant Tissue Culture 3rd edition ,Oxford & IBH Publishing.
3,Shalini Mani , Manisha Singh, Anil Kumar**,**(2024)Animal Cell Culture: Principles and Practice, 2nd edition, Springer International Publishing AG
4.Cappucino, Sherman, (2004). *Microbiology* – A laboratory manual, 7th edition, Pearson
5 Gunasekaran,P.(2018).*Lab Manual in Microbiology*, 23 nd edition, New Age International Publishers.

Web Resources

NCERT videolink:PLANT TISSUE CULTURE CSIR

NPTEL video link:Introduction to plant cell technology

Four Quadrant Streak procedure - How to properly streak a Petri plate for isolated colonies

Staining technique in microbiology: Negative staining

Course Code 24PBOC21P	**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	1	1	2	3	2	2	2
CO 2	2	1	3	2	2	2	2	2	2	2
CO 3	3	1	3	2	2	2	2	2	2	2
CO 4	3	1	3	3	3	2	2	2	1	1
CO 5	1	3	1	1	1	2	2	2	2	1

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

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M.Sc. BIOTECHNOLOGY

(for those who join in 2024 -2025)

Semester II	**ENVIRONMENTAL BIOTECHNOLOGY**	**Hours/Week: 4**	
Elective Course -3 (DSEC)		**Credits: 3**	
Course Code 24PBOE21		**Internal 25**	**External 75**

COURSE OUTCOMES:

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

CO1: understand the basic concepts of Environmental management, Conservation, waste management methods, biofilm kinetics, Biomonitoring and bioremediation. [K2]

CO2: apply the knowledge about pollution to develop biotechnological methods to assess, monitor and manage environmental pollution. [K3]

CO3 : illustrate the techniques involved in remediation of polluted environments. [K3]

CO4: analyse the types of pollution & its management, test for evaluating Toxicity and Biosensors. [K4]

CO5: Examine the use of biotechnology in combating environmental pollution. [K4]

UNIT I

Biogeochemical Cycles. Environmental Pollution: Types of pollution & its control strategies -Air pollution, Soil pollution, Water pollution, Oil pollution & Radioactive pollution. Environment: Basic concepts and issues; Environmental management and Conservation,

(12 Hours)

UNIT II

Biofilm Kinetics: Completely mixed biofilm reactor-Soluble microbial products and inert biomass-Special-case biofilm solution. Reactor types:- batch reactor - continuous-flow stirred-tank reactor- Plug-flow reactor. Engineering design of reactors- Reactors in series. (12 hours)

UNIT III

Waste management strategies,-5Rs-(Reduce, Reuse, Recycle, Replenish and Renew),Solid waste: landfills, incineration, pyrolysis, Composting, Vermiculture and methane production, Waste water management- source of waste water, Wastewater treatment- physical, chemical and biological treatment. Microbiology of Wastewater; Aerobic and anaerobic process, BOD and COD. (12 hours)

UNIT IV

Toxicity: Types and Test for evaluating Toxicity. Biosensors, Biomonitoring of toxic materials .Biomagnification, Biomining and Biofuels. (12 hours)

UNIT V

Environmental quality assessment and monitoring-Environmental Laws & Agencies involved in conservation Bioremediation; *In-situ and Ex-situ* Bioremediation of contaminated soils and waste land; Microbiology of degradation of Xenobiotics in environment; Pesticides, Surfactants, Degradative plasmids. (12 hours)

TEXT BOOKS

1. Gareth M. Evans, Gareth G. Evans, Judy Furlong 2011
2. Environmental biotechnology: theory and application John Wiley & Sons, Ltd. West Sussex, UK
3. M. Moo-Young, W.A. Anderson, A.M. Chakrabarty, 2010. Environmental Biotechnology: Principles and Applications. Springer.

REFERENCE BOOKS

1. Fulekar, M.H. (2018) Environmental Biotechnology, Science Publishers Department of Life Sciences, University of Mumbai, India,

2. Stanley E. Manahan, 2009. Environmental Chemistry, Ninth Edition, CRC Press.

3. Bruce E. Rittmann and Perry L. McCarty. (2020). Environmental Biotechnology :Principles and applications. McGraw Hill, New York.

Web Resources:

1. lbewww.epfl.ch/LBE/Default_E.htm
2. http://lbe.epfl.ch

Course Code 24PBOE21	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	1	1	2	3	2	2	2
CO 2	2	1	3	2	2	2	2	2	2	2
CO 3	3	1	3	2	2	2	2	2	2	2
CO 4	3	1	3	3	3	2	2	2	1	1
CO 5	1	3	1	1	1	2	2	2	2	1

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

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M.Sc. BIOTECHNOLOGY

(for those who join in 2024 -2025)

Semester II	**MICROBIOLOGY**	Hours/Week: 4	
Elective Course -4 (Generic)		Credits: 3	
Course Code 24PBOE22		Internal **25**	External **75**

COURSE OUTCOMES:

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

CO1: understand the fundamental Concepts, History and major discoveries of Microbiology [K2]

CO2: recall microbial culture, identification of microbes, Nutritional requirements of microorganisms, growth regulations and biochemical assays, principle and working of microscopy and sterilization techniques. [K3]

CO3: describe on host microbe interaction and Epidemiology of microbial disease [K3]

CO4: analyze microbial interactions within ecosystems, such as microbial communities in soil, water, or the human microbiome.[K4]

CO5. examine the principles of microbial growth and metabolism, including factors that influence microbial growth rates and metabolic pathways .[K4]

UNIT I

History and microbial taxonomy: Major discoveries related to the field of microbiology: Antony Von Leeuwenhoek, Louis Pasteur, Robert Koch and Edward Jenner. Microbial taxonomy: Bacteria, viruses, fungi, algae and protozoa, Microbial diversity: Biovars, Serovars and Prions, Microbial growth and metabolism: Microbial growth: Growth curve, factors affecting growth, Microbial metabolism- Methanogenesis, acetogenesis and autotrophs.

(12 Hours)

UNIT II

Microbial culture, identification, and control: Nutritional requirements for growth - Growth media and types, Pure culture techniques: Serial dilution and plating methods, Staining methods - Principles and types of staining (simple and differential), Identification of bacteria – Biochemical – IMVIC, 16s rRNA sequencing. Microscopy: principles and applications of Bright field, fluorescent and Scanning electron microscopes, Microbial growth control: Physical Methods – Heat, Filtration, Low Temperatures, High Pressure, Desiccation, Osmotic Pressure, Radiation; Chemical Methods. **(12 hours)**

UNIT III

Host microbe interaction and Epidemiology: Human microbiome; Skin, Gastrointestinal tract, Oral cavity, Lung. Symbiotic relationship of microbes: Symbiosis, Mutualism, Parasitism, Commensalism and endophyte. Epidemiology of microbes: causes, types and transmission of epidemic, endemic and pandemic diseases. (**12 Hours**)

UNIT IV

Microbial Diseases: Microbial diseases - General characteristics, pathogenesis, laboratory diagnosis and control measures of Pandemic and Epidemic diseases: Tuberculosis, Leprosy, Cholera, Typhoid, COVID-19, Yellow Fever, Flu, AIDS, Ebola, Zika Virus, Smallpox, Dengue, Chikungunya, Malaria, filariasis, Candidiasis, superficial mycosis. (**12 hours**)

UNIT V

Agricultural and Environmental Microbiology: Biological nitrogen fixation, free living, symbiotic nitrogen fixation, mechanism of Nitrogen fixation,, Biofertilizers- types and applications; Biogeochemical cycles-Carbon, Nitrogen, Sulphur and Phosphorus; Methanogenic bacteria Extremophiles- Thermophiles, Acidophiles, Halophiles and alkalophiles; Biotechnological applications of extremophiles. **(12 hours)**

TEXT BOOKS

1. Joanne Willey, Linda Sherwood, Christopher J. Woolverton, (2017). Prescott's Microbiology, 10th edition, McGraw-Hill Education.
2. Maheshwari D K, Dubey R C 2013. A Textbook of Microbiology.4th Edition, S Chand Publishing India.
3. Ananthanarayan and Paniker's (2017) Textbook of Microbiology, 10th edition, The Orient Blackswan.

REFERENCE BOOKS

1. Benson HJ. (1999). Microbiological Applications: A Laboratory manual in General Microbiology, 7th Edition, McGraw Hill.
2. Jacquelyn G. Black(2021) Microbiology: Principles and Explorations, 10th Edition, Wiley.
3. Agriculture Microbiology, 2016. E-Course Developed By TNAU (ICAR)
4. Kathleen Park Talaro, Barry Chess (2020),Foundations in Microbiology , 10th Edition, McGraw-Hill Education.

Web Resources

1. https://www.who.int/emergencies/diseases/managing-epidemics-interactive.pdf ISBN 978-92-4-156553-0. https://doi.org/10.3389/fmicb.2020.631736
2. https://www.agrimoon.com/wp-content/uploads/AGRICULTURAL-Microbiology.pdf.

Course Code 24PBOE22	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	1	1	2	3	2	2	1
CO 2	2	1	3	2	2	2	2	2	2	1
CO 3	3	1	3	2	2	2	2	2	2	1
CO 4	3	1	3	3	3	2	2	2	1	1
CO 5	1	3	1	1	1	2	2	2	2	1

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

Dr.V.Jeyasimga — **Head of the Department**

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

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

Semester II	**TISSUE ENGINEERING**	**Hours/Week: 4**	
Elective Course - 5 (NME)		**Credits: 2**	
Course Code 24PBON21		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: recall fundamentals of tissue engineering [K1]

CO2 : illustrate the basis of growth and differentiation, *in vitro* control of tissue development and structural engineering [K2]

CO3: describe the basic scientific principles that support the methods used in tissue engineering such as growth and differentiation[K2]

CO4: apply various tissue engineering techniques for the production of biomaterials[K3]

CO5: analyze the importance of applications of tissue engineering [K4]

UNIT I

Basic biology of tissue engineering: The basis of growth and differentiation-morphogenesis and tissue engineering (12 Hours)

UNIT II

In vitro control of tissue development-Growth factors-Tissue engineering bioreactors- In vitro synthesis of Tissue and organs- Organotypic and histotypic engineered tissues. 3D cell culture-Tissue assembly in microgravity (12 Hours)

UNIT III

Biomaterials in tissue engineering-Scaffolds, extracellular matrix, polymers and nanocomposites. Approaches to transplanting engineered cells (12 Hours)

UNIT IV

Bioartificial pancreas, Hepatassist liver support system, Artificial Womb, Heamatopoietic system: Red blood cell substitutes, Renal replacement devices (12 Hours)

UNIT V

Structural tissue engineering-Bone regeneration through cellular engineering, Skin tissue engineering, Brain implants-Neural stem cells, Periodontal applications (12 Hours)

TEXT BOOKS

1. Bernhard Palsson, Sangeeta Bhatia (2014) Tissue Engineering,2nd Edition,Pearson Pub.
2. Robert Lanza, Robert Langer, Joseph P. Vacanti (2020) Principles of Tissue Engineering,5th Edition,Academic Press.
3. Xiaohong Wang, Changsheng Liu, Ali Khademhosseini, Yilin Cao(2010) Tissue Engineering: Fundamentals and Applications,1st Edition,John Wiley & Sons
4. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons (2020) Biomaterials Science: An Introduction to Materials in Medicine,4th Edition, Academic Press

REFERENCE BOOKS

1. Sylvia, S. Mader, 2011, Human Biology, 12th edition, Mc Graw Hill, USA.
2. Robert P. Lanaza, Robert Langer and Joseph Vacanti, 2011. Principles of Tissue Engineering. 5th edition Academic Press.
3. Micklem.H.S., Loutit John.F., 2004, Tissue grafting and radiation, Academic Press, New York..
4. Penso.G., Balducci.D., 2004.Tissue cultures in biological research, Elsevier, Amsterdam

Web Resources:

- www.nuigalway.ie/anatomy/tissue_engineering.html

Course code 24PBON21	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	1	1	2	3	2	2	2
CO 2	2	1	1	2	2	2	2	2	2	1
CO 3	1	1	2	2	2	2	2	2	2	1
CO 4	2	1	2	2	2	2	2	2	1	1
CO 5	1	3	1	1	1	2	2	2	2	1

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

Dr.V.Jeyasimga — Dr.R.Gurupavithra

Head of the Department — **Course Designer**